

OCS EIS/EA
BOEM 2023-049

Empire Offshore Wind Final Environmental Impact Statement Volume 2

September 2023

Estimated Lead Agency Total Costs to
Prepare the Draft and Final EIS: \$1,743,725



BOEM
Bureau of Ocean Energy
Management

Empire Offshore Wind, Empire Wind Projects (EW 1 and EW 2) Final Environmental Impact Statement

Volume 2

September 2023

Author:

Bureau of Ocean Energy Management
Office of Renewable Energy Programs

Published by:

U.S. Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs

This page intentionally left blank.

LIST OF APPENDICES

- A Required Environmental Permits and Consultations
- B References Cited
- C List of Preparers and Reviewers, & Glossary
- D Analysis of Incomplete or Unavailable Information
- E Project Design Envelope and Maximum-Case Scenario
- F Planned Activities Scenario
- G Assessment of Resources with Minor (or Lower) Impacts

This page intentionally left blank.

Appendix A. Required Environmental Permits and Consultations

A.1. Required Environmental Permits

Table A-1 identifies the environmental permits and approvals that are required for implementation of the EW 1 and EW 2 Projects and the status of each permit or approval. Potential permits and approvals for SBMT are identified in Section 1.4 of the appended Environmental Assessment Form (Appendix Q).

Table A-1 Required Environmental Permits and Approvals for the Proposed Projects

Agency/Regulatory Authority	Permit/Approval	Status
Federal (Portions of the Projects within Federal Jurisdiction)		
BOEM	COP Approval	COP filed with BOEM on January 10, 2020. Updates to the COP were submitted on September 25, 2020; July 2, 2021; May 20, 2022; June 13, 2022; and July 21, 2023.
BSEE	Oil Spill Response Plan	Submitted with COP
BSEE	Safety Management System	Submitted with COP
NMFS	MMPA Section 101(a)(5) Incidental Harassment Authorization or Letter of Authorization	Proposed Rule published in <i>Federal Register</i> on April 13, 2023.
USACE	CWA Section 404, RHA Section 10 Individual Permit, and Section 408 Permission	<u>USACE Section 10/404</u> EW 1: Public notice issued November 7, 2022. Supplemental filing sent to USACE June 30, 23. EW 2: Public notice issued November 7, 2022. Supplemental filing sent to USACE June 23, 2023. <u>USACE Section 408</u> Filed with USACE January 13, 2023. Response to USACE clarifying questions in Q3 2023.
USCG	Private Aids to Navigation authorization	30 days prior to construction
USCG	Local Notice to Mariners per Ports and Waterways Safety Act	Planned for Q3 2023
USEPA	CAA OCS Air Permit	Complete OCS Air Permit Application submitted November 10, 2022. Review underway as of May 2023; anticipated permit decision in Q3 2023.

Agency/Regulatory Authority	Permit/Approval	Status
State (Portions of the Projects within State Jurisdiction)		
New York State, Public Service Commission	Certificate of Environmental Compatibility and Public Need under Article VII CWA Section 401 Certification	EW 1: Article VII application filed June 2021 and deemed complete January 2022. Anticipated Article VII certificate issuance September 2023. Anticipated WQC issuance October 2023. EW 2: Article VII Application filed June 2022 and deemed complete December 2022. Anticipated Certificate issuance October 2024. Anticipated WQC issuance February 2024.
New York Office of General Services, Bureau of Land Management	Application for Use of State Submerged Land (easement for cables)	EW 1 application planned for August 2023. EW 2 application planned for Q4 2023.
NYSDEC	State Pollutant Discharge Elimination System Construction Stormwater Permit	EW 1: planned for Q3 2023. EW 2: planned for Q4 2024.
NYSDOS, Division of Coastal Resources, Coastal Management Program	Coastal Zone Management Act consistency certification	Anticipated September 2023.

NYSDOS = New York State Department of State; Q = quarter; WQC = CWA Section 401 Certification

A.2. Consultation and Coordination

A.2.1 Introduction

This section discusses public and agency involvement leading up to the preparation and publication of the Final EIS, including formal consultations, cooperating agency exchanges, the public scoping and Draft EIS comment periods, and correspondence. This section discusses public involvement in the preparation of this EIS, including BOEM’s consideration of public comments, formal consultations, and cooperating agency exchanges. Interagency consultation, coordination, and correspondence throughout the development of the Final EIS occurred primarily through virtual meetings, teleconferences, and written communications (including email). BOEM coordinated with numerous agencies throughout the development of this document, as listed in Section A.2.3.2, *Cooperating Agencies*.

A.2.2 Consultations

A.2.2.1. Coastal Zone Management Act

The Coastal Zone Management Act requires that federal actions within the coastal zone or within the geographic location descriptions (i.e., areas outside the coastal zone in which an activity would have reasonably foreseeable coastal effects) affecting any land or water use or natural resource of the coastal zone be consistent with the enforceable policies of a state’s federally approved coastal management

program. Because the Lease Area is geographically nearest the coast of New York and certain Project elements would occur within New York State waters, a consistency certification with the New York Coastal Management Program was submitted to the New York State Department of State on June 24, 2021. Empire also filed a voluntary consistency certification with the State of New Jersey on June 24, 2021, due to the geographic proximity of the Lease Area. The consistency certifications for New York and New Jersey are included in Appendix A to Empire's COP (Empire 2023) pursuant to 30 CFR 585.627(9) to assist BOEM with NEPA compliance. Empire's COP provided the necessary data and information under 15 CFR 930.58. The state's concurrence is required before BOEM may approve or approve with conditions the COP per 30 CFR 585.628(f) and 15 CFR 930.130(1).

A.2.2.2. Endangered Species Act

Section 7(a)(2) of the ESA of 1973, as amended (16 USC 1531 et seq.), requires that each federal agency ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of those species. When the action of a federal agency may affect a protected species or its critical habitat, that agency is required to consult with either NMFS or USFWS, depending upon the jurisdiction. Pursuant to 50 CFR 402.07, BOEM has accepted designation as the lead federal agency for the purposes of fulfilling interagency consultation under Section 7 of the ESA for listed species under the jurisdiction of NMFS and USFWS. BOEM is consulting on the proposed activities considered in this Final EIS with both NMFS and USFWS and has prepared BAs for listed species under their respective jurisdictions. A Biological Opinion was issued by USFWS on June 22, 2023, concluding ESA consultation with USFWS. ESA consultation with NMFS is ongoing and terms and conditions outlined in the NMFS Biological Opinion will be incorporated into the ROD.

A.2.2.3. Government-to-Government Tribal Consultation

Executive Order 13175 commits federal agencies to engage in government-to-government consultation with tribes when federal actions have tribal implications, and Secretarial Order No. 3317 requires U.S. Department of the Interior agencies to develop and participate in meaningful consultation with federally recognized tribes where a tribal implication may arise. A June 29, 2018, memorandum outlines BOEM's current tribal consultation policy (BOEM 2018). This memorandum states that "consultation is a deliberative process that aims to create effective collaboration and informed federal decision-making" and is in keeping with the spirit and intent of the NHPA and NEPA, Executive and Secretarial Orders, and U.S. Department of the Interior Policy (BOEM 2018). BOEM implements tribal consultation policies through formal government-to-government consultation, informal dialogue, collaboration, and other engagement.

On April 29, 2021, BOEM initiated formal consultation with tribal nations under the NHPA and invited them to be NHPA Section 106 consulting parties to the Projects through individual letters mailed and emailed to tribal leaders with the Absentee-Shawnee Tribe of Indians of Oklahoma, the Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, Mashantucket Pequot Tribal Nation, Mohegan Tribe of Indians of Connecticut, the Narragansett Indian Tribe, Shawnee Tribe, Stockbridge-Munsee Community Band of Mohican Indians, and the Shinnecock Indian Nation.

On June 24, 2021, BOEM sent another set of letters and emails to tribal leaders notifying them that the Notice of Intent (NOI) to prepare an EIS for the Projects was issued that day and noted that the scoping comment period was open until July 26, 2021. BOEM then sent an email to tribal leaders on July 12, 2021, offering a government-to-government consultation meeting to discuss the public scoping information for the Projects. BOEM held a government-to-government meeting with the following tribal nations on August 3, 2021: Delaware Tribe of Indians, the Delaware Nation, Mashantucket Pequot Tribal Nation, the Shinnecock Indian Nation, and Wampanoag Tribe of Gay Head (Aquinnah). In a letter dated

November 22, 2021, the Mashantucket Pequot Tribal Nation indicated that they no longer wanted to consult on the Projects. A second government-to-government consultation meeting was held on April 28, 2023, that was attended by Delaware Tribe of Indians, the Shinnecock Indian Nation, and Wampanoag Tribe of Gay Head (Aquinnah), and an additional government-to-government consultation meeting was held with Wampanoag Tribe of Gay Head (Aquinnah) on September 7, 2023.

A.2.2.4. National Historic Preservation Act

Section 106 of the NHPA (54 USC 306108) and its implementing regulations (36 CFR 800) require federal agencies to consider the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. BOEM has determined that the proposed Projects is an undertaking subject to Section 106 review. The construction of WTGs and OSS, installation of interarray cables, and development of staging areas are ground- or seabed-disturbing activities that may adversely affect archaeological resources. The presence of WTGs may also introduce visual elements out of character with the historic setting of historic structures or landscapes; in cases where historic setting is a contributing element of historic properties' eligibility for the NRHP, the Projects may adversely affect those historic properties.

The Section 106 regulations at 36 CFR 800.8 provide for use of the NEPA substitution process to fulfill a federal agency's NHPA Section 106 review obligations in lieu of the procedures set forth in 36 CFR 800.3 through 800.6. This process is commonly known as "NEPA substitution for Section 106" and BOEM is using this process and documentation required for the preparation of this EIS and the ROD to comply with Section 106. Appendix N of this Final EIS contains BOEM's Finding of Adverse Effect, which includes a description and summary of BOEM's consultation to date. BOEM will continue consulting with the New York SHPO, New Jersey SHPO, ACHP, federally recognized tribes, and the consulting parties regarding the Finding of Adverse Effect and the resolution of adverse effects.

BOEM conducted Section 106 consultation meeting(s) on the Finding of Adverse Effect and the resolution of adverse effects, and the agency has requested that the consulting parties review and comment on the Finding of Adverse Effect and proposed resolution measures. Four NHPA Section 106 consultation meetings were held with consulting parties on September 12, 2022; December 9, 2022; June 23, 2023; and August 15, 2023. BOEM fulfilled public involvement requirements for Section 106 of the NHPA through the NEPA public scoping and public meetings process, pursuant to 36 CFR 800.2(d)(3). The Scoping Summary Report (BOEM 2021), available on BOEM's Project-specific website, summarizes comments on historic preservation issues.

On April 29, 2021, BOEM initiated consultation with federally recognized tribes: Absentee-Shawnee Tribe of Indians of Oklahoma, the Delaware Nation, Delaware Tribe of Indians, Eastern Shawnee Tribe of Oklahoma, Mashantucket Pequot Tribal Nation, Mohegan Tribe of Indians of Connecticut, the Narragansett Indian Tribe, Shawnee Tribe, Stockbridge-Munsee Community Band of Mohican Indians, and the Shinnecock Indian Nation. (Section A.2.2.3). BOEM requested information on sites of religious and cultural significance to the tribes that the proposed Projects could affect and BOEM offered its assistance in providing additional details and information on the proposed Projects to the tribes. However, in a letter dated November 22, 2021, the Mashantucket Pequot Tribal Nation indicated that they no longer wanted to consult on the Projects.

On April 29, 2021, BOEM contacted representatives of local governments, state and local historical societies, and other federal agencies to solicit information on historic properties and determine their interest in participating as consulting parties. Participants that have accepted consulting party status for the NHPA Section 106 Consultation are listed in Table A-2.

Table A-2 Participating Consulting Parties for NHPA Section 106 Consultation

Participants in the Section 106 Process	Participating Consulting Parties
SHPOs and state agencies	New Jersey Office of Planning Advocacy NJDEP, Historic Preservation Office New York SHPO New York State Parks, Recreation, and Historic Preservation New York State Parks, Recreation and Historic Preservation, Long Island State Parks Region 9 New York State Parks, Recreation and Historic Preservation, Region 9, Gilgo State Park New York State Parks, Recreation and Historic Preservation, Region 9, Jones Beach State Park New York State Parks, Recreation and Historic Preservation, Region 9, Robert Moses State Park
Federal agencies	ACHP BSEE U.S. Maritime Administration National Park Service U.S. Naval History and Heritage Command USACE USEPA
Federally recognized tribes	The Delaware Nation Delaware Tribe of Indians Mashantucket Pequot Tribal Nation Stockbridge-Munsee Community, Wisconsin/Band of Mohican Indians Shinnecock Indian Nation Wampanoag Tribe of Gay Head (Aquinnah)
Local governments	Atlantic Highlands Borough City of Long Beach Highlands Borough Lake Como Borough Long Branch Middletown Township Nassau County New York City Landmarks Commission Ocean County Sea Grit Borough Suffolk County Town of Babylon Town of Hempstead Town of Islip Village of Amityville Village of Bellport

Participants in the Section 106 Process	Participating Consulting Parties
Nongovernmental organizations or groups	Bay Shore Historical Society Equinor Wind US LLC Historical Society of Highlands Ocean Grove Camp Meeting Association Point O’Woods Association Romer Shoal Light The League of Historical Societies of New Jersey

A.2.2.5. Magnuson-Stevens Fishery Conservation and Management Act

Pursuant to Section 305(b) of the MSA, federal agencies are required to consult with NMFS on any action that may result in adverse effects on EFH. NMFS regulations implementing the EFH provisions of the MSA can be found at 50 CFR 600. As provided for in 50 CFR 600.920(b), BOEM has accepted designation as the lead agency for the purposes of fulfilling EFH consultation obligations under Section 305(b) of the MSA. Certain OCS activities authorized by BOEM may result in adverse effects on EFH and, therefore, require consultation with NMFS. BOEM developed an EFH Assessment concurrent with the Draft EIS and transmitted the EFH Assessment to NMFS on August 12, 2022. NMFS anticipates receipt of the complete EFH Assessment from BOEM and initiation of the EFH consultation on March 13, 2023.

A.2.2.6. Marine Mammal Protection Act

Section 101(a) of the MMPA (16 USC 1361) prohibits persons or vessels subject to the jurisdiction of the United States from taking any marine mammal in waters or on lands under the jurisdiction of the United States or on the high seas (16 USC 1372(a)(1), (a)(2)). Sections 101(a)(5)(A) and (D) of the MMPA provide exceptions to the prohibition on take, which give NMFS the authority to authorize the incidental but not intentional take of small numbers of marine mammals, provided certain findings are made and statutory and regulatory procedures are met. Incidental Take Authorizations may be issued as either (1) regulations and associated Letters of Authorization, or (2) an Incidental Harassment Authorization. Letters of Authorizations may be issued for up to a maximum period of 5 years, and Incidental Harassment Authorizations may be issued for a maximum period of 1 year. NMFS has also promulgated regulations to implement the provisions of the MMPA governing the taking and importing of marine mammals (50 CFR 216) and has published application instructions that prescribe the procedures necessary to apply for an Incidental Take Authorization. Applicants seeking to obtain authorization for the incidental take of marine mammals under NMFS’ jurisdiction must comply with these regulations and application instructions in addition to the provisions of the MMPA.

Once NMFS determines an application is adequate and complete, NMFS has a corresponding duty to determine whether and how to authorize take of marine mammals incidental to the activities described in the application. To authorize the incidental take of marine mammals, NMFS evaluates the best available scientific information to determine whether the take would have a negligible impact on the affected marine mammal species or stocks and an immitigable impact on their availability for taking for subsistence uses. NMFS must also prescribe the “means of effecting the least practicable adverse impact” on the affected species or stocks and their habitat, and on the availability of those species or stocks for subsistence uses, as well as monitoring and reporting requirements.

Empire submitted a final Letter of Authorization application to NMFS on July 28, 2022. The application was reviewed and considered complete on August 12, 2022, and NMFS published a Notice of Receipt in the *Federal Register* on September 9, 2022. NMFS published the proposed Letter of Authorization in the *Federal Register* on April 13, 2023.

A.2.3 Development of Draft Environmental Impact Statement

This section provides an overview of the development of the Draft EIS, including public scoping, cooperating agency involvement, and distribution of the Draft EIS for public review and comment.

A.2.3.1. Scoping

On June 24, 2021, BOEM issued an NOI to prepare an EIS consistent with NEPA regulations (42 USC 4321 et seq.) to assess the potential impacts of the Proposed Action and alternatives (83 *Federal Register* 13777). The NOI commenced a public scoping process for identifying issues and potential alternatives for consideration in the EIS. The formal scoping period was from June 24 through July 26, 2021. BOEM held three virtual public scoping meetings to solicit feedback and to identify issues and potential alternatives for consideration in the EIS. Throughout this timeframe, federal agencies, state and local governments, and the general public had the opportunity to help BOEM identify potential significant resources and issues, IPFs, reasonable alternatives (e.g., geographic, seasonal, or other restrictions on construction and siting of facilities and activities), and potential mitigation measures to analyze in the EIS, as well as provide additional information. BOEM also used the NEPA scoping process to initiate the Section 106 consultation process under the NHPA (54 USC 300101 et seq.), as permitted by 36 CFR 800.2(d)(3), which requires federal agencies to assess the effects of projects on historic properties. Additionally, BOEM informed its Section 106 consultation by seeking public comment and input through the NOI regarding the identification of historic properties or potential effects on historic properties from activities associated with approval of the COP. The NOI requested comments from the public in written form, delivered by hand or by mail, or through the [regulations.gov](https://www.regulations.gov) web portal.

BOEM held three virtual scoping meetings on June 30, July 8, and July 13, 2021. BOEM reviewed and considered all scoping comments in the development of the Draft EIS and used the comments to identify alternatives for analysis. A Scoping Summary Report (BOEM 2021) summarizing the submissions received and the methods for analyzing them is available on BOEM's website at <https://www.boem.gov/renewable-energy/state-activities/empire-wind>. In addition, all public scoping submissions received can be viewed online at <http://www.regulations.gov> by typing "BOEM-2021-0038" in the search field. As detailed in the Scoping Summary Report, the resource areas or NEPA topics most referenced in the scoping comments include commercial fisheries and for-hire recreational fishing; mitigation and monitoring; alternatives; birds; NEPA/Public Involvement Process; cumulative effects; climate change; marine mammals; and others.

A.2.3.2. Cooperating Agencies

BOEM invited other federal agencies and state, tribal, and local governments to consider becoming cooperating agencies in the preparation of the Draft EIS. According to CEQ guidelines, qualified agencies and governments are those with "jurisdiction by law or special expertise" (CEQ 1981). BOEM asked potential cooperating agencies to consider their authority and capacity to assume the responsibilities of a cooperating agency, and to be aware that an agency's role in the environmental analysis neither enlarges nor diminishes the final decision-making authority of any other agency involved in the NEPA process. BOEM also asked agencies to consider the "Factors for Determining Cooperating Agency Status" in Attachment 1 to CEQ's January 30, 2002, Memorandum for the Heads of Federal Agencies (CEQ 2002). BOEM held interagency meetings on November 18, 2020, and on May 13, May 21, June 7, August 19,

and November 3, 2021, to discuss the environmental review process, schedule, responsibilities, consultation, and potential EIS alternatives.

The following federal agencies and state, tribal, and local governments have supported preparation of the Draft EIS as cooperating or participating agencies, or cooperating tribal nations:

Federal Cooperating Agencies

- BSEE
- NMFS
- National Park Service
- USACE
- USCG
- USEPA
- U.S. Maritime Administration

State Cooperating Agencies

- NYSDEC
- New York State Department of State
- NYSERDA

Local Cooperating Agencies

- New York City Mayor's Office of Environmental Coordination

Federal Participating Agencies

- ACHP
- Department of Navy
- DOD
- USFWS

Cooperating Tribal Nations

- The Shinnecock Indian Nation

NMFS is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involve activities that have the potential to affect marine resources under its jurisdiction by law and special expertise. As applicable, permits and authorizations are issued pursuant to the MMPA, as amended (16 USC 1361 et seq.); the regulations governing the taking and importing of marine mammals (50 CFR 216); the ESA (16 USC 1531 et seq.); and the regulations governing the taking, importing, and exporting of threatened and endangered species (50 CFR 222–226). In accordance with 50 CFR 402, NMFS also serves as the Consulting Agency under Section 7 of the ESA for federal agencies proposing action that may affect marine resources listed as threatened or endangered. NMFS has additional responsibilities to conserve and manage fishery resources of the United States, which includes the authority to engage in consultations with other federal agencies pursuant to the MSA and 50 CFR 600 when proposed actions may adversely affect EFH. The MMPA is the only authorization for NMFS that

requires NEPA compliance, which, after independent review, may be via adoption of BOEM's EIS and issuance of the ROD.

USACE is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect resources under its jurisdiction by law and special expertise. As applicable, permits and authorizations are issued pursuant to Sections 10 and 14 of the RHA and Section 404 of the CWA. Issuance of Section 10 or Section 404 permits requires NEPA compliance, which will be met via adoption of BOEM's EIS and issuance of the ROD.

BSEE is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect marine resources under its jurisdiction by law and special expertise.

USEPA is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect resources under its jurisdiction by law and special expertise, including air quality and water quality.

USCG is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect navigation and safety issues that fall under its jurisdiction by law and special expertise and because the Proposed Action could affect other USCG missions such as SAR, Inspections, Investigations, and Marine Environmental Response.

The National Park Service is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action and alternatives involves activities that could affect National Park Service resources under its jurisdiction by law and special expertise. The National Park Service, as a bureau within the Department of the Interior and cooperating agency for the preparation of this EIS, has special expertise regarding the regulation of uses on National Park Service units and management of park system resources that includes compliance with the Park System Resource Protection Act (Public Law 113–287, December 2014). The National Park Service also is participating in the consultation under Section 106 of the NHPA.

ACHP is serving as a participating agency because the scope of the Proposed Action and alternatives involves activities that could affect historic properties under its jurisdiction by law and special expertise. ACHP also is participating in the consultation under Section 106 of the NHPA.

USFWS is serving as a participating agency because the scope of the Proposed Action and alternatives involves activities that could affect resources under its jurisdiction by law and special expertise. USFWS also serves as the consulting agency under Section 7 of the ESA for federal agencies proposing actions that may affect terrestrial resources listed as threatened or endangered.

DOD and Department of the Navy are serving as participating agencies because they have special expertise with respect to potential impacts that may occur as a result of the Proposed Action, including regarding potential impacts on special use airspace and radar used for air defense.

New York State Department of State is serving as cooperating agencies pursuant to 40 CFR 1501.8 because it has special expertise with respect to potential impacts that may occur as a result of the Proposed Action.

NYSDEC is serving as a cooperating agency pursuant to 40 CFR 1501.8 because the scope of the Proposed Action, connected actions, and alternatives involve activities that could affect resources under its jurisdiction by law and special expertise. NYSDEC intends to rely upon BOEM's EIS for its compliance with the New York State Quality Review Act. NYSDEC's interest in the connected SBMT

Project is related to NYSDEC regulatory authority, including, but not limited to, 401 water quality certification, and Environmental Conservation Law Article 15 (Water Resources).

The U.S. Maritime Administration and NYSEDA are serving as cooperating agencies pursuant to 40 CFR 1501.8 because the connected action at SBMT would involve federal and state funding that is subject to environmental review under NEPA and the New York State Quality Review Act, respectively. NYSEDA has signed a conditional grant agreement with SBMT Asset LLC (an Equinor/BP joint venture), under which NYSEDA would, if the conditions set forth in the grant agreement are satisfied, provide grant funding for upgrades to the SBMT to make it suitable for WTG staging and assembly and to serve as an O&M hub for the Empire Wind and other offshore wind projects. The conditions in the grant agreement include satisfactory completion of environmental impact review for the SBMT Project. The U.S. Maritime Administration is reviewing the SBMT Project related to a 2021 Port Infrastructure Development Grant application.

BOEM is coordinating with The Shinnecock Indian Nation as a cooperating Tribal Nation under 40 CFR 1501.8. Cooperating Tribal Nations are asked to provide information to BOEM for portions of the EIS for which they have special expertise, including identifying resources that are significant to The Shinnecock Indian Nation, impacts of the Projects on those resources, and potential mitigation of adverse effects.

A.2.3.3. Distribution of the Draft Environmental Impact Statement for Review and Comment

A list of agencies, organizations, and persons to whom copies of the Draft EIS were sent is provided in Appendix K. The Draft EIS is also available in electronic format for public viewing at <https://www.boem.gov/renewable-energy/state-activities/empire-wind>.

Publication of the Draft EIS initiated a 60-day comment period where government agencies, members of the public, and interested stakeholders provided comments and input. BOEM accepted comments in any of the following ways:

- In hard copy form, delivered by mail, enclosed in an envelope labeled “Empire Wind COP Draft EIS” and addressed to Program Manager, Office of Renewable Energy, Bureau of Ocean Energy Management, 45600 Woodland Road, Sterling, Virginia 20166.
- Through the [regulations.gov](https://www.regulations.gov) web portal by navigating to [https://www.regulations.gov/](https://www.regulations.gov) and searching for docket number “BOEM-2022-0053.” Click the “Comment Now!” button to the right of the document link. Enter your information and comment, then click “Submit.”
- By attending one of the public hearings at the locations and dates listed in the notice of availability and providing written or verbal comments.

BOEM considered comments received during the public comment period to inform its preparation of the Final EIS, as appropriate.

A.3. References Cited

Bureau of Ocean Energy Management (BOEM). 2018. *Tribal Consultation Guidance*. June 29, 2018. Available: <https://www.boem.gov/sites/default/files/about-boem/Public-Engagement/Tribal-Communities/BOEM-Tribal-Consultation-Guidance-with-Memo.pdf>.

Bureau of Ocean Energy Management (BOEM). 2021. *Empire Wind Construction and Operations Plan Scoping Report*. August. Available: <https://www.boem.gov/renewable-energy/state-activities/empire-wind>.

Council on Environmental Quality (CEQ). 1981. Memorandum to Agencies: Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulation. Amended 1986. Available: <https://www.energy.gov/sites/prod/files/2018/06/f53/G-CEQ-40Questions.pdf>. Accessed: August 2021.

Council on Environmental Quality (CEQ). 2002. Memorandum for the Heads of Federal Agencies: Cooperating Agencies in Implementing the Procedural Requirements of the National Environmental Policy Act. Available: https://www.energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-CoopAgenciesImplem.pdf. Accessed: September 11, 2020.

Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.

This page intentionally left blank.

Appendix B. References Cited

B.1. Chapter 1, Introduction

Bureau of Ocean Energy Management (BOEM). 2007. *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf*, Final Environmental Impact Statement. October. OCS EIS/EA MMS 2007-046. Available: <https://www.boem.gov/renewable-energy/guide-ocs-alternative-energy-final-programmatic-environmental-impact-statement-eis>.

Bureau of Ocean Energy Management (BOEM). 2016. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New York Revised Environmental Assessment*.

Bureau of Ocean Energy Management (BOEM). 2021. Empire Wind Leasing History. Available: <https://www.boem.gov/renewable-energy/state-activities/empire-wind>. Accessed: September 30, 2021.

B.2. Chapter 2, Alternatives Including the Proposed Action

Bureau of Ocean Energy Management (BOEM). 2023. Supporting National Environmental Policy Act Documentation for Offshore Wind Energy Development Related to Glauconite Sand. OCS Study BOEM 2023-011. 16 pp.

Equinor. 2021. “Empire Wind selects turbine supplier.” November 2. Available: <https://www.equinor.com/en/news/20211018-empire-wind-turbine-supplier.html>. Accessed: March 11, 2022.

Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.

U.S. Department of Energy. 2021. *Offshore Wind Market Report: 2021 Edition*. Office of Energy Efficiency and Renewable Energy. August 30. Available: https://www.energy.gov/sites/default/files/2021-08/Offshore%20Wind%20Market%20Report%202021%20Edition_Final.pdf. Accessed: March 11, 2022.

U.S. Department of the Interior, Bureau of Land Management (BLM). 2005a. *Final Programmatic Environmental Impact Statement on Wind Energy Development on BLM-Administered Lands in the Western United States*. June. Available: <https://windeis.anl.gov/documents/fpeis/maintext/Vol1/Vol1Complete.pdf>.

U.S. Department of the Interior, Bureau of Land Management (BLM). 2005b. *Record of Decision: Implementation of a Wind Energy Development Program and Associated Land Use Plan Amendments*. December. Available: <https://windeis.anl.gov/documents/docs/WindPEISR0D.pdf>.

U.S. Department of the Interior, Bureau of Land Management (BLM). 2013. *Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands*. First Edition. Available: https://blmwyomingvisual.anl.gov/docs/BLM_RenewableEnergyVisualBMPs_LowRes.pdf.

B.3. Chapter 3, Affected Environment and Environmental Consequences

B.3.1 Section 3.1, Impact-Producing Factors

Bureau of Ocean Energy Management (BOEM). 2017. *Evaluating Benefits of Offshore Wind Energy Projects in NEPA*. July. BOEM 2017-048. Available: <https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/Final-Version-Offshore-Benefits-White-Paper.pdf>.

Bureau of Ocean Energy Management (BOEM). 2019. *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf*. May. OCS Study BOEM 2019-036. Available: <https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/IPFs-in-the-Offshore-Wind-Cumulative-Impacts-Scenario-on-the-N-OCS.pdf>.

B.3.2 Section 3.2, Mitigation Identified for Analysis in the Environmental Impact Statement

None.

B.3.3 Section 3.3, Definition of Impact Levels

None.

B.3.4 Section 3.4, Air Quality

Barthelmie, R. J., and S. C. Pryor. 2021. Climate Change Mitigation Potential of Wind Energy. *Climate* 9(9):136. Available: <https://www.mdpi.com/2225-1154/9/9/136>. Accessed: November 5, 2021.

Buonocore, J. J., P. Luckow, J. Fisher, W. Kempton, and J. I. Levy. 2016. “Health and Climate Benefits of Offshore Wind Facilities in the Mid-Atlantic United States,” *Environmental Research Letters* 11 (2016) 074019. DOI:10.1088/1748-9326/11/7/074019.

Council on Environmental Quality (CEQ). 2016. *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews*. Available: https://ceq.doe.gov/docs/ceq-regulations-and-guidance/nepa_final_ghg_guidance.pdf. Accessed: August 2022.

Council on Environmental Quality (CEQ). 2023. *National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change*. Available: <https://www.federalregister.gov/d/2023-00158>. Accessed: March 2023.

- Dolan, Stacey L., and Garvin A. Heath. 2012. Life Cycle Greenhouse Gas Emissions of Utility-Scale Wind Power. *Journal of Industrial Ecology* 16(S1):S136–S154. Available: <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1530-9290.2012.00464.x>. Accessed: January 31, 2023.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Ferraz de Paula, L., and B. S. Carmo. 2022. Environmental Impact Assessment and Life Cycle Assessment for a Deep Water Floating Offshore Wind Turbine on the Brazilian Continental Shelf. *Wind* (2):495–512. Available: <https://doi.org/10.3390/wind2030027>. Accessed: January 31, 2023.
- Interagency Working Group on Social Cost of Greenhouse Gases, United States Government (IWG). 2021. Technical Support Document: *Social Cost of Carbon, Methane, and Nitrous Oxide, Interim Estimates under Executive Order 13990*. Available: https://www.whitehouse.gov/wp-content/uploads/2021/02/TechnicalSupportDocument_SocialCostofCarbonMethaneNitrousOxide.pdf. Accessed: August 2022.
- Katzenstein, W., and J. Apt. 2009. Air Emissions Due to Wind and Solar Power. *Environmental Science and Technology* 43(2):253–258. Available: <https://pubs.acs.org/doi/abs/10.1021/es801437t>.
- Kempton, W., J. Firestone, J. Lilley, T. Rouleau, and P. Whitaker. 2005. “The Offshore Wind Power Debate: Views from Cape Cod.” *Coastal Management Journal* 33(2):119–149. DOI: 10.1080/08920750590917530.
- Monitoring Analytics. 2021. *2020 State of the Market Report for PJM*. Available: <https://www.pjm.com/-/media/committees-groups/committees/mc/2021/20210329-special/20210329-state-of-the-market-report-for-pjm-2020.ashx>. Accessed: November 8, 2021.
- National Oceanographic and Atmospheric Administration (NOAA). 2006. *Small Diesel Spills (500-5000 gallons)*. Available: https://dec.alaska.gov/spar/ppr/response/sum_fy10/100111201/NOAAFactsheet_Diesel.pdf. Accessed: November 2, 2021.
- National Renewable Energy Laboratory (NREL). 2021. *Life Cycle Assessment Harmonization*. Available: <https://www.nrel.gov/analysis/life-cycle-assessment.html>. Accessed: January 31, 2023.
- New Jersey Board of Public Utilities. 2019. *2019 New Jersey Energy Master Plan*. Available: https://nj.gov/emp/docs/pdf/2020_NJBPU_EMP.pdf. Accessed: November 5, 2021.
- New Jersey Department of Environmental Protection (NJDEP). 2019. *New Jersey 2019 IEP Technical Appendix*. Prepared by Evolved Energy research. Available: https://nj.gov/emp/pdf/New_Jersey_2019_IEP_Technical_Appendix.pdf. Accessed: November 5, 2021.
- New York City Economic Development Corporation (NYCEDC). 2023. *Final Environmental Assessment Form, Supplemental Analyses, South Brooklyn Marine Terminal Port Infrastructure Improvement Project*. May.
- New York State Department of Environmental Conservation (NYSDEC). 2022. *Establishing a Value of Carbon: Guidelines for Use by State Agencies*. Available: https://www.dec.ny.gov/docs/administration_pdf/vocguid22.pdf. Accessed: October 24, 2022.

- O'Donoghue, Patrick R., Garvin A. Heath, Stacey L. Dolan, and Martin Vorum. 2014. Life Cycle Greenhouse Gas Emissions of Electricity Generated from Conventionally Produced Natural Gas: Systematic Review and Harmonization. *Journal of Industrial Ecology* 18(1):125–144. Available: <https://doi.org/10.1111/jiec.12084>. Accessed: January 31, 2023.
- Rueda-Bayona, J. G., J. J. Cabello Eras, and T. R. Chaparro. 2022. Impacts generated by the materials used in offshore wind technology on Human Health, Natural Environment and Resources. *Energy* 261, Part A:125223. Available: <https://doi.org/10.1016/j.energy.2022.125223>.
- Shoaib, Nawal. 2022. “A Study on Wind Farms in New Jersey: Life Cycle Assessment and Acceptance of Wind Farms by the Tourists.” *Theses, Dissertations and Culminating Projects* 1114. Available: <https://digitalcommons.montclair.edu/etd/1114>.
- U.S. Energy Information Administration. 2014. *Oil Tanker Sizes Range from General Purpose to Ultra-Large Crude Carriers on AFRA Scale*. September 16, 2014. Available: <https://www.eia.gov/todayinenergy/detail.php?id=17991>. Accessed September 12, 2021.
- U.S. Environmental Protection Agency (USEPA). 1992. *Clarification of Prevention of Significant Deterioration (PSD) Guidance for Modeling Class I Area Impacts*. Memorandum from John Seitz (Director, EPA Office of Air Quality Planning and Standards) to EPA regional air quality directors. October 19. Available: <http://www.epa.gov/region7/air/nsr/nsrmemos/class1.pdf>. Accessed: May 27, 2022.
- U.S. Environmental Protection Agency (USEPA). 2020a. *Greenhouse Gases Equivalencies Calculator—Calculations and References*. Available: <https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references#vehicles>. Accessed: September 16, 2021.
- U.S. Environmental Protection Agency (USEPA). 2020b. CO-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping Tool. Available: <https://www.epa.gov/statelocalenergy/co-benefits-risk-assessment-cobra-health-impacts-screening-and-mapping-tool>. Accessed: September 16, 2021.
- U.S. Environmental Protection Agency (USEPA). 2020c. *User’s Manual for the CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA)*. Available: https://www.epa.gov/sites/default/files/2020-06/documents/cobra_user_manual_june_2020.pdf. Accessed: September 16, 2021.
- U.S. Environmental Protection Agency (USEPA). 2021a. Nonattainment Areas for Criteria Pollutants (Green Book). Available: <https://www.epa.gov/green-book>. Accessed: September 13, 2021.
- U.S. Environmental Protection Agency (USEPA). 2021b. Avoided Emissions and Generation Tool (AVERT), Web Edition. Available: <https://www.epa.gov/avert/avert-web-edition>. Accessed: November 23, 2021.

B.3.5 Section 3.5, Bats

- Arnett, E. B., K. Brown, W. P. Erickson, J. Fiedler, B. L. Hamilton, T. H. Henry, A. Jain, G. D. Johnson, J. Kerns, R. R. Kolford, C. P. Nicholson, T. O’Connell, M. Piorkowski, and R. Tankersley, Jr. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. *Journal of Wildlife Management* 72:61–78.

- Bureau of Ocean Energy Management (BOEM). 2015. *Virginia Offshore Wind Technology Advancement Project on the Atlantic Outer Continental Shelf Offshore Virginia: Revised Environmental Assessment*. Office of Renewable Energy Programs. OCS EIS/EA BOEM 2015-031. Accessed: September 1, 2020. Available: <https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/VA/VOWTAP-EA.pdf>.
- Bureau of Ocean Energy Management (BOEM). 2022. *Empire Wind Project (EW 1 and EW 2) Biological Assessment for the United States Fish and Wildlife Service*. November.
- Choi, D. Y., T. W. Wittig, and B. M. Kluever. 2020. An Evaluation of Bird and Bat Mortality at Wind Turbines in the Northeastern United States. *PLOS ONE* 15(8): e0238034. Available: <https://doi.org/10.1371/journal.pone.0238034>.
- Cryan, P. M. 2007. Mating Behavior as a Possible Cause of Bat Fatalities at Wind Turbines. *Journal of Wildlife Management* 72(3):845–849; 2008) DOI: 10.2193/2007-37.
- Cryan P. M., M. Gorresen, C. D. Hein, M. R. Schirmacher, R. H. Diehld, M. M. Husoe, D. T. S. Hayman, P. D. Fricker, F. J. Bonaccorso, D. H. Johnson, K. Heist, and D. C. Dalton. 2014. Behavior of Bats at Wind Turbine. *Proceedings of the National Academy of Sciences* 11(42): 15126–15131.
- Cryan, P. M., and A. C. Brown. 2007. Migration of Bats Past a Remote Island Offers Clues Toward the Problem of Bat Fatalities at Wind Turbines. *Biological Conservation* 139:1–11.
- Cryan, P. M., and R. M. R. Barclay. 2009. Causes of Bat Fatalities at Wind Turbines: Hypotheses and Predictions. *Journal of Mammalogy* 90:1330–1340.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Ahlén, I., H. J. Baagøe, and L. Bach. 2009. Behavior of Scandinavian bats during migration and foraging at sea. *Journal of Mammalogy* 90:1318–1323.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Barbour, R. W., and W. H. Davis. 1969. *Bats of America*. The University Press of Kentucky, Lexington, KY. 286 pp., Lexington, KY.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Bureau Of Ocean Energy Management (BOEM). 2013. *Information Synthesis on the Potential for Bat Interactions with Offshore Wind Facilities*.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Bureau of Ocean Energy Management (BOEM). 2014. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts: Revised Environmental Assessment*.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Bureau of Ocean Energy Management (BOEM). 2019. *Vineyard Wind Offshore Wind Energy Project Biological Assessment: Final*.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Cryan, P., and A. C. Brown. 2007. Migration of bats past a remote island offers clues toward the problem of bat fatalities at wind turbines. *Biological Conservation* 139:1–11.

- Empire Offshore Wind, LLC (Empire). 2023. Citing Dowling, Z. R., and D. I. O'Dell. 2018. Bat use of an island off the coast of Massachusetts. *Northeastern Naturalist* 25:362–382.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Dowling, Z., P. R. Sievert, E. Baldwin, L. Johnson, S. von Oettingen, and J. Reichard. 2017. *Flight Activity and Offshore Movements of Nano-Tagged Bats on Martha's Vineyard, MA*.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Grady, F. V., and S. L. Olson. 2006. Fossil bats from quaternary deposits on Bermuda (chiroptera: vespertilionidae). *Journal of Mammalogy* 87:148–152.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Hatch, S. K., E. E. Connelly, T. J. Divoll, I. J. Stenhouse, and K. A. Williams. 2013. *Offshore observations of eastern red bats (Lasiurus borealis) in the Mid-Atlantic United States using multiple survey methods*. *PLOS ONE* 8:e83803.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Ingersoll, T. E., B. J. Sewall, and S. K. Amelon. 2016. Effects of white-nose syndrome on regional population patterns of 3 hibernating bat species. *Conservation Biology* 30:1048–1059.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Johnson, J. B., J. E. Gates, and N. P. Zegre. 2011. Monitoring seasonal bat activity on a coastal barrier island in Maryland, USA. *Environmental Monitoring and Assessment* 173:685–699.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Lagerveld, S., D. Gerla, J. T. van der Wal, P. de Vries, S. Brabant, E. Stienen, K. Deneudt, J. Manshanden, and M. Scholl. 2017. *Spatial and temporal occurrence of bats in the southern North Sea area*. Wageningen University & Research Report C090/17. 52.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Maslo, B., and K. Leu. 2013. *The Facts About Bats in New Jersey*.
- Empire Offshore Wind, LLC (Empire). 2023. Citing NJ Division of Fish and Wildlife. 2017. *Bat Conservation in Winter*.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Peterson, T. S., S. K. Pelletier, S. A. Boyden, and K. S. Watrous. 2014. Offshore acoustic monitoring of bats in the Gulf of Maine. *Northeastern Naturalist* 21:154–163.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Rydell, J., and A. Wickman. 2015. Bat activity at a small wind turbine in the Baltic Sea. *Acta Chiropterologica* 17:359–364.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Sjollema, A. L., J. E. Gates, R. H. Hilderbrand, and J. Sherwell. 2014. Offshore activity of bats along the Mid-Atlantic Coast. *Northeastern Naturalist* 21:154–163.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Tetra Tech. 2019. *2018 Bat Study Survey Report: Equinor Wind Offshore Wind Project ICS-A 0512*. Prepared for Equinor Wind US, LLC.
- Erickson, W. P., G. D. Johnson, M. D. Strickland, D. P. Young, Jr., K. J. Sernka, R. E. Good, M. Bourassa, K. Bay, and K. Sernka. 2002. *Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and existing Wind Developments*. Bonneville Power Administration, Portland, Oregon, USA.

- Fiedler, Jenny K. 2004. "Assessment of Bat Mortality and Activity at Buffalo Mountain Windfarm, Eastern Tennessee." Master's Thesis, University of Tennessee, 2004. Available: https://trace.tennessee.edu/cgi/viewcontent.cgi?article=3488&context=utk_gradthes. Accessed: September 1, 2020.
- Hann, Z. A., M. J. Hosler, and P. R. Mooseman, Jr. 2017. Roosting Habits of Two *Lasiurus borealis* (eastern red bat) in the Blue Ridge Mountains of Virginia. *Northeastern Naturalist* 24 (2): N15–N18.
- Kerns, J., W. P. Erickson, and E. B. Arnett. 2005. "Bat and bird fatality at wind energy facilities in Pennsylvania and West Virginia." Pages 24–95 in B. Arnett, editor, *Relationships Between Bats and Wind Turbines in Pennsylvania and West Virginia: An Assessment of Bat Fatality Search Protocols, Patterns of Fatality, and Behavioral Interactions with Wind Turbines*. A final report submitted to the Bats and Wind Energy Cooperative, pp 24–95. Bat Conservation International, Austin, Texas, USA. Available: <http://centrostudinata.it/public2/documenti/687-50647.pdf>. Accessed: October 19, 2020.
- Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007. Ecological Impacts of Wind Energy Development on Bats: Questions, Research Needs, and Hypotheses. *Frontiers in Ecology and the Environment* 5:315–324.
- Maine Department of Inland Fisheries and Wildlife. 2021. "Bats." Available: <https://www.maine.gov/ifw/fish-wildlife/wildlife/species-information/mammals/bats.html>. Accessed: August 27, 2021.
- New Hampshire Fish and Game. No date. "Bats of New Hampshire." Available: <https://wildlife.state.nh.us/nongame/bats-nh.html>. Accessed: August 27, 2021.
- New York State Energy Research and Development Authority (NYSERDA). 2022. ReMOTe: Remote Marine and Onshore Technology, NYSERDA Metocean Buoys. Prepared by Normandeau Associates. Available: https://remote.normandeau.com/portal_buoy_data.php?pj=21&public=1. Accessed: February 25, 2022.
- North Carolina Wildlife Resources Commission. 2017. *Bats of North Carolina*. Available: https://www.ncwildlife.org/Portals/0/Conserving/documents/Bats_Species_Profile.pdf. Accessed: August 27, 2021.
- Pelletier, S. K., K. Omland, K. S. Watrous, and T. S. Peterson. 2013. *Information Synthesis on the Potential for Bat Interactions with Offshore Wind Facilities*—Final Report. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM No. 2013-01163. Available: https://tethys.pnnl.gov/sites/default/files/publications/BOEM_Bat_Wind_2013.pdf. Accessed: September 1, 2020.
- Rhode Island Department of Environmental Management. No date. *Bats of Rhode Island*. Available: <http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/bat.pdf>. Accessed: August 27, 2021.
- Schaub, A., J. Ostwald, and B. M. Siemers. 2008. Foraging Bats Avoid Noise. *Journal of Experimental Biology* 211:3147–3180.
- Simmons, A. M., K. N. Horn, M. Warnecke, and J. A. Simmons. 2016. Broadband Noise Exposure Does Not Affect Hearing Sensitivity in Big Brown Bats (*Eptesicus fuscus*). *Journal of Experimental Biology* 219:1031–1040.

- Stantec Consulting Services (Stantec). 2016. *Long-Term Bat Monitoring on Islands, Offshore Structures, and Coastal Sites in the Gulf of Maine, Mid-Atlantic, and Great Lakes*—Final Report. Prepared for the U.S. Department of Energy. Available: <https://tethys.pnnl.gov/sites/default/files/publications/Stantec-2016-Bat-Monitoring.pdf>. Accessed: October 30, 2018.
- Stantec Consulting Services (Stantec). 2020. *Avian and Bat Acoustic Survey Final Post-Construction Monitoring Report, 2017-2020: Block Island Wind Farm, Rhode Island*. November 25.
- U.S. Fish and Wildlife Service (USFWS). 2015. *White Nose Syndrome: The devastating disease of hibernating bats in North America*. Available: <https://www.fws.gov/mountain-prairie/pressrel/2015/WNS%20Fact%20Sheet%20Updated%2007012015.pdf>. Accessed: September 20, 2021.
- U.S. Fish and Wildlife Service (USFWS). 2021a. Information for Planning and Consultation (IPaC) threatened and endangered species list for the Empire Offshore Wind Project.
- U.S. Fish and Wildlife Service (USFWS). 2021b. “Midwest Species on the National Listing Work Plan 2021 to 2025. April 26.” Available: <https://www.fws.gov/midwest/Endangered/listing/MidwestNLP.html>. Accessed: October 18, 2021.
- U.S. Fish and Wildlife Service (USFWS). 2023. Biological Opinion on the Effects of the Empire Wind 1 and Empire Wind 2 Projects on the Federally Listed Piping Plover (*Charadrius melodus*; threatened) and rufa Red Knot (*Calidris canutus rufa*; threatened) within the Jurisdiction of the Long Island Field Office, Shirley, New York.
- Virginia Department of Wildlife Resources. 2021. “Bats.” Available: <https://dwr.virginia.gov/wildlife/nuisance/bats/>. Accessed: August 27, 2021.
- Whitaker, J. O., Jr. 1998. Life History and Roost Switching in Six Summer Colonies of Eastern Pipistrelles in Buildings. *Journal of Mammalogy* 79(2):651–659.
- Whitenosesyndrom.org. 2021. “Where is WNS Now?” Available: <https://www.whitenosesyndrome.org/where-is-wns>. Accessed: August 27, 2021.

B.3.6 Section 3.6, Benthic Resources

- Able, K. W., J. M. Morson, and D. A. Fox. 2018. Food habits of large nektonic fishes: trophic linkages in Delaware Bay and the adjacent ocean. *Estuaries and Coasts* 41:866–883.
- Adams, T. P., R. G. Miller, D. Aleynik, and M. T. Burrows. 2014. “Offshore marine renewable energy devices as stepping stones across biogeographical boundaries.” *Journal of Applied Ecology* 51:330–338.
- Albert, L., F. Deschamps, A. Jolivet, F. Olivier, L. Chauvaud, and S. Chauvaud. 2020. “A current synthesis on the effects of electric and magnetic fields emitted by submarine power cables on invertebrates.” *Marine Environmental Research* 159:104958. DOI: 10.1016/j.marenvres.2020.104958.
- Austin, B. 1999. The effects of pollution on fish health. *Journal of Applied Microbiology Symposium Supplement* 85:234S–242S.

- Battista, T., W. Sautter, M. Poti, E. Ebert, L. Kracker, J. Kraus, A. Mabrouk, B. Williams, D. S. Dorfman, R. Husted, and C. J. Jenkins. 2019. *Comprehensive seafloor substrate mapping and model validation in the New York Bight*. OCS Study BOEM 2019-069 and NOAA Technical Memorandum NOS NCCOS 255: 187 Pages.
- Bejarano, A., J. Michel, J. Rowe, Z. Li, D. French McCay, and D. Schmidt Etkin. 2013. *Environmental Risks, Fate, and Effects of Chemicals Associated with Wind Turbines on the Atlantic Outer Continental Shelf*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-213. Available: <https://espris.boem.gov/final%20reports/5330.pdf>.
- Bilinski, J. 2021. *Review of the Impacts to Marine Fauna from Electromagnetic Frequencies (EMF) Generated by Energy Transmitted through Undersea Electric Transmission Cables*. NJDEP Division of Science and Research. March 2021. 15 pp.
- Brooks, R. A., C. N. Purdy, S. S. Bell, and K. J. Sulak. 2006. "The benthic community of the eastern US continental shelf: A literature synopsis of benthic faunal resources." *Continental Shelf Research* 26:804–818.
- Budelmann, B. U. 1992. Hearing in Crustacea. Pages 131–139 in D. B. Webster, R. R. Fay, and A. N. Popper (eds.), *The Evolutionary Biology of Hearing*. Springer-Verlag: New York.
- Bureau of Ocean Energy Management (BOEM). 2014. *Final Programmatic Environmental Impact Statement for Atlantic OCS Proposed Geological and Geophysical Activities*, Volume 1. BOEM 2014-001. U.S. Department of the Interior, BOEM, Gulf of Mexico OCS Region. 788 pp.
- Bureau of Ocean Energy Management (BOEM). 2015. *Virginia Offshore Wind Technology Advancement Project on the Atlantic Outer Continental Shelf Offshore Virginia Revised Environmental Assessment*: 239.
- Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: <https://www.boem.gov/vineyard-wind>.
- Carpenter, J. R., L. Merckelbach, U. Callies, S. Clark, L. Gaslikova, and B. Baschek. 2016. Potential impacts of offshore wind farms on North Sea stratification. *PLOS ONE* 11:8 e0160830.
- Carroll, A. G., R. Przeslawski, A. Duncan, M. Ganning, and B. Bruce. 2017. "A critical review of the potential impacts of marine seismic surveys on fish and invertebrates." *Marine Pollution Bulletin* 114:9–24. Available: https://www.researchgate.net/publication/311441406_A_critical_review_of_the_potential_impacts_of_marine_seismic_surveys_on_fish_invertebrates?enrichId=rgreq-6b0616dd3abaaab1dcc54802d61f29e9-XXX&enrichSource=Y292ZXJQYWdlOzMxMTQ0MTQwNjtBUzo0OTMwNDMwMTY2Mzg0NjRAMTQ5NDU2MjAyMzUwMQ%3D%3D&el=1_x3&_esc=publicationCoverPdf.
- Causon, P. D., and A. B. Gill. 2018. "Linking ecosystem services with epibenthic biodiversity change following installation of offshore wind farms." *Environmental Science & Policy* 89:340–347.
- Cazenave, P. W., R. Torres, and J. I. Alen. 2016. "Unstructured grid modelling of offshore wind farm impacts on seasonally stratified shelf seas." *Progress in Oceanography* 145:25–41.

- Chen, Z., E. Curchitser, R. Chant, and D. Kang. 2018. Seasonal variability of the cold pool over the Mid-Atlantic bight continental shelf. *Journal of Geophysical Research: Oceans* 123:8203–8226.
- Chen, C., L. Zhao, S. Gallager, R. Ji, P. He, C. Davis, R. C. Beardsley, D. Hart, W. C. Gentleman, L. Wang, S. Li, H. Lin, K. Stokesbury, and D. Bethoney. 2021. Impact of larval behaviors on dispersal and connectivity of sea scallop larvae over the Northeast U.S. Shelf. *Progress in Oceanography* 195:102604.
- Christiansen, N., U. Daewel, B. Djath, and C. Schrum. 2022. Emergence of large-scale hydrodynamic structures due to atmospheric offshore wind farm wakes. *Frontiers in Marine Science* 9:818501.
- Coates, D. A., Y. Deschutter, M. Vincx, and J. Vanaverbeke. 2013. “Enrichment and shifts in macrobenthic assemblages in an offshore wind farm area in the Belgian part of the North Sea.” *Marine Environmental Research* 95 (Supplement C):1–12.
- Coolen, J. W. P., A. R. Boon, R. Crooijmans, H. van Pelt, F. Kleissen, D. Gerla, J. Beermann, S. N. R. Birchenough, L. E. Becking, and P. C. Luttkhuizen. 2020. Marine stepping stones: connectivity of *Mytilus edulis* populations between offshore energy installations. *Molecular Biology* 29:686–703.
- CSA Ocean Sciences, Inc. and Exponent. 2019. *Evaluation of potential EMF effects on fish species of commercial or recreational fishing importance in southern New England*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Headquarters, Sterling, VA. OCS Study BOEM 2019-049.
- De Mesel, I., F. Kerckhof, A. Norro, B. Rumes, and S. Degraer. 2015. Succession and seasonal dynamics of the epifauna community on offshore wind farm foundations and their role as stepping stones for non-indigenous species. *Hydrobiologia* published online January 20, 2015. DOI 10.1007/s10750-014-2157-1.
- Degraer, S., R. Bragant, B. Rumes, and L. E. Vigin. 2018. *Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea: Assessing and Managing Effect Spheres of Influence*. Brussels. Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management: 136 Pages.
- Dorrell, R. M., C. J. Lloyd, B. J. Lincoln, T. P. Rippeth, J. R. Taylor, C. P. Caulfield, J. Sharples, J. A. Polton, B. D. Scannell, D. M. Greaves, R. A. Hall, and J. H. Simpson. 2022. Anthropogenic mixing in seasonally stratified shelf seas by offshore wind farm infrastructure. *Frontiers in Marine Science* 9:830927.
- Edmonds, N. J., C. J. Firmin, D. Goldsmith, R. C. Faulkner, and D. T. Wood. 2016. “A review of crustacean sensitivity to high amplitude underwater noise: Data needs for effective risk assessment in relation to UK commercial species.” *Marine Pollution Bulletin* 108(1–2):5–11. Available: <http://dx.doi.org/10.1016/j.marpolbul.2016.05.006>.
- Eisler, R. 1988. *Lead Hazards to Fish, Wildlife and Invertebrates: A Synoptic Review*. U.S. Fish and Wildlife Service. Patuxent Wildlife Research Center, Laurel MD. 146 pp.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.

- Exponent Engineering, P.C. (Exponent). 2018. *Deepwater Wind South Fork Wind Farm. Offshore Electric and Magnetic Field Assessment*. May 24
- Fayram, A. H., and A. de Risi. 2007. “The potential compatibility of offshore wind power and fisheries: An example using bluefin tuna in the Adriatic Sea.” *Ocean & Coastal Management* 50:597–605.
- Federal Highway Administration (FHWA). 2012. *Tappan Zee Hudson River Crossing Project. Final Environmental Impact Statement*. Available: <https://www.newnybridge.com/documents/feis/vol1/vol-i-cover-and-table-of-contents.pdf>.
- Fisher, S. C., P. J. Phillips, B. J. Brownawell, and J. P. Browne. 2016. “Comparison of wastewater-associated contaminants in the bed sediment of Hempstead Bay, New York, before and after Hurricane Sandy.” *Marine Pollution Bulletin* 107:499–508.
- Gill, A. B., and M. Desender. 2020. “Risk to Animals from Electromagnetic Fields Emitted by Electric Cables and Marine Renewable Energy Devices.” In A. E. Copping and L. G. Hemery (Eds.), *OES-Environmental 2020 State of the Science Report: Environmental Effects of Marine Renewable Energy Development Around the World*. Report for Ocean Energy Systems (OES). (pp. 86–103). DOI:10.2172/1633088.
- Glarou, M., M. Zrust, and J. C. Svendsen. 2020. “Using artificial-reef knowledge to enhance the ecological function of offshore wind turbine foundations: Implications for fish abundance and diversity.” *Journal of Marine Science and Engineering* 8:8050332.
- Goddard, J. H. R., and M. S. Love. 2008. *Megabenthic invertebrates on shell mounds under oil and gas platforms off California*. MMS OCS Study, Minerals Management Service: 60.
- Greene, J. K., M. G. Anderson, J. Odell, and N. Steinberg, Eds. 2010. *The Northwest Atlantic Marine Ecoregional Assessment: Species, habitats and ecosystems*. Phase One. The Nature Conservancy, Eastern U.S. Division, Boston, MA.
- Griffin, R. A., G. J. Robinson, A. West, I. T. Gloyne-Phillips, and R. F. K. Unsworth. 2016. “Assessing fish and motile fauna around offshore windfarms using stereo baited video.” *PLOS ONE* 11:0149701.
- Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, and E. Estela-Gomez. 2017. *Habitat mapping and assessment of Northeast Wind Energy Areas*. Sterling, VA. US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088: 312 Pages.
- Harsanyi, P., K. Scott, B. A. A. Easton, G. de la Cruz Ortiz, E. C. N. Chapman, A. J. R. Piper, C. M. V. Rochas, and A. R. Lyndon. 2022. The effects of anthropogenic electromagnetic fields (EMF) on the early development of two commercially important crustaceans, European lobster, *Homarus gammarus* (L.) and edible crab, *Cancer pagurus* (L.). *Journal of Marine Science and Engineering* 10:564.
- Hawkins, A. D., and A. N. Popper. 2014. “Assessing the impact of underwater sounds on fishes and other forms of marine life.” *Acoustics Today* Spring: 30–41. Available: <https://acousticstoday.org/wp-content/uploads/2015/05/Assessing-the-Impact-of-Underwater-Sounds-on-Fishes-and-Other-Forms-of-Marine-Life-Anthony-D.-Hawkins-and-Arthur-N.-Popper.pdf>.

- HDR, Inc. (HDR). 2020. *Seafloor Disturbance and Recovery Monitoring at the Block Island Wind Farm, Rhode Island – Summary Report*. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2020-019. 317 pp.
- Hooper, T., C. Hattam, and M. Austen. 2017a. “Recreational use of offshore wind farms: Experiences and opinions of sea anglers in the UK.” *Marine Policy* 78:55–60.
- Hooper, T., N. Beaumont, and C. Hattam. 2017b. “The implications of energy systems for ecosystem services: A detailed case study of offshore wind.” *Renewable & Sustainable Energy Reviews* 70:230–241.
- Houghton, R. W., R. Schlitz, R. C. Beardsley, B. Butman, and J. L. Chamberlin. 1982. The Middle Atlantic Bight Cold Pool: Evolution of the Temperature Structure During Summer 1979. *Journal of Physical Oceanography* 12:1019–1029.
- Hutchison, Z. L., D. H. Secor, and A. B. Gill. 2020. “The interaction between resource species and electromagnetic fields associated with electricity production by offshore wind farms.” *Oceanography* 33(4):96–107.
- Hutchison, Z. L., P. Sigray, H. He, A. B. Gill, J. King, and C. Gibson. 2018. *Electromagnetic field (EMF) impacts on elasmobranch (shark, rays, and skates) and American lobster movement and migration from direct current cables*. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS STUDY BOEM 2018-003. Available: <https://espis.boem.gov/final%20reports/5659.pdf>.
- Johnson, T. L., J. Jon van Berkel, L. O. Mortensen, M. A. Bell, I. Tiong, B. Hernandez, D. B. Snyder, F. Thomsen, and O. S. Petersen. 2021. *Hydrodynamic Modeling, Particle Tracking and Agent-Based Modeling of Larvae in the U.S. Mid-Atlantic Bight*. US Department of the Interior, Bureau of Ocean Management. OCS Study BOEM 2021-049: 232 pages.
- Jones, I. T., J. A. Stanley, and T. A. Mooney. 2020. “Impulsive pile driving noise elicits alarm responses in squid (*Doryteuthis pealeii*).” *Marine Pollution Bulletin* 150:110792. DOI:10.1016/j.marpolbul.2019.110792.
- Jones, I. T., J. F. Peyla, H. Clark, Z. Song, J. A. Stanley, and T. A. Mooney. 2021. “Changes in Feeding Behavior of Longfin Squid (*Doryteuthis pealeii*) during Laboratory Exposure to Pile Driving Noise.” 2021. *Marine Environmental Research* 165 (2021):105250.
- Kerckhof, F., B. Rumes, and S. Degraer. 2019. About ‘Mytilisation’ and ‘Slimeification’: A Decade of Succession of the Fouling Assemblages on Wind Turbines off the Belgian Coast. In: *Memoirs on the Marine Environment: Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea*. S. Degraer, R. Brabant, B. Rumes, and L. Vigin, eds. 73–84. Brussels: Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management. Available: https://odnature.naturalsciences.be/downloads/mumm/windfarms/winmon_report_2019_final.pdf. Accessed: February 12, 2020.
- Kerckhof, F., B. Rumes, T. Jacques, S. Degraer, and A. Norro. 2010. “Early development of the subtidal marine biofouling on a concrete offshore windmill foundation on the Thornton Bank (southern North Sea): first monitoring results.” *International Journal of the Society for Underwater Technology* 29:137–149.

- Kerckhof, F., I. De Mesel, and S. Degraer. 2016. *Do wind farms favour introduced hard substrata species. Environmental impacts of offshore wind farms in the Belgian part of the North Sea: Environmental impact monitoring reloaded*. Pp. 61–75.
- Kerckhof, F., S. Degraer, A. Norro, and B. Rumes. 2011. Offshore intertidal hard substrata: a new habitat promoting non-indigenous species in the Southern North Sea: an exploratory study. *Offshore Wind Farms in the Belgian Part of the North Sea: Selected Findings from the Baseline and Targeted Monitoring*. Royal Belgian Institute of Natural Sciences, Management Unit of the North Sea Mathematical Models, Marine Ecosystem Management Unit, Brussels. Pp. 27–37.
- Kraus, C., and L. Carter. 2018. “Seabed recovery following protective burial of subsea cables – Observations from the continental margin.” *Ocean Engineering* 157:251–261.
- Kraus, S. D., S. Leiter, K. Stone, B. Wikgren, C. Mayo, P. Hughes, R. D. Kenney, C. W. Clark, A. N. Rice, B. Estabrook, and J. Tielens. 2016. *Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles*. Final Report. U.S. Department of the Interior, Bureau of Ocean Energy Management, Sterling, Virginia. OCS Study BOEM 2016-054. Available: <https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/Northeast-Large-Pelagic-Survey-Collaborative-Aerial-and-Acoustic-Surveys-for-Large-Whales-and-Sea-Turtles.pdf>.
- Langhamer, O. 2012. Artificial reef effect in relation to offshore renewable energy conversion: state of the art. *The Scientific World Journal* 2012:386713.
- Lefaible, N., L. Colson, U. Braeckman, and T. Moens. 2019. Evaluation of turbine-related impacts on macrobenthic communities withing two offshore wind farms during the operational phase. Pp. 47–64 in *Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea: Marking a Decade of Monitoring, Research and Innovation*. S. Degraer, R. Brabant, B. Rumes, and L. Vigin, eds, Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management, Brussels.
- Lentz, S. J. 2017. Seasonal warming of the Middle Atlantic Bight Cold Pool. *Journal of Geophysical Research: Oceans* 122:941–954.
- Levin, M., and S. G. Ernst. 1997. Applied DC magnetic fields cause alterations in the time of cell divisions and developmental abnormalities in early sea urchin embryos. *Bioelectromagnetics* 18(3):255–263.
- Lindeboom, H. J., H. J. Kouwenhoven, M. J. N. Bergman, S. Bouma, S. Brasseur, R. Daan, R. C. Fijn, D. de Haan, S. Dirksen, R. van Hal, R. Hille Ris Lambers, R. ter Hofstede, K. L. Krijgsveld, M. Leopold, and M. Scheidat. 2011. Short-term ecological effects of an offshore wind farm in the Dutch coastal zone: a compilation. *Environmental Research Letters* 6:035101.
- Love, M. S., M. M. Nishimoto, S. Clark, M. McCrea, and A. S. Bull. 2017. “Assessing potential impacts of energized submarine power cables on crab harvests.” *Continental Shelf Research* 151:23–29. DOI:10.1016/j.csr.2017.10.002.
- Maurer D., W. Leathem, P. Kinner, and J. Tinsman. 1979. Seasonal fluctuations in coastal benthic invertebrate assemblages. *Estuarine and Coastal Marine Science* 8:2:181–193.

- Miles, J., T. Martin, and L. Goddard. 2017. “Current and wave effects around windfarm monopile foundations.” *Coastal Engineering* 121:167–178.
- Miles, T., S. Murphy, J. Kohut, S. Borsetti, and D. Munroe. 2021. Offshore wind energy and the Mid-Atlantic cold pool: A review of potential interactions. *Marine Technology Society Journal* 55:72–87.
- Miller, J. H., and G. R. Potty. 2017. “Overview of Underwater Acoustic and Seismic Measurements of the Construction and Operation of the Block Island Wind Farm.” *Journal of the Acoustical Society of America* 141(5):3993–3993. DOI:10.1121/1.4989144. Available: <https://asa.scitation.org/doi/10.1121/1.4989144>.
- Minerals Management Service (MMS). 2009. *Environmental Assessment: Issuance of Leases for Wind Resource Data Collection on the Outer Continental Shelf offshore Delaware and New Jersey*. U.S. Department of the Interior, Minerals Management Service, Environmental Division. MMS 2009-025. 112 pp.
- Mooney, T. A., R. T. Hanlon, J. Christensen-Dalsgaard, P. T. Madsen, D. R. Ketten, and P. E. Nachtigall. 2010. Sound Detection by the Longfin Squid (*Loligo pealeii*) Studied with Auditory Evoked Potentials: Sensitivity to Low-Frequency Particle Motion and Not Pressure. *Journal of Experimental Biology* 213:3748–3759. DOI:10.1242/jeb.048348.
- Morley E. L., G. Jones, and A. N. Radford. 2014. The Importance of Invertebrates when Considering the Impacts of Anthropogenic Noise. *Proceedings of the Royal Society of London Series B* 281(1776).
- National Marine Fisheries Service (NMFS). 2021. *Section 7 Effect Analysis: Turbidity in the Greater Atlantic Region*. Available: <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effectanalysis-turbidity-greater-atlantic-region>.
- National Oceanic and Atmospheric Administration (NOAA). 2013. *World Ocean Atlas 2013*. Product Documentation. T. Boyer, A. Mishonov, Eds. 14 Pages. Available: <http://data.nodc.noaa.gov/woa/WOA13/DOC/woa13documentation.pdf>.
- National Oceanic and Atmospheric Administration (NOAA). 2022. 2022 State of the Ecosystem Mid-Atlantic. NOAA Fisheries. Available: <https://www.fisheries.noaa.gov/new-england-mid-atlantic/ecosystems/state-ecosystem-reports-northeast-us-shelf>.
- New York City Economic Development Corporation (NYCEDC). 2023. *Final Environmental Assessment Form, Supplemental Analyses, South Brooklyn Marine Terminal Port Infrastructure Improvement Project*. May.
- New York State Department of Environmental Conservation (NYSDEC). 2004. *Division of Water*. Technical & Operational Guidance Series (TOGS) 5.1.9. Available: https://www.dec.ny.gov/docs/water_pdf/togs519.pdf.
- Normandeau Associates, Inc., Exponent, Inc., T. Tricas, and A. Gill. 2011. *Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species*. Final Report. U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09. Available: <https://epis.boem.gov/final%20reports/5115.pdf>. Accessed: October 11, 2021.

- Payne, J. F., C. A. Andrews, L. L. Fancey, A. L. Cook, and J. R. Christian. 2007. "Pilot Study on the Effects of Seismic Air Gun Noise on Lobster (*Homarus americanus*).” *Canadian Technical Report of Fisheries and Aquatic Sciences* No. 2712:V + 46.
- Pierdomenico, M., A. Gori, V. G. Guida, and J. M. Gili. 2017. Megabenthic assemblages at the Hudson Canyon head (NW Atlantic margin): Habitat-faunal relationships. *Progress in Oceanography* 157:12–26.
- Popper, A. N., A. D. Hawkins, and J. A. Sisneros. 2022. Fish Hearing “Specialization” – A Re-Evaluation. *Hearing Research* 425:108393. DOI:10.1016/j.heares.2021.108393.
- Rutecki, D., T. Dellapenna, E. Nestler, F. Scharf, J. Rooker, C. Glass, and A. Pembroke. 2014. *Understanding the Habitat Value and Function of Shoals and Shoal Complexes to Fish and Fisheries on the Atlantic and Gulf of Mexico Outer Continental Shelf*. Literature Synthesis and Gap Analysis: 176 pages.
- Schultz, I. R., D. L. Woodruff, K. E. Marshall, W. J. Pratt, and G. Roesijadi. 2010. *Effects of Electromagnetic Fields on Fish and Invertebrates*. Task 2.1. 3: Effects on Aquatic Organisms-Fiscal Year 2010 Progress Report- Environmental Effects of Marine and Hydrokinetic Energy (No. PNNL-19883 Final). Pacific Northwest National Laboratory, Richland, Washington.
- Solé, M., M. Lenoir, M. Durfort, M. López-Bejar, A. Lombarte, M. van der Schaar, and M. André. 2013. Does Exposure to Noise from Human Activities Compromise Sensory Information from Cephalopod statocysts? *Deep Sea Research Part II: Topical Studies in Oceanography* 95:160–181. DOI:10.1016/j.dsr2.2012.10.006.
- Solé, M., P. Sigray, M. Lenoir, M. van der Schaar, E. Lalander, and M. Andre. 2017. Offshore Exposure Experiments on Cuttlefish Indicate Received Sound Pressure and Particle Motion Levels Associated with Acoustic Trauma. *Scientific Reports* 7:45899. DOI:10.1038/srep45899.
- Szedlmayer, S. T., and K. W. Able. 1996. Patterns of seasonal availability and habitat use by fishes and decapod crustaceans in a southern New Jersey estuary. *Estuaries* 19:697–709.
- Taormina, B. J. Bald, A. Want, G. Thouzeau, M. Lejart, N. Desroy, and A. Carlier. 2018. “A review of potential impacts of submarine power cables on the marine environment: Knowledge gaps, recommendations and future directions.” *Renewable and Sustainable Energy Reviews* 96:380–391.
- Thomsen, F., A. B. Gill, M. Kosecka, M. Andersson, M. André, S. Degraer, T. Folegot, J. Gabriel, A. Judd, T. Neumann, A. Norro, D. Risch, P. Sigray, D. Wood, and B. Wilson. 2015. *MaRVEN—Environmental Impacts of Noise, Vibrations and Electromagnetic Emissions from Marine Renewable Energy*. Luxembourg: Publications Office of the European Union, 2015. DOI:10.2777/272281. Available: https://www.researchgate.net/publication/301296662_MaRVEN_-_Environmental_Impacts_of_Noise_Vibrations_and_Electromagnetic_Emissions_from_Marine_Renewable_Energy.
- Tougaard, J., L. Hermannsen, and P. T. Madsen. 2020. “How loud is the underwater noise from operating offshore wind turbines?” *Journal of the Acoustical Society of America* 148(5):2885–2893.
- U.S. Army Corps of Engineers (USACE). 2014. *Hudson-Raritan Estuary Comprehensive Restoration Plan Potential Restoration Opportunities Project Summary Sheets: Lower Bay*. USACE, New York District. 138 pp.

- U.S. Army Corps of Engineers New York District (USACE NYD). 2006. *New York and New Jersey Harbor Deepening Project: Harborwide Benthic Monitoring Program Final Report*. 23 pages. Available: <https://www.nan.usace.army.mil/Portals/37/docs/harbor/Biological%20and%20Physical%20Monitoring/Benthic/2006%20Harborwide%20Benthos%20Report.pdf>. Accessed: March 9, 2021.
- U.S. Army Corps of Engineers New York District (USACE NYD). 2011. Benthic Recovery Monitoring Report Contract areas: S-AM-1, S-AN-1a, and S-KVK-2. Available: https://www.nan.usace.army.mil/Portals/37/docs/harbor/Biological%20and%20Physical%20Monitoring/Benthic/BenthicRecovery_AM1_AN1a_KVK2.pdf. Accessed March 9, 2021.
- U.S. Environmental Protection Agency (USEPA). 1986. Quality Criteria for Water. EPA 440/5-86-001.
- U.S. Environmental Protection Agency (USEPA). 2021. Superfund Site: Gowanus Canal Brooklyn, NY Site Home Page. Available: <https://cumulis.epa.gov/supercpad/cursites/csitinfo.cfm?id=0206222>.
- U.S. Fish and Wildlife Service (USFWS). 1997. *Significant Habitats and Habitat Complexes of the New York Bight Watershed*: Final Report. Available: https://nctc.fws.gov/pubs5/web_link/text/toc.htm.
- Verbruggen, W., R. van Weerdenburg, F. Scheel, and R. Hoekstra. 2022. *Empire Wind 1 Sediment Transport Study: Modeling of trenching-induced sediment dispersion during the installation of the EW 1 export cables*. Deltares 11207423-002-HYE-0004, July 4, 2022. 263 pp.
- Verbruggen et al. 2022 citing Fugro. 2020. Volume 3: *Data interpretation and evaluation of representative geotechnical parameters, Geotechnical Investigation, Empire Wind, Offshore New York*. Doc. No.:0219021558-3 03. Final Report. February 2020.
- Waterproof Marine Consultancy & Services and Bureau Waardenburg. 2021. *Potential effects of electromagnetic fields in the Dutch North Sea, Phase 1: Desk Study*. Available: <https://www.noordzeeloket.nl>.
- Wilber, D. H., and D. G. Clarke. 2007. Defining and Assessing Benthic Recovery Following Dredging and Dredged Material Disposal. Presentation from the 2007 WODCON XVIII Conference in Lake Buena Vista, FL. Available: https://www.westernredging.org/phocadownload/ConferencePresentations/2007_WODA_Florida/Session3D-EnvironmentalAspectsOfDredging/3%20-%20Wilber%20-%20Defining%20Assessing%20Benthic%20Recovery%20Following%20Dredged%20Material%20Disposal.pdf.
- Williams, S. J., M. A. Arsenault, L. J. Poppe, J. A. Reid, J. M. Reise, and C. J. Jenkins. 2007. *Surficial sediment character of the New York-New Jersey offshore continental shelf region: a GIS compilation*. U.S. Geological Survey Open-File Report 2006-1046.
- Woodruff, D. L., I. R. Schultz, K. E. Marshall, J. A. Ward, and V. Cullinan. 2012. *Effects of Electromagnetic Fields on Fish and Invertebrates*. Task 2.1.3: Effects on Aquatic Organisms – Fiscal Year 2011 Progress Report. PNNL-20813, Pacific Northwest National Laboratory, Richland, Washington.
- Woodruff, D. L., I. R. Schultz, K. E. Marshall, J. A. Ward, and V. I. Cullinan. 2013. *Effects of Electromagnetic Fields on Fish and Invertebrates*: Task 2.1. 3: Effects on Aquatic Organisms-Fiscal Year 2012 Progress Report- Environmental Effects of Marine and Hydrokinetic Energy (No. PNNL-22154 Final). Pacific Northwest National Laboratory, Richland, Washington.

B.3.7 Section 3.7, Birds

- Adams, E. M., P. B. Chilson, and K. A. Williams. 2015. Chapter 27 : Using WSR-88 weather radar to identify patterns of nocturnal avian migration in the offshore environment.
- Ainley, D. G., E. Porzig, D. Zajanc, and L. B. Spear. 2015. Seabird flight behavior in response to altered wind strength and direction. *Marine Ornithology* 43:25–36.
- Audubon. 2019. New York: Survival by Degrees: 389 Species on the Brink.
- Bayne, E. M., L. Habib, and S. Boutin. 2008. Impacts of Chronic Anthropogenic Noise from Energy-sector Activity on Abundance of Songbirds in the Boreal Forest. *Conservation Biology* 22(5):1186–1193.
- Bi, R., Y. Jiao, and J. A. Browder. 2021. Climate driven spatiotemporal variations in seabird bycatch hotspots and implications for seabird bycatch mitigation. *Sci Rep* 11:20704. Available: https://www.bmis-bycatch.org/system/files/zotero_attachments/library_1/U6W3TEDN%20-%20Bi%20et%20al.%20-%202021%20-%20Climate%20driven%20spatiotemporal%20variations%20in%20seabir.pdf. Accessed: May 17, 2022.
- Briggs, K. T., M. E. Gershwin, and D. W. Anderson. 1997. Consequences of petrochemical ingestion and stress on the immune system of seabirds. *ICES Journal of Marine Science* 54:718–725.
- Bruderer, B., and F. Lietchi. 1999. Bird migration across the Mediterranean. In *Proceedings of the 22nd International Ornithological Congress* (N. J. Adams and R. H. Slotow, Editors). Durban, Johannesburg, South Africa, pp. 1983–1999.
- Buehler, D. A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). In *The Birds of North America*, No. 506 (A. Poole and F. Gill, eds.). The Birds of North America Inc., Philadelphia, PA.
- Bureau of Ocean Energy Management (BOEM). 2012. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts: Environmental Assessment*. OCS EIS/EA BOEM 2012-087. Available: https://www.boem.gov/sites/default/files/uploadedFiles/BOEM/BOEM_Newsroom/Library/Publications/2012/BOEM-2012-087.pdf. Accessed: October 13, 2021.
- Bureau of Ocean Energy Management (BOEM). 2014a. *Atlantic OCS Proposed Geological and Geophysical Activities: Mid-Atlantic and South Atlantic Planning Areas Final Programmatic Environmental Impact Statement*. Office of Renewable Energy Programs. OCS EIS/EA BOEM 2014-001. February 2014. Available: <https://www.boem.gov/oil-gas-energy/atlantic-geological-and-geophysical-gg-activities-programmatic-environmental-impact>. Accessed: October 13, 2021.
- Bureau of Ocean Energy Management (BOEM). 2014b. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore Massachusetts: Revised Environmental Assessment*. Office of Renewable Energy Programs. OCS EIS/EA BOEM 2014-603. Available: <https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/MA/Revised-MA-EA-2014.pdf>. Accessed: October 13, 2021.

- Bureau of Ocean Energy Management (BOEM). 2016. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New York: Environmental Assessment*. Office of Renewable Energy Programs. OCS EIS/EA BOEM 2016-042. June 2016. Available: <https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NY/NY-Public-EA-June-2016.pdf>. Accessed: October 13, 2021.
- Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. March. Available: <https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Vineyard-Wind-1-FEIS-Volume-1.pdf>. Accessed: July 27, 2022.
- Bureau of Ocean Energy Management (BOEM). 2021b. *Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development*. April 2021.
- Bureau of Ocean Energy Management (BOEM). 2022. *Empire Wind Project (EW 1 and EW 2) Biological Assessment for the United States Fish and Wildlife Service*. November.
- Causon, Paul D., and Andrew B. Gill. 2018. Linking Ecosystem Services with Epibenthic Biodiversity Change Following Installation of Offshore Wind Farms. *Environmental Science and Policy* 89:340–347.
- Choi, D. Y., T. W. Wittig, and B. M. Kluever. 2020. An Evaluation of Bird and Bat Mortality at Wind Turbines in the Northeastern United States. *PLOS ONE* 15(8): e0238034. Available: <https://doi.org/10.1371/journal.pone.0238034>.
- Cochran, W. W. 1985. Ocean migration of Peregrine Falcons: is the adult male pelagic? In *Proceedings of Hawk Migration Conference IV* (M. Harwood, Editor). Hawk Migration Association of North America, Rochester, NY, pp. 223–237.
- Cook, A. S. C. P., and N. H. K. Burton. 2010. A Review of Potential Impacts of Marine Aggregate Extraction on Seabirds. Marine Environment Protection Fund Project 09/P130. Available: https://www.bto.org/sites/default/files/shared_documents/publications/research-reports/2010/rr563.pdf. Accessed: February 25, 2020.
- Cornell University. 2019. “Golden Eagle Identification.” Available: https://www.allaboutbirds.org/guide/Golden_Eagle/id. Accessed: August 19, 2021. Kerlinger, P. 1985. Water-crossing behavior of raptors during migration. *Wilson Bulletin* 97:109–113.
- Curtice, C., J. Cleary, E. Shumchenia, and P. Halpin. 2016. *Marine-life Data and Analysis Team (MDAT) technical report on the methods and development of marine-life data to support regional ocean planning and management*. Prepared on behalf of the Marine-life Data and Analysis Team (MDAT).
- DeLuca, W. V., B. K. Woodworth, C. C. Rimmer, P. P. Marra, P. D. Taylor, K. P. McFarland, S. A. Mackenzie, and D. R. Norris. 2015. Transoceanic migration by a 12 g songbird. *Biology Letters* 11.
- Desholm, M., and J. Kahlert. 2005. “Avian Collision Risk at an Offshore Wind Farm.” *Biology Letters* 1 (3):296–298. DOI:10.1098/rsbl.2005.0336.
- DeSorbo, C. R., C. Persico, and L. Gilpatrick. 2018. *Studying migrant raptors using the Atlantic Flyway. Block Island Raptor Research Station, Block Island, RI: 2017 season*.

- DeSorbo, C. R., K. G. Wright, and R. Gray. 2012. Bird migration stopover sites: ecology of nocturnal and diurnal raptors at Monhegan Island. Available: <https://briwildlife.org/wp-content/uploads/2022/02/DeSorbo-Wright-Gray-2012-Bird-migration-stopover-sites-ecology-of-nocturnal-and-diurnal-raptors-at-Monhegan-Island-annotated.pdf>. Accessed: January 27, 2023.
- Dierschke, V., R. W. Furness, and S. Garthe. 2016. Seabirds and Offshore Wind Farms in European Waters: Avoidance and Attraction. *Biological Conservation* 202:59–68.
- Dolbeer, R. A., M. J. Begier, P. R. Miller, J. R. Weller, and A. L. Anderson. 2019. *Wildlife Strikes to Civil Aircraft in the United States, 1990–2018*. Federal Aviation Administration National Wildlife Strike Database Serial Report Number 25. 95 pp. + Appendices.
- Drewitt, Allan L., and Rowena H. W. Langston. 2006. “Assessing the Impacts of Wind Farms on Birds.” *Ibis* 148:29–42. Available: <https://doi.org/10.1111/j.1474-919X.2006.00516.x>.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- English, P. A., T. I. Mason, J. T. Backstrom, B. J. Tibbles, A. A. Mackay, M. J. Smith, and T. Mitchell. 2017. *Improving Efficiencies of National Environmental Policy Act Documentation for Offshore Wind Facilities Case Studies Report*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2017-026.
- Equinor. 2019. *Lease Area OCS-A 0512 Annual Avian Report for Survey Activities*. October.
- Equinor. 2021. *Lease Area OCS-A 0512 Annual Avian Report for Survey Activities*; Revision 1. November.
- Faaborg, J., R. T. Holmes, A. D. Anders, K. L. Bildstein, K. M. Dugger, S. A. Gauthreaux, P. Heglund, K. A. Hobson, A. E. Jahn, D. H. Johnson, S. C. Latta, et al. 2010. Recent advances in understanding migration systems of New World land birds. *Ecological Monographs* 80:3–48. DOI: 10.1890/09-0395.1
- Fox, A. D., and I. K. Petersen. 2019. Offshore wind farms and their effects on birds. *Dansk Orn. Foren. Tidsskr.* 113:86–101.
- Fox, A. D., Mark Desholm, Johnny Kahlert, Thomas Kjaer Christensen, and Ib Krag Petersen. 2006. “Information Needs to Support Environmental Impact Assessment of the Effects of European Marine Offshore Wind Farms on Birds.” *Ibis* 148:129–144.
- Furness, B., and H. Wade. 2012. *Vulnerability of Scottish Seabirds to Offshore Wind Turbines*. Marine Scotland Report. Available: <https://tethys.pnnl.gov/sites/default/files/publications/Furness%20and%20Wade%202012.pdf>. Accessed: September 23, 2020.
- Furness, R. W., H. M. Wade, and E. Masden. 2013. Assessing Vulnerability of Marine Bird Populations to Offshore Wind Farms. *Journal of Environmental Management* 119:56–66.
- Garthe, S., and O. Hüppop. 2004. Scaling Possible Adverse Effects of Marine Wind Farms on Seabirds: Developing and Applying a Vulnerability Index. *Journal of Applied Ecology* 41:724–734.

- Gauthreaux, S. A., and C. G. Belser. 1999. Bird migration in the region of the Gulf of Mexico. In *Proceedings of the 22nd International Ornithological Congress* (N. J. Adams and R. H. Slotow, Editors). BirdLife South Africa, Durban, Johannesburg, South Africa, pp. 1931–1947.
- Goodale, M. Wing, and Anita Millman. 2016. “Cumulative Adverse Effects of Offshore Wind Energy Development on Wildlife.” *Journal of Environmental Planning and Management* 59(1):1–29. DOI: 10.1080/09640568.2014.973483.
- Goodwin, S. E., and W. G. Shriver. 2010. Effects of Traffic Noise on Occupancy Patterns of Forest Birds. *Conservation Biology* 25(2):406–411.
- Gray, C. E., A. T. Gilbert, I. J. Stenhouse, and A. M. Berlin. 2016. Occurrence patterns and migratory pathways of Red-throated Loons wintering in the offshore Mid-Atlantic U. S., 2012-2016. In *Determining Fine-scale Use and Movement Patterns of Diving Bird Species in Federal Waters of the Mid-Atlantic United States Using Satellite Telemetry* (C. S. Spiegel, A. M. Berlin, A. T. Gilbert, C. O. Gray, W. A. Montevecchi, I. J. Stenhouse, S. L. Ford, G. H. Olsen, J. L. Fiely, L. Savoy, M. W. Goodale and C. M. Burke, Editors). Department of the Interior, Bureau of Ocean Energy Management . OCS Study BOEM 2017-069, pp. 2012–2016.
- Haney, J. C., P. G. R. Jodice, W. A. Montevecchi, and D. C. Evers. 2017. Challenges to Oil Spill Assessments for Seabirds in the Deep Ocean. *Archives of Environmental Contamination and Toxicology* 73:33–39.
- Hatch, J. M. 2017. Comprehensive Estimates of Seabird-Fishery Interactions for the U.S. Northeast and Mid-Atlantic. *Aquatic Conservation: Marine and Freshwater Ecosystems* 28(1):182–193.
- Hatch, S. K., E. E. Connelly, T. J. Divoll, I. J. Stenhouse, and K. A. Williams. 2013. Offshore Observations of Eastern Red Bats (*Lasiurus borealis*) in the Mid-Atlantic United States Using Multiple Survey Methods. *PLOS ONE* 8:e83803. DOI: 10.1371/journal.pone.0083803.
- Hüppop, O., J. Dierschke, K. Exo, E. Frerich, and R. Hill. 2006. Bird Migration and Potential Collision Risk with Offshore Wind Turbines. *Ibis* 148:90–109.
- Johnston, A., A. S. C. P. Cook, L. J. Wright, E. M. Humphreys, and N. H. K. Burton. 2014. Modeling Flight Heights of Marine Birds to More Accurately Assess Collision Risk with Offshore Wind Turbines. *Journal of Applied Ecology* 51:31–41.
- Kerlinger, P. 1985. Water-crossing behavior of raptors during migration. *Wilson Bulletin* 97:109-113.
- Kerlinger, P., J. L. Gehring, W. P. Erickson, R. Curry, A. Jain, and J. Guarnaccia. 2010. Night Migrant Fatalities and Obstruction Lighting at Wind Turbines in North America. *The Wilson Journal of Ornithology* 122(4):744–754.
- Kushlan, J. A., and H. Hafner (Editors). 2000. *Heron Conservation*. Academic Press, San Diego, CA.
- Leopold, M. F., E. M. Dijkman, and L. Teal. 2011. *Local Birds in and around the Offshore Wind Farm Egmond aan Zee (OWEZ) (T-0 & T-1, 2002-2010)*. Report C187/11. IMARES Wageningen UR, Texel, the Netherlands. Appendices.

- Leopold, M. F., R. S. A. van Bemmelen, and A. F. Zuur. 2013. *Responses of Local Birds to the Offshore Wind Farms PAWP and OWEZ off the Dutch mainland coast*. Report C151/12. IMARES Wageningen UR, Texel, the Netherlands.
- Lindeboom, H. J., H. J. Kouwenhoven, M. J. N. Bergman, S. Bouma, S. Brasseur, R. Daan, R. C. Fijn, D. de Haan, S. Dirksen, R. van Hal, R. Hille Ris Lambers, R. ter Hofstede, K. L. Krijgsveld, M. Leopold, and M. Scheidat. 2011. Short-term Ecological Effects of an Offshore Wind Farm in the Dutch Coastal Zone; a compilation. *Environmental Research Letters* 6:1–13.
- Madsen E. A., R. Reeve, M. Desholm, A. D. Fox, R. W. Furness, and D. T. Haydon. 2012. Assessing the Impact of Marine Wind Farms on Birds Through Movement Modelling. *Journal of the Royal Society Interface* 9:2120–2130.
- Maggini, I., L. V. Kennedy, A. Macmillan, K. H. Elliot, K. Dean, and C. G. Guglielmo. 2017. Light Oiling of Feathers Increases Flight Energy Expenditure in a Migratory Shorebird. *Journal of Experimental Biology* 220:2372–2379.
- McLaughlin, K. E., and H. P. Kunc. 2013. Experimentally Increased Noise Levels Change Spatial and Singing Behavior. *Biology Letters* 9:20120771.
- Mojica, E. K., B. D. Watts, and C. L. Turrin. 2016. Utilization Probability Map for Migrating Bald Eagles in Northeastern North America: A Tool for Siting Wind Energy Facilities and Other Flight Hazards. *PLOS ONE* 11. DOI: 10.1371/journal.pone.0157807
- Morris, S. R., M. E. Richmond, and D. W. Holmes. 1994. Patterns of stopover by warblers during spring and fall migration on Appledore Island, Maine. *Wilson Bulletin* 106:703–718.
- New Jersey Bureau of GIS. 2019. “Landscape 3.3 Regions of New Jersey.” Available: <https://njogis-newjersey.opendata.arcgis.com/datasets/njdep:landscape-3-3-regions-of-new-jersey/explore?location=39.344761%2C-74.511322%2C11.60>. Accessed: August 19, 2021.
- New Jersey Department of Environmental Protection (NJDEP). 2017. *New Jersey Bald Eagle Project, 2017*.
- New Jersey Department of Environmental Protection (NJDEP). 2018. *New Jersey’s Wildlife Action Plan*. Division of Fish and Wildlife. March. Available: https://www.nj.gov/dep/fgw/ensp/wap/pdf/wap_plan18.pdf. Accessed: July 8, 2021.
- New York City Economic Development Corporation (NYCEDC). 2023. *Final Environmental Assessment Form, Supplemental Analyses, South Brooklyn Marine Terminal Port Infrastructure Improvement Project*. May.
- New York State Department of Environmental Conservation (NYSDEC). 2015. *New York State Wildlife Action Plan*. September.
- New York State Department of Environmental Conservation (NYSDEC). No date. Golden Eagle. Available: <https://www.dec.ny.gov/animals/7096.html>. Accessed: October 12, 2021.

- North American Bird Conservation Initiative (NABCI), U.S. Committee. 2016. *The State of the Birds 2016: Report on Public Lands and Waters*. U.S. Department of the Interior. Washington, DC. Available: <https://www.stateofthebirds.org/2016/wpcontent/uploads/2016/05/SoNAB-ENGLISH-web.pdf>. Accessed: September 1, 2020.
- Nye, P. 2010. *New York State Bald Eagle Report 2010*.
- Orr, Terry L., Susan M. Herz, and Darrell L. Oakley. 2013. *Evaluation of Lighting Schemes for Offshore Wind Facilities and Impacts to Local Environments*. Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-0116. Available: <https://espris.boem.gov/final%20reports/5298.pdf>. Accessed: September 1, 2020.
- Paleczny, M., E. Hammill, V. Karpouzi, and D. Pauly. 2015. Population Trend of the World's Monitored Seabirds, 1950–2010. *PLOS ONE* 10(6): e0129342. Available: <https://doi.org/10.1371/journal.pone.0129342>.
- Panuccio, M., G. Dell'Omo, G. Bogliani, C. Catoni, and N. Sapir. 2019. "Migrating Birds Avoid Flying Through Fog and Low Clouds." *International Journal of Biometeorology* 63:231–239. January 28, 2019. Available: <https://doi.org/10.1007/s00484-018-01656-z>.
- Paruk, J. D., E. M. Adams, H. Uher-Koch, K. A. Kovach, D. Long, IV, C. Perkins, N. Schoch, and D. C. Evers. 2016. Polycyclic Aromatic Hydrocarbons in Blood Related to Lower Body Mass in Common Loons. *Science of the Total Environment* 565:360–368.
- Percival, S. 2010. *Kentish Flats Offshore Wind Farm: Diver Surveys 2009–2010*. Ecology Consulting Report to Vattenfall Wind Energy.
- Petersen, Ib Krag, Thomas Kjær Christensen, Johnny Kahlert, Mark Desholm, and Anthony D. Fox. 2006. *Final Results of Bird Studies at the Offshore Wind Farms at Nysted and Horns Rev, Denmark*. National Environmental Research Institute, Ministry of the Environment, Denmark. Available: https://tethys.pnnl.gov/sites/default/files/publications/NERI_Bird_Studies.pdf. Accessed: September 1, 2020.
- Pettersson, J. 2005. *The Impact of Offshore Wind Farms on Bird Life in Southern Kalmar Sound, Sweden: a Final Report Based on Studies 1999–2003*. Report for the Swedish Energy Agency, Lund University, Lund, Sweden.
- Pezy, J. P., A. Raoux, J. C. Dauvin, and Steven Degraer. 2018. "An Ecosystem Approach for Studying the Impact of Offshore Wind Farms: A French Case Study." *ICES Journal of Marine Science*, fsy125, September 12, 2018.
- Plonczkier, P., and I. C. Simms. 2012. Radar Monitoring of Migrating Pink-footed Geese: Behavioral Responses to Offshore Wind Farm Development. *Journal of Applied Ecology* 49:1187–1194.
- Raoux, A., S. Tecchio, J. P. Pezy, G. Lassalle, S. Degraer, S. Wilhelmsson, M. Cachera, B. Ernande, C. Le Guen, M. Haraldsson, K. Grangere, F. Le Loc'h, J. C. Dauvin, and N. Niquil. 2017. Benthic and Fish Aggregation Inside an Offshore Wind Farm: Which Effects on the Trophic Web Functioning? *Ecological Indicators* 72:33–46.

- Regular, P., W. Montevecchi, A. Hedd, G. Roberson, and S. Wilhelm. 2013. “Canadian Fisheries Closure Provides a Large-scale Test of the Impact of Gillnet Bycatch on Seabird Populations.” *Biology Letters* 9(4): 20130088. Available: <https://royalsocietypublishing.org/doi/pdf/10.1098/rsbl.2013.0088>. Accessed: September 1, 2020.
- Roberts, A. J. 2019. *Atlantic Flyway Harvest and Population Survey Data Book*. U.S. Fish and Wildlife Service, Laurel, MD.
- Robinson Willmott, J., and G. Forcey. 2014. *Acoustic Monitoring of Temporal and Spatial Abundance of Birds near Outer Continental Shelf Structures: Synthesis Report*. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Herndon, VA. BOEM 2014-004. 172 pp. Available: <https://espi.boem.gov/final%20reports/5349.pdf>. Accessed: September 7, 2020.
- Robinson Willmott, J., G. Forcey, and A. Kent. 2013. *The Relative Vulnerability of Migratory Bird Species to Offshore Wind Energy Projects on the Atlantic Outer Continental Shelf: An Assessment Method Database*. Final report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2013-207. Available: <https://espi.boem.gov/final%20reports/5319.pdf>. Accessed: September 7, 2020.
- Roman, L., B. D. Hardesty, M. A. Hindell, and C. Wilcox. 2019. A Quantitative Analysis Linking Seabird Mortality and Marine Debris Ingestion. *Scientific Reports* 9(1):1–7.
- Sigourney, D. B., C. D. Orphanides, and J. M. Hatch. 2019. *Estimates of Seabird Bycatch in Commercial Fisheries off the East Coast of the United States from 2015-2016*. NOAA Technical Memorandum NMFS-NE-252. Woods Hole, Massachusetts. 27 pp.
- Skov, H., S. Heinanen, T. Norman, R. M. Ward, S. Mendez-Roldan, and I. Ellis. 2018. *ORJIP Bird Collision and Avoidance Study*. Final report. The Carbon Trust. United Kingdom. April 2018.
- Spiegel, C. S., A. M. Berlin, A. T. Gilbert, C. O. Gray, W. A. Montevecchi, I. J. Stenhouse, S. L. Ford, G. H. Olsen, J. L. Fiely, L. Savoy, M. W. Goodale, and C. M. Burke. 2017. *Determining Finescale Use and Movement Patterns of Diving Bird Species in Federal Waters of the MidAtlantic United States Using Satellite Telemetry*. OCS Study BOEM 2017-069. Available: <https://www.boem.gov/espi/5/5635.pdf>.
- Stabile, Frank A., Gregory J. Watkins-Colwell, Jon A. Moore, Michael Vecchione, and Edward H. Burt Jr. 2017. “Observations of Passerines and a Falcon from a Research Vessel in the Western North Atlantic Ocean.” *The Wilson Journal of Ornithology* 129(2):349–353.
- U.S. Fish and Wildlife Service (USFWS). 2018. “Wind Turbines.” Available: <https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds/collisions/wind-turbines.php>. Accessed: October 13, 2021.
- U.S. Fish and Wildlife Service (USFWS). 2021a. Information for Planning and Consultation (IPaC) threatened and endangered species list for the Empire Offshore Wind Project.
- U.S. Fish and Wildlife Service (USFWS). 2021b. “Threats to Birds: Migratory Bird Mortality – Questions and Answers.” Available: <https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php>. Accessed: October 14, 2021.

- U.S. Fish and Wildlife Service (USFWS). 2023. Biological Opinion on the Effects of the Empire Wind 1 and Empire Wind 2 Projects on the Federally Listed Piping Plover (*Charadrius melodus*; threatened) and rufa Red Knot (*Calidris canutus rufa*; threatened) within the Jurisdiction of the Long Island Field Office, Shirley, New York.
- Vattenfall. 2023. *AOWFL-Resolving Key Uncertainties of Seabird Flight and Avoidance Behaviours at Offshore Wind Farms*. Final report for the study period 2020–2021. Prepared by RPS. February 20.
- Vilela, R., C. Burger, A. Diederichs, F. E. Bachl, L. Szostek, A. Freund, A. Braasch, J. Bellebaum, B. Beckers, W. Piper, and G. Nehls. 2021. Use of an INLA Latent Gaussian Modeling Approach to Assess Bird Population Changes Due to the Development of Offshore Wind Farms. *Front. Mar. Sci.* 8:701332. DOI: 10.3389/fmars.2021.701332.
- Wang, J., X. Zou, W. Yu, D. Zhang, and T. Wang. 2019. Effects of Established Offshore Wind Farms on Energy Flow of Coastal Ecosystems: A Case Study of the Rudong Offshore Wind Farms in China. *Ocean & Coastal Management* 171:111–118.
- Watts, Bryan D. 2010. *Wind and Waterbirds: Establishing Sustainable Mortality Limits within the Atlantic Flyway*. Center for Conservation Biology Technical Report Series, CCBTR-10-15. College of William and Mary/Virginia Commonwealth University, Williamsburg, VA. 43 pp. Available: https://www.ccbirds.org/wp-content/uploads/2013/12/ccbtr-10-05_Watts-Wind-and-waterbirds-Establishing-sustainable-mortality-limits-within-the-Atlantic-Flyway.pdf. Accessed: September 1, 2020.
- Winship, A. J., B. P. Kinlan, T. P. White, J. B. Leirness, and J. Christensen. 2018. Modeling At-Sea Density of Marine Birds to Support Atlantic Marine Renewable Energy Planning: Final Report. OCS Study BOEM 2018-010. Sterling, VA. 67 pp. Available: https://coastalscience.noaa.gov/data_reports/modeling-at-sea-density-of-marine-birds-to-support-atlantic-marine-renewable-energy-planning-final-report/. Accessed: September 7, 2020.

B.3.8 Section 3.8, Coastal Habitat and Fauna

- Bureau of Ocean Energy Management (BOEM). 2022. *Empire Wind Project (EW 1 and EW 2) Biological Assessment for the United States Fish and Wildlife Service*. November.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Friggens, Megan M., Mary I. Williams, Karen E. Bagne, Tosha T. Wixom, and Samuel A. Cushman. 2018. “Chapter 9: Effects of Climate Change on Terrestrial Animals.” *Climate Change Vulnerability and Adaptation in the Intermountain Region*. USDA Forest Service RMRS-GTR-375.
- Kight, C. R., and P. Swaddle. 2011. How and Why Environmental Noise Impacts Animals: an Integrative, Mechanistic Review. *Ecology Letters* (2011) 14:1052–1061.
- New Jersey Department of Environmental Protection (NJDEP). 2020. *New Jersey Scientific Report on Climate Change*, Version 1.0. (Eds. R. Hill, M. M. Rutkowski, L. A. Lester, H. Genievich, N. A. Procopio). Trenton, NJ. 184 pp.

- New York City Economic Development Corporation (NYCEDC). 2023. *Final Environmental Assessment Form, Supplemental Analyses, South Brooklyn Marine Terminal Port Infrastructure Improvement Project*. May.
- New York State. 2008. Coastal Fish & Wildlife Habitat Assessment Form. Nassau Beach. Designated March 15, 1987; revised December 15, 2008.
- New York State Department of Environmental Conservation (NYSDEC). 2015. *New York State Wildlife Action Plan*. September.
- U.S. Department of Agriculture (USDA). No date. *Northeast Climate Hub: Climate Change Impacts to Coastal Forests*. Available: <https://www.climatehubs.usda.gov/hubs/northeast/topic/climate-change-impacts-coastal-forests>. Accessed: October 8, 2021.
- U.S. Fish and Wildlife Service (USFWS). 2022. IPaC: Information for Planning and Consultation. Federally Listed Species List for EW 1 and EW 2.
- U.S. Fish and Wildlife Service (USFWS). 2023. Biological Opinion on the Effects of the Empire Wind 1 and Empire Wind 2 Projects on the Federally Listed Piping Plover (*Charadrius melodus*; threatened) and rufa Red Knot (*Calidris canutus rufa*; threatened) within the Jurisdiction of the Long Island Field Office, Shirley, New York.

B.3.9 Section 3.9, Commercial Fisheries and For-Hire Recreational Fishing

- Andersson, M. H., E. Dock-Åkerman, R. Ubral-Hedenberg, M.C. Öhman, and P. Sigraý. 2007. Swimming behavior of roach (*Rutilus rutilus*) and three-spined stickleback (*Gasterosteus aculeatus*) in response to wind power noise and single-tone frequencies. *AMBIO* 36(8):636–638.
- Atlantic States Marine Fisheries Commission (ASMFC). 2021. Fisheries Management. Available: <http://www.asmfc.org/fisheries-management/program-overview>. Accessed: November 2021.
- Bald, J., C. Hernández, A. Uriarte, J. A. Castillo, P. Ruiz, N. Ortega, Y. T. Enciso, and D. Marina. 2015. Acoustic Characterization of Submarine Cable Installation in the Biscay Marine Energy Platform (BIMEP). [Presentation]. Presented at Bilbao Marine Energy Week, Bilbao, Spain.
- Barton, B. A. 2002. Stress in fishes: A diversity of responses with particular reference to changes in circulating corticosteroids. *Integrative and Comparative Biology* 42:517–525.
- Bureau of Ocean Energy Management (BOEM). 2019. *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Continental Shelf*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Sterling, VA. OCS Study BOEM 2019-036. May 2019.
- Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: <https://www.boem.gov/vineyard-wind>. Accessed: November 2021.

- Carroll, A. G., R. Przeslawski, A. Duncan, M. Ganning, and B. Bruce. 2016. "A critical review of the potential impacts of marine seismic surveys on fish and invertebrates." *Marine Pollution Bulletin* 114:9–24. Available: https://www.researchgate.net/publication/311441406_A_critical_review_of_the_potential_impacts_of_marine_seismic_surveys_on_fish_invertebrates?enrichId=rgreq-6b0616dd3abaaab1dcc54802d61f29e9-XXX&enrichSource=Y292ZXJQYWdlOzMxMTQ0MTQwNjUzOTMwNDMwMTY2Mzg0NjRAMTQ5NDU2MjAyMzUwMQ%3D%3D&el=1_x3&_esc=publicationCoverPdf.
- Claisse, J. T., D. J. Pondella II, M. Love, L. A. Zahn, C. M. Williams, J. P. Williams, and A. S. Bull. 2014. Oil Platforms Off California are among the Most Productive Marine Fish Habitats Globally. *Proceedings of the National Academy of Sciences of the United States of America* 111(43):15462–15467.
- Debusschere, E., K. Hostens, D. Adriaens, B. Ampre, D. Botteldooren, G. De Boeck, A. De Muynck, A. Kumar Sinha, S. Vandendriessche, L. Van Hoorebeke, M. Vincx, and S. Degraer. 2016. Acoustic stress responses in juvenile sea bass *Dicentrarchus labrax* induced by offshore pile driving. *Environmental Pollution* 208:747–757.
- Edmonds, N. J., C. J. Firmin, D. Goldsmith, R. C. Faulkner, and D. T. Wood. 2016. "A review of crustacean sensitivity to high amplitude underwater noise: Data needs for effective risk assessment in relation to UK commercial species." *Marine Pollution Bulletin* 108(1–2):5–11. Available: <http://dx.doi.org/10.1016/j.marpolbul.2016.05.006>.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Fabrizio, M. C., J. P. Manderson, and J. P. Pessutti. 2014. Home Range and Seasonal Movements of Black Sea Bass (*Centropristis striata*) During their Inshore Residency at a Reef in the Mid-Atlantic Bight. *Fishery Bulletin* 112:82–97.
- Fisheries Hydroacoustic Working Group (FHWG). 2008. *Agreement in principle for interim criteria for injury to fish from pile driving activities*. Prepared for FHWG Agreement in Principle Technical/Policy Meeting, June 11, 2008, Vancouver, WA. Available: http://www.dot.ca.gov/hq/env/bio/files/fhwgcriteria_agree.pdf.
- Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, and E. Estela-Gomez. 2017. Habitat Mapping and Assessment of Northeast Wind Energy Areas. Sterling, VA: US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088. 312 p.
- Hare, J. A., W. E. Morrison, M. W. Nelson, M. M. Stachura, E. J. Teeters, R. B. Griffis, M. A. Alexander, J. D. Scott, L. Alade, R. J. Bell, A. S. Chute, K. L. Curti, T. H. Curtis, D. Kircheis, J. F. Kocik, S. M. Lucey, C. T. McCandless, L. M. Milke, D. E. Richardson, E. Robillard, H. J. Walsh, M. C. McManus, K. E. Marancik, and C. A. Griswold. 2016. A vulnerability assessment of fish and invertebrates to climate change on the Northeast U.S. continental shelf. *PLOS ONE* 11(2):e0146756.
- Hawkins, A. D., and A. N. Popper. 2014. "Assessing the impact of underwater sounds on fishes and other forms of marine life." *Acoustics Today* Spring: 30–41. Available: <https://acousticstoday.org/wp-content/uploads/2015/05/Assessing-the-Impact-of-Underwater-Sounds-on-Fishes-and-Other-Forms-of-Marine-Life-Anthony-D.-Hawkins-and-Arthur-N.-Popper.pdf>.

- Jones, I. T., J. A. Stanley, and T. A. Mooney. 2020. Impulsive Pile Driving Noise Elicits Alarm Responses in Squid (*Doryteuthis pealeii*). *Marine Pollution Bulletin*. Available: <https://www.sciencedirect.com/science/article/pii/S0025326X19309488?via%3Dihub>.
- Kirkpatrick, A., S. Benjamin, G. DePiper, T. Murphy, S. Steinback, and C. Demarest. 2017. *Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic*. Volumes I and II. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. Prepared under BOEM Interagency Agreement No: M12PG00028. OCS Study BOEM 2017-012.
- Madsen, P. T., M. Wahlberg, J. Tougaard, K. Lucke, and P. Tyack. 2006. Wind turbine underwater noise and marine mammals: implications of current knowledge and data needs. *Marine Ecology Progress Series* 309:279–295.
- McCauley, R. D., J. Fewtrell, A. J. Duncan, C. Jenner, M. N. Jenner, J. Penrose, R. I. T. Prince, A. Adhitya, J. Murdoch, and K. McCabe. 2000. Marine seismic surveys – a study of environmental implications. *Australian Petroleum Production Exploration Association Journal* 40:692–708.
- McCreary, S., and B. Brooks. 2019. Atlantic Large Whale Take Reduction Team Meeting: Key Outcomes Meeting. April 23–26, 2019. Providence, Rhode Island. Available: <https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-mammal-protection/atlantic-large-whale-take-reduction-plan>.
- Mid-Atlantic Fishery Management Council (MAFMC). 2021. Fishery Management Plans and Amendments. Available: <https://www.mafmc.org/fishery-management-plans>. Accessed: November 2021.
- Mid-Atlantic Regional Council on the Ocean (MARCO). Mid-Atlantic Ocean Data Portal. 2022. U.S. Government Publishing Office. NOAA Office of Coast Survey. U.S. Army of Corps of Engineers. Available: <https://portal.midatlanticocean.org/>. Accessed: September 2020.
- Moser, J., and G. R. Shepherd. 2009. Seasonal Distribution and Movement of Black Sea Bass (*Centropristis striata*) in the Northwest Atlantic as Determined from a Mark-Recapture Experiment. *Journal of Northwest Atlantic Fisheries Science* 40:17–28.
- Mueller-Blenkle, C., P. K. McGregor, A. B. Gill, M. H. Andersson, J. Metcalfe, V. Bendall, P. Sigra, D. T. Wood, and F. Thomsen. 2010. *Effects of Pile-driving Noise on the Behaviour of Marine Fish*. COWRIE Ref: Fish 06-08; Cefas Ref: C3371. 62 p.
- National Marine Fisheries Service (NMFS). 2006. Consolidated Atlantic Highly Migratory Species Management Plan. Available: <https://www.fisheries.noaa.gov/management-plan/consolidated-atlantic-highly-migratory-species-management-plan>. Accessed: November 2021.
- National Marine Fisheries Service (NMFS). 2019. *Fisheries Economics of the United States 2019*. Available: <https://www.fisheries.noaa.gov/resource/document/fisheries-economics-united-states-report-2019>. Accessed: December 2022.
- National Marine Fisheries Service (NMFS). 2022a. Commercial Fisheries Statistics. Available: <https://www.fisheries.noaa.gov/national/sustainable-fisheries/commercial-fisheries-landings>. Accessed: December 2022.

- National Marine Fisheries Service (NMFS). 2022b. Socioeconomic Impacts of Atlantic Offshore Wind Development. Available: <https://www.fisheries.noaa.gov/resource/data/socioeconomic-impacts-atlantic-offshore-wind-development>. Accessed: December 2022.
- National Marine Fisheries Service (NMFS). 2022c. Social Indicators for Coastal Communities. Available: <https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-coastal-communities>. Accessed: December 2022.
- National Marine Fisheries Service (NMFS). 2022d. Recreational Fisheries Statistics Queries. Available: <https://www.fisheries.noaa.gov/recreational-fishing-data/recreational-fishing-data-and-statistics-queries>. Accessed: December 2022.
- Nedwell, J., and D. Howell. 2004. *A Review of Offshore Windfarm Related Underwater Noise Sources*. Final Report submitted to COWRIE (Collective Offshore Wind Energy Research into the Environment). 57 pp.
- New England Fishery Management Council (NEFMC). 2017. Omnibus Essential Fish Habitat Amendment 2, Including a Final Environmental Impact Statement.
- New England Fishery Management Council (NEFMC). 2021. Management Plans. Available: <https://www.nefmc.org/management-plans>. Accessed: November 2021.
- New Jersey Department of Environmental Protection (NJDEP). 2019. Locations of New Jersey Artificial Reefs: A guide to fishing and diving New Jersey's reefs. Available: <https://www.nj.gov/dep/fgw/refloc00.html>. Accessed: November 2021.
- New York State Department of Environmental Conservation (NYSDEC). 2019. Artificial Reefs in New York. Available: <https://www.dec.ny.gov/outdoor/7896.html>. Accessed: November 2021.
- O'Farrell, S., I. Chollett, J. N. Sanchirico, and L. Perruso. 2019. Classifying fishing behavioral diversity using high-frequency movement data. *Proceedings of the National Academy of Sciences of the United States of America* 116:16811–16816.
- Papaioannou, E. A., R. L. Selden, J. Olson, B. J. McCay, M. L. Pinsky, and K. St. Martin. Not all those who wander are lost – responses of fishers' communities to shifts in the distribution and abundance of fish. *Frontiers in Marine Science* 8:669094.
- Popper, A. N., and M. C. Hastings. 2009. The effects of anthropogenic sources of sound on fishes. *Journal of Fish Biology* 75:455–489.
- Popper, A. N., A. D. Hawkins, R. R. Fay, D. Mann, S. Bartol, T. H. Carlson, S. Coombs, W. T. Ellison, R. Gentry, M. B. Halvorsen, S. Løkkeborg, P. Rogers, B. L. Southall, D. G. Zeddies, and W. N. Tavolga. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles*. A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI.
- Purser, J., and A. N. Radford. 2011. Acoustic noise induces attention shifts and reduces foraging performance in three-spined sticklebacks (*Gasterosteus aculeatus*). *PLOS ONE* 6(2):e17478.
- Roberts, L. and M. Elliott. 2017. Good or bad vibrations? Impacts of anthropogenic vibration on marine epibenthos. *Science of the Total Environment* 595:255–268.

- Roberts, L., S. Cheesman, T. Breithaupt, and M. Elliot. 2015. Sensitivity of the mussel *Mytilus edulis* to substrate-borne vibration in relation to anthropogenically generated noise. *Marine Ecology Progress Series* 538(2015):185–195.
- Secor, D. H., F. Zhang, M. H. P. O'Brien, and M. Li. 2018. Ocean Destratification and Fish Evacuation Caused by a Mid-Atlantic Tropical Storm. *ICES Journal of Marine Science* 76(2):573–584.
- Shelledy, K., B. Phelan, J. Stanley, and H. Soulen. 2018. *Could Offshore Wind Energy Construction Affect Black Sea Bass Behavior?* Available: <https://apps-nefsc.fisheries.noaa.gov/rcb/news/pr2018/features/afs-2018/offshore-wind-black-sea-bass.html>.
- Siddagangaiah, S., C.-F. Chen, W.-C. Hu, R. Danovaro, and N. Pieretti. 2021. Silent winters and rock-and-roll summers: The long-term effects of changing oceans on marine fish vocalization. *Ecological Indicators* 125:107456.
- Skalski, J. R., W. H. Pearson, and C. I. Malme. 1992. Effects of Sound from a Geophysical Survey Device on Catch-Per-Unit-Effort in a Hook-and-Line Fishery for Rockfish (*Sebastes* spp.). *Canadian Journal of Fisheries and Aquatic Sciences* 49:1357–1365.
- Slabbekoorn, H., N. Bouton, I. van Opzeeland, A. Coers, C. Ten Cate, and A. N. Popper. 2010. A noisy spring: the impact of globally rising underwater sound levels on fish. *Trends in Ecology and Evolution* 25:419–427.
- Smith, J., M. Lowry, C. Champion, and I. Suthers. 2016. A Designed Artificial Reef is Among the Most Productive Marine Fish Habitats: New Metrics to Address “Production Versus Attraction.” *Marine Biology* 163:18.
- Stöber, U., and F. Thomsen. 2021. How could operational underwater sound from future offshore wind turbines impact marine life? *The Journal of the Acoustical Society of America* 149:1791–1795.
- Taormina B., J. Bald, A. Want, G. Thouzeau, M. Lejart, N. Desroy, and A. Carrier. 2018. A Review of Potential Impacts of Submarine Cables on the Marine Environment: Knowledge Gaps, Recommendations, and Future Directions. *Renewable and Sustainable Energy Reviews* 96:380–391.
- Wahlberg, M., and H. Westerberg. 2005. Hearing in fish and their reactions to sounds from offshore wind farms. *Marine Ecology Progress Series* 288:295–309.
- Wysocki, L. E., S. Amoser, and F. Ladich. 2007. Diversity in ambient noise in European freshwater habitats: Noise levels, spectral profiles, and impact on fishes. *Journal of the Acoustical Society of America* 121(5):2559–2566.

B.3.10 Section 3.10, Cultural Resources

- Atlantic Shores Offshore Wind, LLC (Atlantic Shores). 2021. *Atlantic Shores Offshore Wind, Construction and Operations Plan, Lease Area OCS-A 0499*. Available: <https://www.boem.gov/renewable-energy/state-activities/atlantic-shores-offshore-wind-construction-and-operations-plan>.

- Bureau of Ocean Energy Management (BOEM). 2012. *Inventory and analysis of archaeological site occurrence on the Atlantic outer continental shelf*. Prepared by TRC Environmental Corporation for the U.S. Dept. of the Interior, Bureau of Ocean Energy, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2012-008. 324 pp.
- Bureau of Ocean and Energy Management (BOEM). 2020. *Guidelines for Providing Archaeological and Historic Property Information Pursuant to 30 CFR Part 585*. May 27. Available: <https://www.boem.gov/sites/default/files/documents/about-boem/Archaeology%20and%20Historic%20Property%20Guidelines.pdf>. Accessed: November 7, 2021.
- Bureau of Ocean and Energy Management (BOEM). 2022. *Cumulative Historic Resources Visual Effects Analysis for the Empire Wind Project (EW 1 and EW 2)*. October.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Federal Transit Administration (FTA). 2006. *Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06)*. Available: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_Noise_and_Vibration_Manual.pdf. Accessed: May 31, 2019.
- New York City Economic Development Corporation (NYCEDC). 2023. South Brooklyn Marine Terminal Port Infrastructure Improvement Project, U.S. Army Corps of Engineers/New York State Department of Environmental Conservation (NYSDEC) Joint Permit Application Package. USACE Pre-Application # NAN-2022-00900-EMI. May.

B.3.11 Section 3.11, Demographics, Employment, and Economics

- American Wind Energy Association (AWEA). 2020. *U.S. Offshore Wind Power Economic Impact Assessment*. Available: https://supportoffshorewind.org/wp-content/uploads/sites/6/2020/03/AWEA_Offshore-Wind-Economic-ImpactsV3.pdf. Accessed: March 2020.
- Atkinson-Palombo, Carol, and Ben Hoen. 2014. *Relationship Between Wind Turbines and Residential Property Values in Massachusetts*. A Joint Report of University of Connecticut and Lawrence Berkeley National Laboratory. Available: <http://files.masscec.com/research/RelationshipWindTurbinesandResidentialPropertyValuesinMassachusetts.pdf>. Accessed: November 6, 2018.
- BVG Associates Limited (BVG). 2017. *U.S. Job Creation in Offshore Wind: A Report for the Roadmap Project for Multi-State Cooperation on Offshore Wind*. Final Report. Report No. 17-22. Report for New York State Energy Research and Development Authority (NYSERDA). Available: <https://tethys.pnnl.gov/sites/default/files/publications/NYSERDA-Report-2017-OSW-Jobs.pdf>. Accessed: October 7, 2020.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Equinor. 2020. Port of Albany Press Release. Available: <https://www.equinor.com/content/dam/statoil/documents/united-states/Equinor-Port-of-Albany-Press-release-11122020.pdf>. Accessed: November 12, 2021.

- Georgetown Economic Services, LLC. 2020. *Potential Employment Impact from Offshore Wind in the United States: The Mid-Atlantic and New England Region*. July 27, 2020.
- Gould, Ross, and Eliot Cresswell. 2017. *New York State and the Jobs of Offshore Wind Energy*. Workforce Development Institute, New York.
- National Ocean Economics Program. 2018. Market Data: Ocean Economy Data. Available: <http://www.oceaneconomics.org/Market/ocean/oceanEcon.asp?IC=N&dataSource=E>. Accessed: November 10, 2021.
- National Oceanic and Atmospheric Administration (NOAA). 2018. Quick Report Tool for Socioeconomic Data, 2018. Available: <https://coast.noaa.gov/quickreport/#/index.html>. Accessed: November 1, 2021.
- New York City Economic Development Corporation (NYCEDC). 2023. South Brooklyn Marine Terminal Port Infrastructure Improvement Project, U.S. Army Corps of Engineers/New York State Department of Environmental Conservation (NYSDEC) Joint Permit Application Package. USACE Pre-Application # NAN-2022-00900-EMI. May.
- New York State Energy Research and Development Authority (NYSERDA). 2021. Offshore Wind, Workforce Development. Available: <https://www.nyserda.ny.gov/All-Programs/Programs/Offshore-Wind/Focus-Areas/Supply-Chain-Economic-Development/Workforce-Development>. Accessed: November 8, 2021.
- U.S. Bureau of Economic Analysis (U.S. BEA). 2020. *Current-Dollar Gross Domestic Product (GDP) by State and Region, 2018:Q1–2019: Q4*. Available: <https://www.bea.gov/data/gdp/gdp-state>. Accessed: August 2020.
- U.S. Bureau of Economic Analysis (U.S. BEA). 2021. GDP by County 2020. Available: <https://www.bea.gov/data/gdp/gdp-county-metro-and-other-areas>. Accessed: September 22, 2022.
- U.S. Bureau of Labor Statistics. 2021a. Labor Force Data by County, 2021 Annual Averages. Available: <https://www.bls.gov/lau/laucnty21.txt>. Accessed: September 21, 2022.
- U.S. Bureau of Labor Statistics. 2021b. Unemployment Rates for States, 2021 Annual Averages. Available: <https://www.bls.gov/lau/lastrk21.htm>. Accessed: September 21, 2022.
- U.S. Census Bureau. 2019a. American Community Survey 2015–2019 5-Year Estimates. Available: <https://socialexplorer.com>. Accessed: November 10, 2021.
- U.S. Census Bureau. 2019b. OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2002–2019), All Jobs, Where Workers Work, 2019. Available: <https://onthemap.ces.census.gov/>. Accessed: November 10, 2021.
- U.S. Census Bureau. 2020. Census 2020. Available: <https://socialexplorer.com>. Accessed: November 3, 2021.
- U.S. Energy Information Administration. 2019. State Energy Production Estimates 1960 Through 2019. Available: https://www.eia.gov/state/seds/sep_prod/SEDS_Production_Report.pdf. Accessed: November 12, 2021.

University of Delaware. 2019. *Supply Chain Contracting Forecast for U.S. Offshore Wind Power*. Special Initiative on Offshore Wind. March 2019.

B.3.12 Section 3.12, Environmental Justice

Bureau of Ocean Energy Management (BOEM). 2021. *Empire Wind Construction and Operations Plan Scoping Report*. August.

Buonocore, Jonathan J., Patrick Luckow, Jeremy Fisher, Willett Kempton, and Jonathan L. Levy. 2016. "Health and Climate Benefits of Offshore Wind Facilities in the Mid-Atlantic United States." *Environmental Research Letters* 11 074019. July 14, 2016. Available: <https://iopscience.iop.org/article/10.1088/1748-9326/11/7/074019/pdf>. Accessed: November 2021.

City of New York. 2021. New York City Counties. Available: <https://portal.311.nyc.gov/article/?kanumber=KA-02877>. Accessed: November 18, 2021.

Corburn, Jason. 2002. "Combining Community-Based Research and Local Knowledge to Confront Asthma and Subsistence-Fishing Hazards in Greenpoint/Williamsburg, Brooklyn, New York." *Environmental Health Perspectives*, Volume 110, Supplement 2, April.

Council on Environmental Quality (CEQ). 1997. *Environmental Justice: Guidance Under the National Environmental Policy Act*. Available: https://www.epa.gov/sites/default/files/2015-02/documents/ej_guidance_nepa_ceq1297.pdf. Accessed: September 20, 2021

Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.

National Oceanic and Atmospheric Administration (NOAA). 2022a. Social Indicators for Coastal Communities. Available: <https://www.fisheries.noaa.gov/national/socioeconomics/social-indicators-coastal-communities>. Accessed: May 9, 2022.

National Oceanic and Atmospheric Administration (NOAA). 2022b. Marine Recreational Information Program. Available: <https://www.st.nmfs.noaa.gov/msd/html/siteRegister.jsp>. Accessed: September 26, 2022.

New York State Climate Justice Working Group (NYS CJWG). 2023. Disadvantaged Communities Criteria. Frequently Asked Questions. Available: <https://climate.ny.gov/resources/disadvantaged-communities-criteria/>. Accessed: May 14, 2023.

New York State Gaming Commission (NYS Gaming Commission). 2021. Frequently Asked Questions. Available: <https://www.gaming.ny.gov/gaming/indianFAQ.php#FAQ5>. Accessed: November 19, 2021.

Texas Historical Commission. No date. Tribal Contacts. Available: <https://www.thc.texas.gov/project-review/tribal-consultation-guidelines/tribal-contacts>. Accessed: January 5, 2022.

Texas State Historical Association. 2020. Karankawa Indians. Available: <https://www.tshaonline.org/handbook/entries/karankawa-indians>. Accessed: January 5, 2022.

- Thind, Maninder P.S., Christopher W. Tessum, Ines L. Azevedo, and Julian D. Marshall. 2019. Fine Particulate Air Pollution from Electricity Generation in the US: Health Impacts by Race, Income, and Geography. *Environmental Science & Technology*. DOI: 10.1021/acs.est.9b02527. Available: https://depts.washington.edu/airqual/Marshall_117.pdf. Accessed: November 7, 2021.
- U.S. Census Bureau (USCB). 2010. Table S1701: POVERTY STATUS IN THE PAST 12 MONTHS. 2010: ACS 1-year Estimates Subject Table. Available: <https://data.census.gov/cedsci/>.
- U.S. Census Bureau (USCB). 2019. Table S1701: POVERTY STATUS IN THE PAST 12 MONTHS. 2019: ACS 5-year Estimates Subject Table. Available: <https://data.census.gov/cedsci/>.
- U.S. Environmental Protection Agency (USEPA). 2016. *Promising Practices for EJ Methodologies in NEPA Reviews: Report for the Federal Interagency Working Group on Environmental Justice & NEPA Committee*. Available: https://www.epa.gov/sites/default/files/2016-08/documents/nepa_promising_practices_document_2016.pdf. Accessed: September 20, 2021.
- U.S. Environmental Protection Agency (USEPA). 2022. Environmental Justice Screening and Mapping Tool (Version 2.0). Available at: <https://ejscreen.epa.gov/mapper/>.
- Wang, Y., I. Kloog, B. A. Coull, A. Kosheleva, A. Zanobetti, and J. D. Schwartz. 2016. “Estimating causal effects of long-term PM_{2.5} exposure on mortality in New Jersey.” *Environ Health Perspect*. 124:1182–1188. Available: <https://ehp.niehs.nih.gov/doi/pdf/10.1289/ehp.1409671>. Accessed: November 2021.

B.3.13 Section 3.13, Finfish, Invertebrates, and Essential Fish Habitat

- Able, K. W., and M. P. Fahay. 1998. *The First Year in the Life of Estuarine Fishes in the Middle Atlantic Bight*. Rutgers University Press, New Brunswick, New Jersey.
- Able, K. W., T. M. Grothues, J. M. Morson, and K. E. Coleman. 2014. Temporal variation in winter flounder recruitment at the southern margin of their range: is the decline due to increasing temperatures? *ICES Journal of Marine Science* 71:2186–2197.
- AECOM Technical Services (AECOM). 2022. *Essential Fish Habitat Assessment for the South Brooklyn Marine Terminal Port Infrastructure Improvement Project*. USACE Project # NAN202200900EMI. 100 pp.
- Akhtar, N., B. Geyer, B. Rockel, P. S. Sommer, and C. Schrum. 2021. Accelerating deployment of offshore wind energy alter wind climate and reduce future power generation potentials. *Scientific Reports* 11:11826.
- Albert, L., F. Deschamps, A. Jolivet, F. Olivier, L. Chauvaud, and S. Chauvaud. 2020. A current synthesis on the effects of electric and magnetic fields emitted by submarine power cables on invertebrates. *Marine Environmental Research* 159:104958.
- Albert, L., O. Maire, F. Olivier, C. Lambert, A. Romero-Ramirez, A. Jolivet, L. Chauvaud, and S. Chauvaud. 2022. Can artificial magnetic fields alter the functional role of the blue mussel, *Mytilus edulis*? *Marine Biology* 169:75.

- Andersson, M. H., E. Dock-Åkerman, R. Ubral-Hedenberg, M.C. Öhman, and P. Sigray. 2007. Swimming behavior of roach (*Rutilus rutilus*) and three-spined stickleback (*Gasterosteus aculeatus*) in response to wind power noise and single-tone frequencies. *AMBIO* 36:636–638.
- Andre, M., M. Sole, M. Lenoir, M. Durfort, C. Quero, A. Mas, A. Lombarte, M. van der Schaar, M. Lopez-Bejar, M. Morell, S. Zaugg, and L. Houegnigan. 2011. Low-frequency sounds induce acoustic trauma in cephalopods. *Frontiers in Ecology and the Environment* 9:489–493.
- Austin, B. 1999. The effects of pollution on fish health. *Journal of Applied Microbiology Symposium Supplement* 85:234–242.
- Bacheler, N. M., C. M. Schobernd, S. L. Harter, A. W. David, G. R. Sedberry, and G. T. Kellison. 2022. Reef fish community structure along the southeastern US Atlantic continental shelf break and upper slope appears resistant to increasing lionfish (*Pterois volitans/miles*) density. *Bulletin of Marine Science* 98:75–98.
- Bacheler, N. M., P. E. Whitfield, R. C. Muñoz, B. B. Harrison, C. A. Harms, and C. A. Buckel. 2015. Movement of invasive adult lionfish *Pterois volitans* using telemetry: importance of controls to estimate and explain variable detection probabilities. *Marine Ecology Progress Series* 527:205–220.
- Bain, M. B. 1997. Atlantic and shortnose sturgeons of the Hudson River: common and divergent life history attributes. *Environmental Biology of Fishes* 48:347–358.
- Baker, K. and U. Howson. 2021. *Data Collection and Site Survey Activities for Renewable Energy on the Atlantic Outer Continental Shelf*. Biological Assessment. Bureau of Ocean Energy Management Office of Renewable Energy Programs. U.S. Department of the Interior. 152 pp.
- Balazik, M. T., K. J. Reine, A. J. Spells, C. A. Fredrickson, M. L. Fine, G. C. Garman, and S. P. McNich. 2012. The potential for Vessel Interactions with Adult Atlantic Sturgeon in the James River, Virginia. *North American Journal of Fisheries Management* 32:1062–1069.
- Bald, J., C. Hernández, A. Uriarte, J. A. Castillo, P. Ruiz, N. Ortega, Y. T. Enciso, and D. Marina. 2015. Acoustic Characterization of Submarine Cable Installation in the Biscay Marine Energy Platform (BIMEP). [Presentation]. Presented at Bilbao Marine Energy Week, Bilbao, Spain.
- Bärfuss, K., J. Schulz-Stellenfleth, and A. Lampert. 2021. The impact of offshore wind farms on sea state demonstrated by airborne LiDAR measurements. *Journal of Marine Science and Engineering* 9:644.
- Barker, B. D., A. Z. Horodysky, and D. W. Kerstetter. 2018. Hot or not? Comparative behavioral thermoregulation, critical temperature regimes, and thermal tolerances of the invasive lionfish *Pterois* sp. versus native western North Atlantic reef fishes. *Biological Invasions* 20:45–58.
- Beardsall, J. W., M. F. McLean, S. J. Cooke, B. C. Wilson, M. J. Dadswell, A. M. Redden, and J. W. Stokesbury. 2013. Consequences of incidental otter trawl capture on survival and physiological condition of threatened Atlantic sturgeon. *Transactions of the American Fisheries Society* 142:1202–1214.
- Beardsley, R. C., and B. Butman. 1974. Circulation on the New England Continental Shelf: Response to strong winter storms. *Geophysical Research Letters* 1:181–184.

- Beardsley, R. C., and C. D. Winant. 1979. On the mean circulation in the Mid-Atlantic bight. *Journal of Physical Oceanography* 9:612–619.
- Bergstrom, L., F. Sundqvist, and U. Bergstrom. 2013. Effects of an offshore wind farm on temporal and spatial patterns in the demersal fish community. *Marine Ecology Progress Series* 485:199–210.
- Berrien, P., and J. Sibunka. 1999. *Distribution patterns of fish eggs in the U.S. Northeast continental shelf ecosystem 1977–1987*. NOAA Technical Report NMFS 145. 310 pages.
- Boehlert, G. W., and B. C. Mundy. 1988. Roles of behavioral and physical factors in larval and juvenile fish recruitment to estuarine nursery areas. *American Fisheries Society Symposium* 3:51–67.
- Bonzek, C. F., J. Gartland, D. J. Gauthier, and R. J. Latour. 2017. *Northeast Area Monitoring and Assessment Program (NEAMAP) 2016 data collection and analysis in support of single and multispecies stock assessments in the Mid-Atlantic: Northeast Area Monitoring and Assessment Program Near Shore Trawl Survey*. Virginia Institute of Marine Science, William & Mary. Available: <https://doi.org/10.25773/7206-KM61>. Accessed: June 2021.
- Bonzek, C. F., J. Gartland, D. J. Gauthier, and R. J. Latour. 2020. *Annual Report – 2019 data collection and analysis in support of single and multispecies stock assessments in Chesapeake Bay: The Chesapeake Bay Multispecies Monitoring and Assessment Program*. Virginia Institute of Marine Science, William & Mary. DOI: 10.25773/5ngg-ja47.
- Breece, M. W., A. L. Higgs, and D. A. Fox. 2021. Spawning intervals, timing, and riverine habitat use of adult Atlantic sturgeon in the Hudson River. *Transactions of the American Fisheries Society* 150:528–537.
- Brown, J. J. and G. W. Murphy. 2010. Atlantic sturgeon vessel-strike mortalities in the Delaware Estuary. *Fisheries* 35:72–83.
- Budelmann, B. U. 1992. Hearing in Crustacea. In D. B. Webster, R. R. Fay, and A. N. Popper, Eds. *The Evolutionary Biology of Hearing*. Springer-Verlag, New York. Pages 131–139.
- Buehler, P. E., R. Oestman, J. Reyff, K. Pommerenck, and B. Mitchell. 2015. *Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish*. California Department of Transportation, Division of Environmental Analysis. CTHWANP-RT-15-306.1.1.
- Bureau of Ocean Energy Management (BOEM). 2014. *Proposed Geological and Geophysical Activities. Mid-Atlantic and South Atlantic Planning Areas. Final Programmatic Environmental Impact Statement*. Volume I: Chapters 1–8, Figures, Tables, and Keyword Index. OCS EIS/EA BOEM 2014-001. Available: <https://www.boem.gov/sites/default/files/oil-and-gas-energy-program/GOMR/BOEM-2014-001-v1.pdf>. Accessed: January 2021.
- Bureau of Ocean Energy Management (BOEM). 2018. *Vineyard Wind Offshore Wind Energy Project Scoping Report*. U.S. Department of the Interior.
- Bureau of Ocean Energy Management (BOEM). 2019. *Draft Proposed Guidelines for Providing Information on Lighting and Marking of Structures Supporting Renewable Energy Development*. Office of Renewable Energy Programs. U.S. Department of the Interior.

- Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: <https://www.boem.gov/vineyard-wind>. Accessed: November 2021.
- Bureau of Ocean Energy Management (BOEM). 2021b. *South Fork Wind Farm and South Fork Export Cable Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2020-057. Available: <https://www.boem.gov/renewable-energy/state-activities/south-fork>. Accessed: November 2021.
- Burlas, M., and D. Clarke. 2001. Chapter 9 – Offshore Borrow Area Finfish Collection. In M. Burlas, G. Ray, D. Clarke, Eds. *The New York District's Biological Monitoring Program for the Atlantic Coast of New Jersey, Asbury Park to Manasquan Section Beach Erosion Control Project*. Available: <https://www.nan.usace.army.mil/Portals/37/docs/civilworks/projects/nj/coast/SHtoBI/Chap9.pdf>. Accessed: June 2021.
- Cañadillas, B., R. Foreman, V. Barth, S. Siedersleben, A. Lampert, and A. Platis. 2020. Offshore wind farm wake recovery: Airborne measurements and its representation in engineering models. *Wind Energy* 23:1249–1265.
- Cargnelli, L. M., S. J. Griesbach, D. B. Packer, and E. Weissberger. 1999. *Essential fish habitat source document: Atlantic surfclam, Spisula solidissima, life history and habitat characteristics*. Woods Hole, Massachusetts: 22 Pages.
- Carpenter, J. R., L. Merckelbach, U. Callies, S. Clark, L. Gaslikova, and B. Baschek. 2016. Potential impacts of offshore wind farms on North Sea stratification. *PLOS ONE* 11:1–28.
- Carroll, A. G., R. Przeslawski, A. Duncan, M. Gunning, and B. Bruce. 2017. A critical review of the potential impacts of marine seismic surveys on fish & invertebrates. *Marine Pollution Bulletin* 114:9–24.
- Causon, P. D., and A. B. Gill. 2018. Linking ecosystem services with epibenthic biodiversity change following installation of offshore wind farms. *Environmental Science & Policy* 89:340–347.
- Cazenave, P. W., R. Torres, and J. I. Alen. 2016. Unstructured grid modelling of offshore wind farm impacts on seasonally stratified shelf seas. *Progress in Oceanography* 145:25–41.
- Cerino, D., A. S. Overton, J. A. Rice, and J. A. Morris Jr. 2013. Bioenergetics and trophic impacts of the invasive Indo-Pacific lionfish. *Transactions of the American Fisheries Society* 142:1522–1534.
- Charifi, M., M. Sow, P. Ciret, S. Benomar, and J. C. Massabuau. 2017. The sense of hearing in the Pacific oyster, *Magallana gigas*. *PLOS ONE* 12(10):19.
- Chen, C., L. Zhao, S. Gallager, R. Ji, P. He, C. Davis, R. C. Beardsley, D. Hart, W. C. Gentleman, L. Wang, S. Li, H. Lin, K. Stokesbury, and D. Bethoney. 2021. Impacts of larval behaviors on dispersal and connectivity of sea scallop larvae over the Northeast U.S. shelf. *Progress in Oceanography* 195:102604.
- Chen, Changsheng, R. C. Beardsley, J. Qi, and H. Lin. 2016. *Use of Finite-Volume Modeling and the Northeast Coastal Ocean Forecast System in Offshore Wind Energy Resource Planning*. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. BOEM 2016-050.

- Chen, C., M. Kong, Y. - Y. Wang, Q. - S. Shen, J. - C. Zhong, and C. - X. Fan. 2020. Dredging method effects on sediment resuspension and nutrient release across the sediment-water interface in Lake Taihu, China. *Environmental Science and Pollution Research* 27:25861–25869.
- Chen, Z., E. Curchitser, R. Chant, and D. Kang. 2018. Seasonal variability of the cold pool over the Mid-Atlantic bight continental shelf. *Journal of Geophysical Research: Oceans* 123:8203–8226.
- Christiansen, N., U. Daewel, B. Djath, and C. Schrum. 2022. Emergence of large-scale hydrodynamic structures due to atmospheric offshore wind farm wakes. *Frontiers in Marine Science* 9:818501.
- Claisse, J. T., D. J. Pondella II, M. Love, L. A. Zahn, C. M. Williams, J. P. Williams, and A. S. Bull. 2014. Oil platforms off California are among the most productive marine fish habitats globally. *Proceedings of the National Academy of Sciences of the United States of America* 111:15462–15467.
- Clark, S. H., and B. E. Brown. 1977. Changes in biomass of finfishes and squids from the Gulf of Maine to Cape Hatteras, 1963-74, as determined from research vessel survey data. *Fishery Bulletin* 75:1–21.
- Clarke, D. G., and D. H. Wilber. 2000. *Assessment of potential impacts of dredging operations due to sediment resuspension*. DOER Technical Notes Collection (ERDC TN-DOER-E9), United States Army Engineering Research and Development Center, Vicksburg, MS.
- Coates, D. A., Y. Deschutter, M. Vincx, and J. Vanaverbeke. 2014. Enrichment and shifts in macrobenthic assemblages in an offshore wind farm area in the Belgian part of the North Sea. *Marine Environmental Research* 95 (Supplement C):1–12.
- Condon, R. H., C. M. Duarte, K. A. Pitt, K. L. Robinson, C. H. Lucas, K. R. Sutherland, H. W. Mianzan, M. Bogeberg, J. E. Purcell, M. B. Decker, S. Uye, L. P. Madin, R. D. Brodeur, S. H. D. Haddock, A. Malej, G. D. Parry, E. Eriksen, J. Quiñones, M. Acha, M. Harvey, J. M. Arthur, and W. M. Graham. 2013. Recurrent jellyfish blooms are a consequence of global oscillations. *Proceedings of the National Academy of Sciences of the United States of America* 110:1000–1005.
- Cooke, D. W., and S. D. Leach. 2004. Implications of a migration impediment on shortnose sturgeon spawning. *North American Journal of Fisheries Management* 24:1460–1468.
- Coolen, J. W. P., B. van der Weide, J. Cuperus, M. Blomberg, G. W. N. M. Van Moorsel, M. A. Faasse, O. G. Bos, S. Degraer, and H. J. Lindeboom. 2020. Benthic biodiversity on old platforms, young wind farms, and rocky reefs. *ICES Journal of Marine Science* 77:1250–1265.
- Copping, A. E. and L. G., Hemery. 2020. OES-Environmental 2020 *State of the Science Report: Environmental Effects of Marine Renewable Energy Development Around the World*. Report for Ocean Energy Systems (OES). 327 pp.
- Cresci, A., P. Perrichon, C. M. F. Durif, E. Sørhus, E. Johnsen, R. Bjelland, T. Larsen, A. B. Skiftesvik, and H. I. Browman. 2022. Magnetic fields generated by the DC cables of offshore wind farms have no effect on spatial distribution or swimming behavior of lesser sandeel larvae (*Ammodytes marinus*). *Marine Environmental Research* 176:105609.
- Dadswell, M. J., B. D. Taubert, T. S. Squiers, D. Marchette, and J. Buckley. 1984. Synopsis of Biological Data on Shortnose Sturgeon, *Acipenser brevirostrum* LeSueur 1818. NOAA Technical Report NMFS 14. 47 pp.

- Daewel, U., N. Akhtar, N. Christiansen, and C. Schrum. 2022. Offshore wind farms are projected to impact primary production and bottom water deoxygenation in the North Sea. *Communications Earth & Environment* 3:292.
- Daewel, U., M. A. Peck, and C. Schrum. 2011. Life history strategy and impacts of environmental variability on early life stages of two marine fishes in the North Sea: an individual-based modelling approach. *Canadian Journal of Fisheries and Aquatic Sciences* 68:426–443.
- Day, R. D., R. D. McCauley, Q. P. Fitzgibbon, K. Hartmann, and J. M. Semmens. 2017. Exposure to seismic air gun signals causes physiological harm and alters behavior in the scallop *Pecten fumatus*. *Proceedings of the National Academy of Sciences of the United States of America* 114(40):e8537–e8546.
- De Mesel, I., F. Kerckhof, A. Norro, B. Rumes, and S. Degraer. 2015. Succession and seasonal dynamics of the epifauna community on offshore wind farm foundations and their role as stepping stones for non-indigenous species. *Hydrobiologia* 756:37–50.
- Degraer, S., D. A. Carey, J. W. P. Coolen, Z. L. Hutchison, F. Kerckhof, B. Rumes, and J. Vanaverbeke. 2020. Offshore wind farm artificial reefs affect ecosystem structure and functioning. *Oceanography* 33:48–57.
- Degraer, S., R. Brabant, B. Rumes, and L. E. Vigin (editors). 2018. *Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea: Assessing and Managing Effect Spheres of Influence*. Brussels: Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management, 136 pages.
- Dionne, P. E., G. B. Zydlewski, M. T. Kinnison, J. Zydlewski, and G. S. Wippelhauser. 2013. Reconsidering residency: characterization and conservation implications of complex migratory patterns of shortnose sturgeon (*Acipenser brevirostrum*). *Canadian Journal of Fisheries and Aquatic Sciences* 70:119–127.
- Djath, B., J. Schulz-Stellenfleth, and B. Cañadillas. 2018. Impact of atmospheric stability on X-band and C-band synthetic aperture radar imagery of offshore windpark wakes. *Journal of Renewable and Sustainable Energy* 10:043301.
- Dorrell, R. M., C. J. Lloyd, B. J. Lincoln, T. P. Rippeth, J. R. Taylor, C. P. Caulfield, J. Sharples, J. A. Polton, B. D. Scannell, D. M. Greaves, R. A. Hall, and J. H. Simpson. 2022. Anthropogenic mixing in seasonally stratified shelf seas by offshore wind farm infrastructure. *Frontiers in Marine Science* 9:830927.
- Duncan, M. S., J. J. Isely, and D. W. Cooke. 2004. Evaluation of shortnose sturgeon spawning in the Pinopolis Dam Tailrace, South Carolina. *North American Journal of Fisheries Management* 24:932–938.
- Elliot, J., A. A. Khan, Ying-Tsong, L., T. Mason, J. H. Miller, A. E. Newhall, G. R. Potty, and K. J. Vigness-Raposa. 2019. *Field Observations during Wind Turbine Operations at the Block Island Wind Farm, Rhode Island*. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2019-028.

- Emeana, C. J., T. J. Hughes, J. K. Dix, T. M. Gernon, T. J. Henstock, C. E. L. Thompson, and J. A. Pilgrim. 2016. The thermal regime around buried submarine high-voltage cables. *Geophysical Journal International* 206:1051–1064.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Enger, P. S., H. E. Karlsen, F. R. Knudsen, and O. Sand. 1993. Detection and reaction of fish to infrasound. *ICES Journal of Marine Science* 196:108–112.
- Epsilon Associates, Inc. (Epsilon). 2020. *Draft Construction and Operations Plan. Vineyard Wind Project*. September 2020. Accessed: October 14, 2020. Available: <https://www.boem.gov/Vineyard-Wind/>.
- Ernst, D. A., and K. J. Lohmann. 2018. Size-dependent avoidance of a strong magnetic anomaly in Caribbean spiny lobsters. *Journal of Experimental Biology* 221:172205.
- Fabrizio, M. C., J. P. Manderson, and J. P. Pessutti. 2014. Home Range and Seasonal Movements of Black Sea Bass (*Centropristis striata*) During their Inshore Residency at a Reef in the Mid-Atlantic Bight. *Fishery Bulletin* 112:82–97. DOI: 10.7755/FB.112.1.5.
- Farmer, N. A., L. P. Garrison, C. Horn, M. Miller, T. Gowan, R. D. Kenney, M. Vukovich, J. R. Willmott, J. Pate, D. H. Webb, T. J. Mullican, J. D. Stewart, K. Bassos-Hull, C. Jones, D. Adams, N. A. Pelletier, J. Waldron, and S. Kajiura. 2022. The distribution of manta rays in the western North Atlantic Ocean off the eastern United States. *Nature* 22:6544.
- Fayram, A. H., and A. de Risi. 2007. The potential compatibility of offshore wind power and fisheries: An example using bluefin tuna in the Adriatic Sea. *Ocean & Coastal Management* 50(8):597–605. DOI:10.1016/j.ocecoaman.2007.05.004.
- Ferguson, M. D., D. Evensen, L. A. Ferguson, D. Bidwell, J. Firestone, T. L. Dooley, and C. R. Mitchell. 2021. Uncharted waters: Exploring coastal recreation impacts, coping behaviors, and attitudes towards offshore wind energy development in the United States. *Energy Research & Social Science* 75:102029.
- Fisheries Hydroacoustic Working Group (FHWG). 2008. Agreement in principle for interim criteria for injury to fish from pile driving activities. Technical/Policy Meeting June 11, 2008, Vancouver, Washington.
- Ford, W. L., J. R. Longard, and R. E. Banks. 1952. On the nature, occurrence and origin of cold low salinity water along the edge of the Gulf Stream. *Journal of Marine Research* 11:281–293.
- Friedland, K. D., and J. A. Hare. 2007. Long-term trends and regime shifts in sea surface temperature on the continental shelf of the northeast United States. *Continental Shelf Research* 27:2313–2328.

- Gaichas, S. K., J. Hare, M. Pinsky, G. Depiper, O. Jensen, T. Lederhouse, J. Link, D. Lipton, R. Seagraves, J. Manderson, and M. Clark. 2015. *Climate change and variability: A white paper to inform the Mid-Atlantic Fishery Management Council on the impact of climate change on fishery science and management*. Second Draft. Accessed: August 28, 2020. Available: https://static1.squarespace.com/static511cdc7fe4b00307a2628ac6/t/5c5c8fa9652dea319f3f8fe6/1549569962945/MAFMC-Climate-Change-and-Variability-White-Paper_Apr2015.pdf.
- Gendron, G., R. Tremblay, A. Jolivet, F. Olivier, L. Chauvaud, G. Winkler, and C. Audet. 2020. Anthropogenic boat noise reduces feeding success in winter flounder larvae (*Pseudopleuronectes americanus*). *Environmental Biology of Fishes* 103:1079–1090.
- Gill, A. B. 2005. Offshore renewable energy: ecological implications of generating electricity in the coastal zone. *Journal of Applied Ecology* 42:605–615.
- Gill, A. B., I. Gloyne-Philips, J. Kimber, and P. Sigray. 2014. Marine Renewable Energy, Electromagnetic (EM) Fields and EM-Sensitive Animals. Chapter 6. In M. A. Shields, A. I. L. Payne (eds), *Marine Renewable Energy Technology and Environmental Interactions*. Springer. pp 61–79 of 182 pp.
- Gill, A. B., M. Bartlett, and F. Thomsen. 2012. Potential interactions between diadromous fishes of U.K. conservation importance and the electromagnetic fields and subsea noise from marine renewable energy developments. *Journal of Fish Biology* 81:664–695.
- Gillson, J. P., T. Bašić, P. I. Davison, W. D. Riley, L. Talks, A. M. Walker, and I. C. Russel. 2022. A review of marine stressors impacting Atlantic salmon *Salmo salar*, with an assessment of the major threats to English stocks. *Reviews in Fish Biology and Fisheries* 32:879–919.
- Glarou, M., M. Zrust, and J. C. Svendsen. 2020. Using artificial-reef knowledge to enhance the ecological function of offshore wind turbine foundations: Implications for fish abundance and diversity. *Journal of Marine Science and Engineering* 8:8050332.
- Goddard, J. H. R., and M. S. Love. 2008. *Megabenthic Invertebrates on Shell Mounds under Oil and Gas Platforms off California*. MMS OCS Study, Minerals Management Service: 60.
- Green, S. J., J. K. Matley, D. E. Smith, B. Castillo II, J. L. Akins, R. S. Nemeth, C. Pollock, and K. Reale-Munroe. 2021. Broad-scale acoustic telemetry reveals long-distance movements and large home ranges for invasive lionfish on Atlantic coral reefs. *Marine Ecology Progress Series* 673:117–134.
- Greene, J. K., M. G. Anderson, J. Odell, and N. Steinberg, eds. 2010. *The Northwest Atlantic Marine Ecoregional Assessment: Species, Habitats and Ecosystems*. Phase One. The Nature Conservancy, Eastern U.S. Division, Boston, MA.
- Grieve, B. D., E. N. Curchister, and R. R. Rykaczewski. 2016. Range expansion of the invasive lionfish in the Northwest Atlantic with climate change. *Marine Ecology Progress Series* 546:225–237.
- Griffin, R. A., G. J. Robinson, A. West, I. T. Gloyne-Phillips, and R. F. K. Unsworth. 2016. “Assessing Fish and Motile Fauna around Offshore Windfarms Using Stereo Baited Video.” *PLOS ONE* 11(3):14. DOI:10.1371/journal.pone.0149701.
- Gaurinello, M. L., and D. A. Carey. 2022. Multi-modal approach for benthic assessments in moraine habitats: a case study at the Block Island Wind Farm. *Estuaries and Coasts* 45:1107–1122.

- Guerra, Á., Á. F. González, S. Pascual, and E. G. Dawe. 2011. The giant squid *Architeuthis*: An emblematic invertebrate that can represent concern for the conservation of marine biodiversity. *Biological Conservation* 144:1989–1997.
- Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, and E. Estela-Gomez. 2017. *Habitat Mapping and Assessment of Northeast Wind Energy Areas*. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088.
- Hare, J. A., W. E. Morrison, M. W. Nelson, M. M. Stachura, E. J. Teeters, R. B. Griffis et al. 2016. A vulnerability assessment of fish and invertebrates to climate change on the northeast U.S. continental shelf. *PLOS ONE* 11(2):e0146757. DOI:10.1371/journal.pone.0146756.
- Harsanyi, P., K. Scott, B. A. A. Easton, G. de la Cruz Ortiz, E. C. N. Chapman, A. J. R. Piper, C. M. V. Rochas, and A. R. Lyndon. 2022. The effects of anthropogenic electromagnetic fields (EMF) on the early development of two commercially important crustaceans, European lobster, *Homarus Gammarus* (L.) and edible crab, *Cancer pagurus* (L.). *Journal of Marine Science and Engineering* 10:10050564.
- Hasager, C. B., L. Rasmussen, A. Peña, L. E. Jensen, and P. - E. Réthoré. 2013. Wind farm wake: The Horns Rev photo case. *energies* 6:696–716.
- Haven, D. S. 1959. Migration of the croaker, *Micropogon undulatus*. *Copeia* 1959:25–30.
- Hawkins, A. D., and A. N. Popper. 2017. A sound approach to assessing the impact of underwater noise on marine fishes and invertebrates. *ICES Journal of Marine Science* 74:635–651.
- HDR. 2020. *Benthic and epifaunal monitoring during wind turbine installation and operation at the Block Island Wind Farm, Rhode Island – Project Report*. OCS Study BOEM 2020-044. Accessed: October 28, 2020. Available: https://epis.boem.gov/final%20reports/BOEM_2020-044.pdf.
- Hinchey, E. K., L. C. Schaffner, C. C. Hoar, B. W. Vogt, and L. P. Battle. 2006. Responses of estuarine benthic invertebrates to sediment burial: the importance of mobility and adaptation. *Hydrobiologia* 556:85–98.
- Hofmann, E. E., E. N. Powell, J. M. Klinck, D. M. Munroe, R. Mann, D. B. Haidvogel, D. A. Naváerz, X. Zhang, and K. M. Kuykendall. 2018. An overview of factors affecting distribution of the Atlantic surfclam (*Spisula solidissima*), a continental shelf biomass dominant, during a period of climate change. *Journal of Shellfish Research* 37:821–831.
- Hooper, T., C. Hattam, and M. Austen. 2017a. Recreational use of offshore wind farms: Experiences and opinions of sea anglers in the UK. *Marine Policy* 78:55–60.
- Hooper, T., N. Beaumont, and C. Hattam. 2017b. The implications of energy systems for ecosystem services: A detailed case study of offshore wind. *Renewable & Sustainable Energy Reviews* 70:230–241.
- Hurst, T. P., and D. O. Conover. 2002. Effects of temperature and salinity on survival of young-of-the-year Hudson River striped bass (*Morone saxatilis*): implications for optimal overwintering habitats. *Canadian Journal of Fisheries and Aquatic Sciences* 59:787–795.

- Hutchison, Z. L., A. B. Gill, P. Sigray, H. He, and J. W. King. 2021. A modelling evaluation of electromagnetic fields emitted by buried subsea power cables and encountered by marine animals: considerations for marine renewable energy development. *Renewal Energy* 177:72–81.
- Hutchison, Z. L., A. B. Gill, P. Sigray, H. He, and J. W. King. 2020a. Anthropogenic electromagnetic fields (EMF) influence the behaviour of bottom-dwelling marine species. *Scientific Reports* 10:4219.
- Hutchison, Z. L., D. H. Secor, and A. B. Gill. 2020b. The interaction between resource species and electromagnetic fields associated with electricity production by offshore wind farms. *Oceanography* 33:96–107.
- Hutchison, Z. P. Sigray, H. He, A. Gill, J. King, and C. Gibson. 2018. *Electromagnetic field (EMF) impacts on elasmobranch (shark, rays, and skates) and American lobster movement and migration from direct current cables*. Bureau of Ocean Energy Management Office of Renewable Energy Programs. U.S. Department of the Interior. OCS Study BOEM 2018-003. 254 pp.
- Itano, D. G., and K. N. Holland. 2000. Movement and vulnerability of bigeye (*Thunnus obesus*) and yellowfin tuna (*Thunnus albacares*) in relation to FADs and natural aggregation points. *Aquatic Living Resources* 13(4):213–223.
- Jakubowska, M., B. Urban-Lalinga, Z. Otremba, and E. Andrulowics. 2019. Effects of low frequency electromagnetic field on the behavior and bioenergetics of the polychaete *Hediste diversicolor*. *Marine Environmental Research* 150:104766.
- Jakubowska-Lehrmann, M., M. Bialowas, Z. Otremba, A. Hallman, S. Sliwinska-Wilczewska, and B. Urban-Malinga. 2022. Do magnetic fields related to submarine power cables affect the functioning of a common bivalve? *Marine Environmental Research* 179:105700.
- Jones, I. T., J. A. Stanley, and T. A. Mooney. 2020. Impulsive Pile Driving Noise Elicits Alarm Responses in Squid (*Doryteuthis pealeii*). *Marine Pollution Bulletin* 150:110792. DOI: 10.1016/j.marpolbul.2019.110792.
- Kazyak, D. C., S. L. White, B. A. Lubinski, R. Johnson, and M. Eackles. 2021. Stock composition of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) encountered in marine and estuarine environments on the U.S. Atlantic coast. *Conservation Genetics* 22:767–781.
- Kerckhof, F., B. Rumes, and S. Degraer. 2019. About “Mytilisation” and “Slimeification”: A Decade of Succession of the Fouling Assemblages on Wind Turbines off the Belgian Coast. In: *Memoirs on the Marine Environment: Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea*. S. Degraer, R. Brabant, B. Rumes, and L. Vigin, eds. 73–84. Brussels: Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management.
- Kerckhof, F., S. Degraer, A. Norro, and B. Rumes. 2011. Offshore intertidal hard substrata: a new habitat promoting non-indigenous species in the Southern North Sea: an exploratory study. *Royal Belgian Institute National Science* 32:27–37.
- Kimball, M. E., J. M. Miller, P. E. Whitfield, and J. A. Hare. 2004. Thermal tolerance and potential distribution of invasive lionfish (*Pterois volitans/miles* complex) on the east coast of the United States. *Marine Ecology Progress Series* 283:269–278.

- Klimley, A. P., M. T. Wyman, and R. Kavet. 2017. Chinook salmon and green sturgeon migrate through San Francisco Estuary despite large distortions in the local magnetic fields produced by bridges. *PLOS ONE* 12:e0169031.
- Klimley, A. P., N. F. Putman, B. A. Keller, and D. Noakes. 2021. A call to assess the impacts of electromagnetic fields from subsea cables on the movement ecology of marine migrants. *Conservation Science and Practice* 3:e436.
- Krone, R., G. Dederer, P. Kanstinger, P. Kramer, C. Schneider, and I. Schmalenbach. 2017. Mobile demersal megafauna at common offshore wind turbine foundations in the German Bight (North Sea) two years after deployment - increased production rate of Cancer pagurus. *Marine Environmental Research* 123:53–61.
- Krone, R., L. Guttow, T. Brey, J. Dannheim, and A. Schroder. 2013. Mobile Demersal Megafauna at Artificial Structures in the German Bight-Likely Effects of Offshore Wind Farm Development. *Estuarine, Coastal and Shelf Science* 125:1–12.
- Kynard, B., S. Bolden, K. Kieffer, M. Collins, H. Brundage, E. J. Hilton, M. Litvak, M. T. Kinnison, T. King, and D. Peterson. 2016. Life history and status of shortnose sturgeon (*Acipenser brevirostrum* LeSueur, 1818). *Journal of Applied Ichthyology* 32:208–248.
- Lentz, S. J. 2008. Observations and a model of the mean circulation over the Middle Atlantic Bight continental shelf. *Journal of Physical Oceanography* 38:1203–1221.
- Lentz, S. J. 2017. Seasonal warming of the Middle Atlantic Bight Cold Pool. *Journal of Geophysical Research: Oceans* 122:941–954.
- Levin, J., J. Wilkin, N. Fleming, and J. Zavala-Garay. 2018. Mean circulation of the Mid-Atlantic Bight from a climatological data assimilative model. *Ocean Modelling* 128:1:14.
- Litvak, M. K., V. Zadmajid, and I. A. E. Butts. 2020. Growth and survival of winter flounder (*Pseudopleuronectes americanus*) larvae reared on different photoperiod regimes from hatch to metamorphosis. *Aquatic Research* 51:2314–2321.
- Love, M. S., J. T. Claisse, and A. Roeper. 2019. An analysis of the fish assemblages around 23 oil and gas platforms off California with comparisons with natural habitats. *Bulletin of Marine Science* 95:477–514.
- Lucey, S. M., and J. A. Nye. 2010. Shifting species assemblages in the Northeast US Continental Shelf Large Marine Ecosystem. *Marine Ecology Progress Series* 415:23–33.
- Mavraki, N., S. Degraer, and J. Vanaverbeke. 2021. Offshore wind farms and the attraction-production hypothesis: insights from a combination of stomach content and stable isotope analyses. *Hydrobiologia* 848:1639–1657.
- McGregor, F., A. J. Richardson, A. J. Armstrong, A. O. Armstrong, and C. L. Dudgeon. 2019. Rapid wound healing in a reef manta ray masks the extent of vessel strike. *PLOS ONE* 14:e0225681.
- Methratta, E. T., and W. R. Dardick. 2019. Meta-Analysis of Finfish Abundance at Offshore Wind Farms. *Reviews in Fisheries Science & Aquaculture* 27(2):242–260.

- Mid-Atlantic Fishery Management Council (MAFMC), Atlantic States Marine Fisheries Commission, National Marine Fisheries Service, New England Marine Fisheries Service, and South Atlantic Fishery Management Council. 1998. *Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan*. No. NA57FC0002.
- Mid-Atlantic Fishery Management Council (MAFMC). 2016. *Ecosystem Approach to Fisheries Management Guidance Document*: 68 pages.
- Mid-Atlantic Fishery Management Council (MAFMC). 2017. *Unmanaged Forage Omnibus Amendment: Amendment 20 to the summer flounder, scup, and black sea bass Fishery Management Plan, Amendment 18 to the mackerel, squid, and butterfish Fishery Management Plan, Amendment 6 to the bluefish Fishery Management Plan, Amendment 5 to the tilefish Fishery Management Plan, Amendment 5 to the spiny dogfish Fishery Management Plan, Including an Environmental Assessment, Regulatory Impact Review, and Regulatory Flexibility Act analysis*. Dover, DE.
- Miles, J., T. Martin, and L. Goddard. 2017. Current and Wave Effects around Windfarm Monopile Foundations. *Coastal Engineering* 121:167–178.
- Miles, T., S. Murphy, J. Kohut, S. Borsetti, and D. Munroe. 2021. Offshore wind energy and the Mid-Atlantic cold pool: A review of potential interactions. *Marine Technology Society Journal* 55:72–87.
- Miller, T. J., J. A. Hare, and L. A. Alade. 2016. A state-space approach to incorporating environmental effects on recruitment in an age-structured assessment model with an application to southern New England yellowtail flounder. *Canadian Journal of Fisheries and Aquatic Sciences* 73:1261–1270.
- Miller, T. J., K. Curti, D. Loewensteiner, A. F. Sharov, B. Muffley, M. C. Christman, J. H. Volstad, and E. D. Houde. 2003. *Abundance, distribution and diversity of Chesapeake Bay fishes: Results from CHESFIMS* (Chesapeake Bay Fishery Independent Multispecies Fisheries Survey). [UMCES Contribution] CBL 03-023. 12 Pages.
- Minerals Management Service (MMS). 2007. *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, Final Environmental Impact Statement*. October. OCS EIS/EA MMS 2007-046.
- Minerals Management Service (MMS). 2009. *Cape Wind Energy Project Final Environmental Impact Statement*. January 2009. U.S. Department of the Interior. OCS Publication No. 2008-040.
- Minkoff, D., N. F. Putman, J. Atema, and W. Ardren. 2020. Nonanadromous and anadromous Atlantic salmon differ in orientation responses to magnetic displacements. *Canadian Journal of Fisheries and Aquatic Sciences* 77:1846–1852.
- Miro, J. M., C. Megina, I. Donazar-Aramendia, and J. C. Garcia-Gomez. 2022. Effects of maintenance dredging on the macrofauna of the water column in a turbid estuary. *Science of the Total Environment* 806:151304.
- Misund, O. A., and A. Aglen. 1992. Swimming behaviour of fish schools in the North Sea during acoustic surveying and pelagic trawl sampling. *ICES Journal of Marine Science* 49:325–334.

- Mooney, T. A., R. T. Hanlon, J. Christensen-Dalsgaard, P. T. Madsen, D. R. Ketten, and P. E. Nachtigall. 2010. Sound detection by the longfin squid (*Loligo pealeii*) studied with auditory evoked potentials: sensitivity to low-frequency particle motion and not pressure. *Journal of Experimental Biology* 213(21):3748–3759.
- Moser, J., and G. R. Shepherd. 2009. Seasonal distribution and movement of black sea bass (*Centropristis striata*) in the Northwest Atlantic as determined from a mark-recapture experiment. *Journal of Northwest Atlantic Fishery Science* 40:17–28.
- Mueller-Blenkle, C., P. K. McGregor, A. B. Gill, M. H. Andersson, J. Metcalfe, V. Bendall, P. Sigray, D. T. Wood, and F. Thomsen. 2010. Effects of pile-driving noise on the behaviour of marine fish. COWRIE Ref: Fish 06-08; Cefas Ref: C3371. 62 pp.
- Munroe, D. M., E. N. Powell, J. M. Klinck, A. M. Scheld, S. Borsetti, J. Beckensteiner, and E. E. Hofmann. 2022. The Atlantic surfclam fishery and offshore wind energy development: 1. Model development and verification. *ICES Journal of Marine Science*: fsac106.
- National Marine Fisheries Service (NMFS). 2015. *Endangered Species Section 7 Consultation: Biological Opinion: Deepwater Wind: Block Island Wind Farm and Transmission System*. NER-2015-12248. 270 pages.
- National Marine Fisheries Service (NMFS). 2017. *Final Amendment 10 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan: Essential Fish Habitat*. Office of Sustainable Fisheries and Atlantic Highly Migratory Species Management Division. Silver Spring, Maryland: 442.
- National Oceanic and Atmospheric Administration (NOAA) Office of National Marine Sanctuaries. 2017. *Small but Mighty: Understanding Sand Lance in Stellwagen Bank National Marine Sanctuary*. Available: <https://sanctuaries.noaa.gov/news/jan17/sand-lance-stellwagen-bank.html>.
- National Oceanic and Atmospheric Administration (NOAA). 2013. *World Ocean Atlas 2013 Product Documentation*. Eds: T. Boyer, Ed.; A. Mishonov, 14 pp. Available: <http://data.nodc.noaa.gov/woa/WOA13/DOC/woa13documentation.pdf>.
- Nedwell, J., and D. Howell. 2004. *A Review of Offshore Windfarm Related Underwater Noise Sources*. Final Report submitted to COWRIE (Collective Offshore Wind Energy Research into the Environment). 57 pp.
- New England Fishery Management Council (NEFMC). 2017. *Final Omnibus Essential Fish Habitat Amendment 2*. Available: <https://www.nefmc.org/library/omnibus-habitat-amendment-2>.
- New Jersey Department of Environmental Protection (NJDEP). 2019. *Locations of New Jersey Artificial Reefs*.
- New York State Department of Environmental Conservation Division of Water (NYSDEC). 2004. Technical and Operational Guidance Series (TOGS) 5.1.9. Available: https://www.dec.ny.gov/docs/water_pdf/togs519.pdf.
- New York State Energy Research and Development Authority (NYSERDA). 2017. *New York State Offshore Wind Master Plan: Fish and Fisheries Study Final Report*: 2020 Pages.

- Nyqvist, D., C. Durif, M. G. Johnsen, D. De Jong, T. N. Forland, and L. D. Sivle. 2020. Electric and magnetic senses in marine animals, and potential behavioral effects of electromagnetic surveys. *Marine Environmental Research* 155:104888.
- Öhman, M. C., P. Sigraý, and H. Westerberg. 2007. Offshore windmills and the effects of electromagnetic fields on fish. *AMBIO: A Journal of the Human Environment* 36:630–633.
- Oleynik, H. A. 2020. *Changes in a mid Atlantic estuary: Trends and drivers of the fish and macroinvertebrate community in Delaware Bay*. University of Delaware. Summer 2020.
- Orr, T. L., S. M. Herz, and D. L. Oakley. 2013. *Evaluation of lighting schemes for offshore wind facilities and impacts to local environments*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-0115. 429 Pages.
- Pacheco, A. L. 1988. *Characterization of the Middle Atlantic Water Management Unit of the Northeast Regional Action Plan*. U.S. Department of Commerce. 332 pp.
- Paris, C. B., and R. K. Cowen. 2004. Direct evidence of a biophysical retention mechanism for coral reef fish larvae. *Limnology and Oceanography* 49:1964–1979.
- Paskyabi, M. B. 2015. Offshore wind farm wake effect on stratification and coastal upwelling. *Energy Procedia* 80:131–140.
- Passerotti, M. S., A. H. Andres, and L. J. Natanson. 2020. Inferring life history characteristics of the oceanic whitetip shark *Carcharhinus longimanus* from vertebral bomb radiation. *Frontiers in Marine Science* 7:581775.
- Pate, J. H., and A. D. Marshall. 2020. Urban manta rays: potential manta ray nursery habitat along a highly developed Florida coastline. *Endangered Species Research* 43:51–64.
- Petruny-Parker, M., A. Malek, M. Long, D. Spencer, F. Mattera, E. Hasbrouck, and J. Wilson. 2015. *Identifying information needs and approaches for assessing potential impacts of offshore wind farm development on fisheries resources in the northeast region*. Sterling, VA. Available: <https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/Identifying-Information-Needs-and-Approaches-for-Assessing-Potential-Impacts-of-Offshore-Wind-Farm-Development-on-Fisheries-Resources-in-the-Northeast-Regi.pdf>.
- Platis, A., M. Hundhausen, M. Mauz, S. Siedersleben, A. Lampert, K. Barfuss, B. Djath, J. Schulz-Stellenfleth, B. Canadillas, T. Neumann, S. Emeis, and J. Bange. 2020. Evaluation of a simple analytical model of offshore wind farm wake recovery by in situ data and Weather Research and Forecasting simulations. *Wind Energy* 24:212–228.
- Popper, A. N., A. D. Hawkins, R. R. Fay, D. Mann, S. Bartol, T. H. Carlson, S. Coombs, W. T. Ellison, R. Gentry, M. B. Halvorsen, S. Løkkeborg, P. Rogers, B. L. Southall, D. G. Zeddies, and W. N. Tavolga. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles*. A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI.
- Purser, J., and A. N. Radford. 2011. Acoustic noise induces attention shifts and reduces foraging performance in three-spined sticklebacks (*Gasterosteus aculeatus*). *PLOS ONE* 6:e17478.

- Reine, K., D. Clarke, M. Balzaik, S. O’Haire, C. Dickerson, C. Frederickson, G. Garman, C. Hager, A. Spells, and C. Turner. 2014. *Assessing impacts of navigation dredging on Atlantic sturgeon (Acipenser oxyrinchus)*. U.S. Army Corps of Engineers. ERDC/EL TR-14-12. 42 pp.
- Reubens, J. T., S. Degraer, and M. Vincx. 2014. The ecology of benthopelagic fishes at offshore wind farms: a synthesis of 4 years of research. *Hydrobiologica* 727:121–136.
- Rikardsen, A. H., D. Righton, J. F. Strom, E. B. Thorstad, P. Gargan, T. Sheehan, Finn Okland, C. M. Chittenden, R. D. Hedger, T. F. Naesje, M. Renkawitz, J. Sturlaugsson, P. Caballero, H. Baktoft, J. G. Davidsen, E. Halttunen, S. Wright, B. Finstad, and K. Aerestrup. 2021. Redefining the oceanic distribution of Atlantic salmon. *Nature* 11:12266.
- Roberts, L., H. R. Harding, I. Voellmy, R. Brintjes, S. D. Simpson, A. N. Radford, T. Breithaupt, and M. Elliot. 2016. Exposure of benthic invertebrates to sediment vibration: from laboratory experiments to outdoor simulated pile-driving. *Fourth International Conference on the Effects of Noise on Aquatic Life* 27:010029.
- Ross, S. T., W. T. Slack, R. J. Heise, M. A. Dugo, H. Rogillio, B. R. Bowen, P. Mickle, and R. W. Heard. 2009. Estuarine and coastal habitat use of Gulf sturgeon (*Acipenser oxyrinchus desotoi*) in the North-Central Gulf of Mexico. *Estuaries and Coasts* 32:360–374.
- Rothermel, E. R., M. T. Balazik, J. E. Best, M. W. Breece, D. A. Fox, B. I. Gahagan, D. E. Haulsee, A. L. Higgs, M. H. P. O’Brien, M. J. Oliver, I. A. Park, and D. H. Secor. 2020. Comparative migration ecology of striped bass and Atlantic sturgeon in the US southern mid-Atlantic bight flyway. *PLOS ONE* 15:e0234442.
- Ruddle, V. K. 2018. *Age Structure, Reproduction, and Recruitment of Atlantic Sturgeon (Acipenser oxyrinchus) and Shortnose Sturgeon (Acipenser brevirostrum) in the Cooper River, South Carolina*. Thesis. The Graduate School of the University of Charleston, South Carolina at the College of Charleston. 82 pp.
- Sabatini, M. 2007. *Spisula solida*: A surf clam. In H. Tyler-Walters and K. Hiscock, Eds. *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*. Plymouth: Marine Biological Association of the United Kingdom. Available: <https://www.marlin.ac.uk/species/detail/2030>.
- Scanlan, M. M., N. F. Putman, A. M. Pollock, and D. L. G. Noakes. 2019. Magnetic map in nonanadromous Atlantic salmon. *Proceedings of the National Academy of Sciences of the United States of America* 115:10995–10999.
- Scheltema, R. S. 1986. On dispersal and planktonic larvae of benthic invertebrates: An eclectic overview and summary of problems. *Bulletin of Marine Science* 39:290–322.
- Schultz, E. T., J. J. Pereira, and P. J. Auster. 2007. Determining winter flounder spawning sites two Connecticut Estuaries. University of Connecticut Ecology and Evolutionary Biology EEB Articles. 63 pp.
- Scott, K., P. Harsanyi, and A. R. Lyndon. 2018. Understanding the effects of electromagnetic field emissions from Marine Renewable Energy Devices (MREDs) on the commercially important edible crab, *Cancer pagurus* (L.). *Marine Pollution Bulletin* 131:580–588.

- Scott, K., P. Harsanyi, B. A. A. Easton, A. J. R. Piper, C. M. V. Rochas, and A. R. Lyndon. 2021. Exposure to electromagnetic fields (EMF) from submarine power cables can trigger strength-dependent behavioural and physiological responses in edible crab, *Cancer pagurus* (L.). *Journal of Marine Science and Engineering* 9:9070776.
- Secor, D. H., F. Zhang, M. H. P. O'Brien, and M. Li. 2019. Ocean destratification and fish evacuation caused by a mid-Atlantic tropical storm. *ICES Journal of Marine Science* 76(2):573–584.
- Sha, J., Y. - H. Jo, X. - H. Yan, and W. T. Liu. 2015. The modulation of the seasonal cross-shelf sea level variation by the cold pool in the Middle Atlantic Bight. *Journal of Geophysical Research: Oceans* 120:7182–7194.
- Shelledy, K., B. Phelan, J. Stanley, and H. Soulen. 2018. *Could Offshore Wind Energy Construction Affect Black Sea Bass Behavior?*
- Siedersleben, S. K., J. K. Lundquist, A. Platis, J. Bange, K. Bärfuss, A. Lampert, B. Cañadillas, T. Neumann, and S. Emeis. 2018. Micrometeorological impacts of offshore wind farms as seen in observations and simulations. *Environmental Research Letters* 13:124012.
- Slater, W. L., J. J. Pierson, M. B. Decker, E. D. Houde, C. Lozano, and J. Seuberling. 2020. Fewer copepods, fewer anchovies, and more jellyfish: How does hypoxia impact the Chesapeake Bay zooplankton community? *Diversity* 12:d12010035.
- Smythe, T., D. Bidwell, and G. Tyler. 2021. Optimistic with reservations: The impacts of the United States' first offshore wind farm on the recreational fishing experience. *Marine Policy* 127:104440.
- Sparling, C. E., A. C. Seitz, E. Madsen, K. Smith. 2020. Collision risk for animals around turbines. In: *OES-Environmental 2020 State of the Science Report: Environmental effects of marine renewable energy development around the world*. Report for Ocean Energy Systems (OES). DOI:102172/1632878. Available: <https://tethys.pnnl.gov/publications/state-of-the-science-2020>. Accessed: November 9, 2020.
- Stankevičiūtė, M., M. Jakubowska, J. Pazusiene, T. Makaras, Z. Otremba, B. Urban-Malinga, D. P. Fey, M. Greszkiewicz, G. Sauliute, J. Barsiene, and E. Andrulewicz. 2019. Genotoxic and cytotoxic effects of 50 Hz 1 mT electromagnetic field on larval rainbow trout (*Oncorhynchus mykiss*), Baltic clam (*Limecola balthica*) and common ragworm (*Hediste diversicolor*). *Aquatic Toxicology* 208:109–117.
- Steimle, F. W., and C. Zetlin. 2000. Reef habitats in the middle Atlantic bight: Abundance, distribution, associated biological communities, and fishery resource use. *Marine Fisheries Review* 62:24–42.
- Stein, A. B., K. D. Friedland, and M. Sutherland. 2004. Atlantic sturgeon marine distribution and habitat use along the northeastern coast of the United States. *Transactions of the American Fisheries Society* 133:527–537.
- Stevens, B. G., C. Schweitzer, and A. Price. 2019. *Hab in the MAB: Characterizing Black Sea Bass Habitat in the Mid-Atlantic Bight*. Final Report to the Atlantic Coastal Fish Habitat Partnership (ACFHP). 60 pp.

- Stevenson, D., L. Chiarella, D. Stephan, R. Reid, K. Willheim, J. McCarthy, and M. Pentony. 2004. *Characterization of the Fishing Practices and Marine Benthic Ecosystems of the Northeast U.S. Shelf, and an Evaluation of the Potential Effects of Fishing on Essential Fish Habitat*. NOAA Technical Memorandum NMFS-NE-181. 194 pp.
- Stöber, U., and F. Thomsen. 2021. How could operational underwater sound from future offshore wind turbines impact marine life? *Journal of the Acoustical Society of America* 149(3):1791–1795.
- Taormina B., J. Bald, A. Want, G. Thouzeau, M. Lejart, N. Desroy, and A. Carlier. 2018. A Review of Potential Impacts of Submarine Cables on the Marine Environment: Knowledge Gaps, Recommendations, and Future Directions. *Renewable and Sustainable Energy Reviews* 96:380–391.
- Thatcher, H., T. Stamp, D. Wilcockson, and P. J. Moore. 2023. Residency and habitat use of European lobster (*Homarus Gammarus*) within an offshore wind farm. *ICES Journal of Marine Science: fsad067*.
- Thaxton, W. C., J. C. Taylor, and R. G. Asch. 2020. Climate-associated trends and variability in ichthyoplankton phenology from the longest continuous larval fish time series on the east coast of the United States. *Marine Ecology Progress Series* 650:269–287.
- Thomsen, F, A. Gill, M. Kosecka, M. Andersson, M. Andre, S. Degraer, T. Folegot, J. Gabriel, A. Judd, T. Neumann, A. Norro, D. Risch, P. Sigray, D. Wood, and B. Wilson. 2015. *MaRVEN – Environmental impacts of noise, vibrations and electromagnetic emissions from marine renewable energy*. Final Study Report. European Commission, Directorate General for Research and Innovation. September 2015.
- Timbs, J. R., E. N. Powell, and R. Mann. 2018. Assessment of the relationship of stock and recruitment in the Atlantic surfclam *Spisula solidissima* in the Northwestern Atlantic Ocean. *Journal of Shellfish Research* 37:965–978.
- Tougaard, J., L. Hermannsen, and P. T. Madsen. 2020. How loud is the underwater noise from operating offshore wind turbines? *Journal of the Acoustical Society of America* 148:2885–2892.
- Townsend, D. W., A. C. Thomas, L. M. Mayer, M. A. Thomas, and J. A. Quinlan. 2004. Chapter 5: Oceanography of the northwest Atlantic continental shelf (1,W). In A. R. Robinson and K. H. Brink, Eds. *The Sea: The global coastal ocean: Interdisciplinary regional studies and syntheses*. Harvard University Press.
- Townsend, D. W., N. R. Pettigrew, M. A. Thomas, M. G. Neary, D. J. McGillicuddy Jr., and J. O'Donnell. 2015. Water masses and nutrient sources to the Gulf of Maine. *U.S. Department of Health & Human Services* 73:93–122.
- U.S. Atlantic Salmon Assessment Committee (USASAC). 2020. *Annual Report of the U.S. Atlantic Salmon Assessment Committee*. Report No. 33 – 2020 Activities. 185 pp.
- United Kingdom Hydrographic Office (UKHO). 2009. *Admiralty Sailing Directions, East Coast of the United States Pilot*. Volume 1. Volume 68. NP 68.
- United States Army Corps of Engineers – New York District (USACE NYD). 2015a. *New York and New Jersey Harbor Deepening Project Migratory Finfish Survey Summary Report*. December 2015.

- United States Army Corps of Engineers – New York District (USACE NYD). 2015b. *Demersal Fish Assemblages of New York / New Jersey Harbor and Near-Shore Fish Communities of New York Bight*. October 2015.
- van Berkel, J., H. Burchard, A. Christensen, L. O. Mortensen, O. Svenstrup Peterson, and F. Thomsen. 2020. The effects of offshore wind farms on hydrodynamics and implications for fishes. *Oceanography* 33:108–117.
- van Dijk, T. A. G. P., and M. G. Kleinhans. 2005. Processes controlling the dynamics of compound sand waves in the North Sea, Netherlands. *Journal of Geophysical Research* 110:000173.
- Verbruggen, W., R. van Weerdenburg, F. Scheel, and R. Hoekstra. 2022. *Empire Wind 1 Sediment Transport Study Modelling of Trenching-Induced Sediment Dispersion During the Installation of the EW 1 Export Cables*. Deltares 11207423-002-HYE-0004. 263 pp.
- Walsh, H. J., D. E. Richardson, K. E. Marancik, and J. A. Hare. 2015. Long-term changes in the distributions of larval and adult fish in the northeast U.S. shelf ecosystem. *PLOS ONE* 10(9):e0137382.
- Weilgart, L. 2018. *The impact of ocean noise pollution on fish and invertebrates*. Ocean Care and Dalhousie University. May 2018. 34 Pages.
- Whitfield, P. E., R. C. Muñoz, C. A. Buckel, B. P. Degan, D. W. Freshwater, and J. A. Hare. 2014. Native fish community structure and Indo-Pacific lionfish *Pterois volitans* densities along a depth-temperature gradient in Onslow Bay, North Carolina, USA. *Marine Ecology Progress Series* 509:241–254.
- Wilber, D. H., and D. G. Clarke. 2007. Defining and assess benthic recovery following dredging and dredged material disposal. *Proceedings XVIII World Dredging Congress & Expositions*:603–618.
- Wilber, D. H., D. G. Clarke, G. L. Ray, and M. Burlas. 2003. Response of surf zone fish to beach nourishment operations on the northern coast of New Jersey, USA. *Marine Ecology Progress Series* 250:231–246.
- Wilber, D. H., D. G. Clarke, J. Gallo, C. J. Alcoba, A. M. Dilorenzo, and S. E. Zappala. 2013. Identification of winter flounder (*Pseudopleuronectes americanus*) estuarine spawning habitat and factors influencing egg and larval distributions. *Estuaries and Coasts* 36:1304–1318.
- Wilber, D. H., L. Brown, M. Griffin, G. R. DeCelles, and D. A. Carey. 2022a. Demersal fish and invertebrate catches relative to construction and operation of North America’s first offshore wind farm. *ICES Journal of Marine Science*:fsac051.
- Wilber, D. H., L. Brown, M. Griffin, G. R. DeCelles, and D. A. Carey. 2022b. Offshore wind farm effects on flounder and gadid dietary habits and condition on the northeastern US coast. *Marine Ecology Progress Series* 683:123–138.
- Wilber, D. H., W. Brostoff, D. G. Clarke, and G. L. Ray. 2005. *Sedimentation: Potential Biological Effects of Dredging Operations in Estuarine and Marine Environments*. U.S. Army Engineer Research and Development Center ERDC TN-DOER-E20.

- Wilhelmsson, D., and O. Langhamer. 2014. The Influence of Fisheries Exclusion and Addition of Hard Substrata on Fish and Crustaceans. In M. A. Shields and A. I. L. Payne (Editors). *Marine Renewable Energy Technology and Environmental Interactions* (pp. 49–60). Dordrecht: Springer.
- Woodland, R. J., A. Buchheister, R. J. Latour, C. Lozano, E. Houde, C. J. Sweetman, M. C. Fabrizio, and T. D. Tuckey. 2021. Environmental drivers of forage fishes and benthic invertebrates at multiple scales in a large temperate estuary. *Estuaries and Coasts* 44:921–938.
- Wyman, M. T., A. P. Klimley, R. D. Battleson, T. V. Agosta, E. D. Chapman, P. J. Haverkamp, M. D. Pagel, and R. Kavet. 2018. Behavioral responses by migrating juvenile salmonids to a subsea high-voltage DC power cable. *Marine Biology* 165:134.
- Wysocki, L. E., S. Amoser, and F. Ladich. 2007. Diversity in ambient noise in European freshwater habitats: Noise levels, spectral profiles, and impact on fishes. *The Journal of the Acoustical Society of America* 121:2559–2566.
- Xu, H., T. J. Miller, S. Hameed, L. A. Alade, and J. A. Nye. 2018. Evaluating the utility of the Gulf Stream Index for predicting recruitment of Southern New England-Mid Atlantic yellowtail flounder. *Fisheries Oceanography* 27:85–95.
- Young, C. N., and J. K. Carlson. 2020. The biology and conservation status of the oceanic whitetip shark (*Carcharhinus longimanus*) and future directions for recovery. *Reviews in Fish Biology and Fisheries* 30:293–312.

B.3.14 Section 3.14, Land Use and Coastal Infrastructure

- Carter, Diana. 2023. Assistant Division Director for Planning and Analysis, New York State Office of Parks, Recreation & Historic Preservation. Personal communication on May 23.
- City of Corpus Christi. 2016. *Plan CC, Comprehensive Plan*. Available: <https://www-cdn.cctexas.com/sites/default/files/PlanCC%20Final%20Version%20Approved%209-27-2016.pdf>. Accessed: February 11, 2022.
- City Planning Commission. 2020. *Industry City Final Environmental Impact Statement*. Available: <https://www1.nyc.gov/site/planning/applicants/env-review/industry-city.page>. Accessed: February 9, 2022.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- New York City Economic Development Corporation (NYCEDC). 2023. South Brooklyn Marine Terminal Port Infrastructure Improvement Project, U.S. Army Corps of Engineers/New York State Department of Environmental Conservation (NYSDEC) Joint Permit Application Package. USACE Pre-Application # NAN-2022-00900-EMI. May.
- New York Department of Small Business Services (NYDSBS). 2021. *SBMT 35th Street Pier Expansion Project NYC Department of Small Business Services FY2021 Port Infrastructure Development Program (PIDP) Grant Application*. July.

New York State Energy Research and Development Authority (NYSERDA). 2019. “2018 Ports Assessment: Port of Albany-Rensselaer, Pre-front End Engineering Design Report.”

Port of Albany. 2021. Offshore Wind Tower Manufacturing Port Project, Port of Albany New York, FY 2021 Port Infrastructure Development Program Grant Application.

B.3.15 Section 3.15, Marine Mammals

Akhtar, N., B. Geyer, and C. Schrum. 2022. Impacts of accelerating deployment of offshore windfarms on near-surface climate. *Scientific Reports* 12:18307.

APEM and Normandeau Associates (Normandeau). 2018. *Digital Aerial Baseline Survey of Marine Wildlife in Support of Offshore Wind Energy prepared for New York State Energy Research and Development Authority - OPA 2016*. Data downloaded from OBIS-SEAMAP. Available: <http://seamap.env.duke.edu/dataset/1817>.

Arveson, P., and D. Vendittis. 2000. Radiated noise characteristics of a modern cargo ship. *Journal of the Acoustical Society of America* 2000:118–129.

Atlantic Shores Offshore Wind (Atlantic Shores). 2022. Application for Marine Mammal Protection Act (MMPA) Rulemaking and Letter of Authorization. September.

Au, W. W. L., and M. C. Hastings. 2008. *Principles of Marine Bioacoustics*. New York: Springer.

Austin, M. E., D. E. Hannay, and K. C. Bröker. 2018. Acoustic characterization of exploration drilling in the Chukchi and Beaufort seas. *Journal of the Acoustical Society of America* 144:115–123.

Azzara, A., W. M. von Zharen, and J. Newcomb. 2013. Mixed-methods analytic approach for determining potential impacts of vessel noise on sperm whale click behavior. *Journal of the Acoustical Society of America* 2013:4566–4574.

Balcomb, K. C., and D. E. Claridge. 2001. A mass stranding of cetaceans caused by naval sonar in the Bahamas. *Bahamas Journal of Science* 8:1–12.

Bald, J., C. Hernández, A. Uriarte, J. A. Castillo, P. Ruiz, N. Ortega, Y. T. Enciso, and D. Marina. 2015. Acoustic Characterization of Submarine Cable Installation in the Biscay Marine Energy Platform (BIMEP). [Presentation]. Presented at Bilbao Marine Energy Week, Bilbao, Spain. Available: <https://tethys.pnnl.gov/publications/acoustic-characterization-submarine-cable-installation-biscay-marine-energy-platform>. Accessed: September 3, 2020.

Baulch, S., and C. Perry. 2014. Evaluating the impacts of marine debris on cetaceans. *Marine Pollution Bulletin* 80:210–221.

Bejarano, A., J. Michel, J. Rowe, Z. Li, D. F. McCay, and D. S. Etkin. 2013. *Environmental Risks, Fate, and Effects of Chemicals Associated with Wind Turbines on the Atlantic Outer Continental Shelf*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-213. Available: <https://espis.boem.gov/final%20reports/5330.pdf>. Accessed: September 3, 2020.

- Bejder, L., A. Samuels, H. Whitehead, H. Finn, and S. Allen. 2009. Impact assessment research: Use and misuse of habituation, sensitisation and tolerance in describing wildlife responses to anthropogenic stimuli. *Marine Ecology Progress Series* 395:177–185.
- Benhemma-Le Gall, A., I. Graham, N. Merchant, and P. Thompson. 2021. Broad-scale responses of harbor porpoises to pile-driving and vessel activities during offshore windfarm construction. *Frontiers in Marine Science* 8:664724.
- Benjamins, S., V. Harnois, H. C. M. Smith, L. Johanning, L. Greenhill, C. Carter, and B. Wilson. 2014. *Understanding the Potential for Marine Megafauna Entanglement Risk from Marine Renewable Energy Developments*. Scottish Natural Heritage Commissioned Report No. 791.
- Bilinski, J. 2021. *Review of the Impacts to Marine Fauna from Electromagnetic Frequencies (EMF) Generated by Energy Transmitted through Undersea Electric Transmission Cables*. NJDEP Division of Science and Research. Available: <https://www.nj.gov/dep/offshorewind/docs/njdep-marine-fauna-review-impacts-from-emf.pdf>.
- Blackwell, S. B., C. S. Nations, T. L. McDonald, C. R. Greene, A. M. Thode, M. Guerra, and A. M. Macrander. 2013. Effects of airgun sounds on bowhead whale calling rates in the Alaskan Beaufort Sea. *Marine Mammal Science* 29:E342–E365.
- Blackwell, S. B., C. S. Nations, A. M. Thode, M. E. Kauffman, A. S. Conrad, R. G. Norman, and K. H. Kim. 2017. Effects of tones associated with drilling activities on bowhead whale calling rates. *PLOS ONE* 12:e0188459.
- Bradbury, J. W., and S. L. Vehrencamp. 1998. *Principles of Animal Communication*. Sinauer Associates.
- Brandt, M. J., A. Diederichs, K. Betke, and G. Nehls. 2011. Responses of harbour porpoises to pile driving at the Horns Rev II offshore wind farm in the Danish North Sea. *Marine Ecology Progress Series* 421:205–216.
- Brandt, M. J., A. Dragon, A. Diederichs, A. Schubert, V. Kosarev, G. Nehls, V. Wahl, A. Michalik, A. Braasch, C. Hinz, C. Ketzer, D. Todeskino, M. Gauger, M. Laczny, and W. Piper. 2016. *Effects of Offshore Pile Driving on Harbour Porpoise Abundance in the German Bight: Assessment of Noise Effects*. Final Report. Prepared for Offshore Forum Windenergie.
- Branstetter, B. K., V. F. Bowman, and D. S. Houser. 2018. Effects of vibratory pile driver noise on echolocation and vigilance in bottlenose dolphins (*Tursiops truncatus*). *The Journal of Acoustical Society of America* 143:429.
- British Columbia Ministry of Transportation and Infrastructure (BC MoTI). 2016. *Policy for Assessing and Mitigating Noise Impacts from New and Upgraded Numbered Highways*. Revision 2 October 2016. 7 pp.
- Brown, D. M., P. L. Sieswerda, and E. C. M. Parsons. 2019. Potential encounters between humpback whales (*Megaptera novaeangliae*) and vessels in the New York Bight apex, USA. *Marine Policy* 106:103527.
- Browne, M. A., A. J. Underwood, M. G. Chapman, R. Williams, R. C. Thompson, and J. A. van Franeker. 2015. Linking effects of anthropogenic debris to ecological impacts. *Proceedings of the Royal Society B* 282:20142929.

- Buckstaff, K. C. 2006. Effects of watercraft noise on the acoustic behavior of bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. *Marine Mammal Science* 20:709–725.
- Bureau of Ocean Energy Management (BOEM). 2014. *Atlantic OCS Proposed Geological and Geophysical Activities Mid-Atlantic and South Atlantic Planning Areas. Final Programmatic Environmental Impact Statement*. OCS EIS/EA BOEM 2014-001.
- Bureau of Ocean Energy Management (BOEM). 2017. *Gulf of Mexico OCS Proposed Geological and Geophysical Activities Western, Central, and Eastern Planning Areas. Final Programmatic Environmental Impact Statement*. OCS EIS/EA BOEM 2017-051.
- Bureau of Ocean Energy Management (BOEM). 2018. *Vineyard Wind Offshore Wind Energy Project Scoping Report*. U.S. Department of the Interior. Available: <https://www.boem.gov/Vineyard-Wind/>. Accessed: May 7, 2019.
- Bureau of Ocean Energy Management (BOEM). 2019. Response to the National Marine Fisheries Service April 3, 2019, Request for Additional Information Needed to Initiate Formal Consultation under the Endangered Species Act. U.S. Department of the Interior, Bureau of Ocean Energy Management. Transmitted to the National Marine Fisheries Service via email on April 10, 2019.
- Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: <https://www.boem.gov/vineyard-wind>.
- Bureau of Ocean Energy Management (BOEM). 2021b. *Data Collection and Site Survey Activities for Renewable Energy on the Atlantic Outer Continental Shelf*. Biological Assessment.
- Carpenter, J. R., L. Merckelbach, U. Callies, S. Clark, L. Gaslikova, and B. Baschek. 2016. Potential impacts of offshore wind farms on North Sea stratification. *PLOS ONE* 11:e0160830.
- Castellote, M., C. W. Clark, and M. O. Lammers. 2012. Acoustic and behavioral changes by fin whales (*Balaenoptera physalus*) in response to shipping and airgun noise. *Biological Conservation* 157:115–122.
- Causon, P. D., and A. B. Gill. 2018. “Linking ecosystem services with epibenthic biodiversity change following installation of offshore wind farms.” *Environmental Science and Policy* 89:340–347.
- Cerchio, S., S. Strindberg, T. Collins, C. Bennett, and H. Rosenbaum. 2014. Seismic surveys negatively affect humpback whale singing activity off northern Angola. *PLOS ONE* 9:e86464.
- Cetacean and Turtle Assessment Program (CETAP). 1981. *A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the U.S. outer continental shelf*. Cetacean and Turtle Assessment Program, University of Rhode Island. Final Report #AA55 1-CT8-48 to the Bureau of Land Management, Washington, DC.
- Chen, Changsheng, R. C. Beardsley, J. Qi and H. Lin. 2016. *Use of Finite-Volume Modeling and the Northeast Coastal Ocean Forecast System in Offshore Wind Energy Resource Planning*. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. BOEM 2016-050. 131 pp.

- Chen, Z., E. Curchitser, R. Chant, and D. Kang. 2018. Seasonal variability of the cold pool over the Mid-Atlantic Bight continental shelf. *Journal of Geophysical Research: Oceans* 123.
- Cholewiak, D., A. I. DeAngelis, D. Palka, P. J. Corkeron, and S. M. Van Parijs. 2017. Beaked whales demonstrate a marked acoustic response to the use of shipboard echosounders. *Royal Society Open Science* 4:170940.
- Christiansen, N., U. Daewel, B. Djath, and C. Schrum. 2022. Emergence of large-scale hydrodynamic structures due to atmospheric offshore wind farm wakes. *Frontiers in Marine Science* 9:818501.
- Clark, C. W., W. T. Ellison, B. L. Southall, L. Hatch, S. M. Van Parijs, A. Frankel, and D. Ponirakis. 2009. Acoustic masking in marine ecosystems: Intuition, analysis, and implication. *Marine Ecology Progress Series* 395:201–222.
- Conn, P. B., and G. K. Silber. 2013. Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales. *Ecosphere* 4:43.
- Corkeron, P., P. Hamilton, J. Bannister, P. Best, C. Charlton, K. R. Groch, K. Findlay, V. Rowntree, E. Vermeulen, and R. M. Pace. 2018. The recovery of North Atlantic right whales, *Eubalaena glacialis*, has been constrained by human-caused mortality. *Royal Society Open Science* 5:180892.
- Costello, C., L. Cao, S. Gelcich, M. A. Cisneros-Mata, C. M. Free, H. E. Froehlich, C. D. Golden, G. Ishimura, J. Maier, I. Macadam-Somer, T. Mangin, M. C. Melnychuk, M. Miyahara, C. L. de Moor, R. Naylor, L. Nøstbakken, E. Ojea, E. O'Reilly, A. M. Parma, A. J. Plantinga, S. H. Thilsted, and J. Lubchenco. 2020. The future of food from the sea. *Nature* 588:95–100.
- Cox, T. M., T. J. Ragen, A. J. Read, E. Vos, R. W. Baird, K. Balcomb, J. Barlow, J. Caldwell, T. Cranford, L. Crum, A. D'Amico, G. D'Spain, A. Fernández, J. Finneran, R. Gentry, W. Gerth, F. Gulland, J. Hildebrand, D. Houser, T. Hullar, P. D. Jepson, D. Ketten, C. D. MacLeod, P. Miller, S. Moore, D. Mountain, D. Palka, P. Ponganis, S. Rommel, T. Rowles, B. Taylor, P. Tyack, D. Wartzok, R. Gisiner, J. Mead, and L. Benner. 2006. Understanding the impacts of anthropogenic sound on beaked whales. *Journal of Cetacean Research and Management* 7:177–187.
- Cranford, T. W., and P. Krysl. 2015. Fin whale sound reception mechanisms: Skull vibration enables low-frequency hearing. *PLOS ONE* 10(1):e0116222.
- D'Amico, A. D., R. C. Gisiner, D. R. Ketten, J. A. Hammock, C. Johnson, P. L. Tyack, and J. Mead. 2009. Beaked whale strandings and naval exercises. *Aquatic Mammals* 35:452–472.
- Daewel, U., N. Akhtar, N. Christiansen, and C. Schrum. 2022. *Offshore wind wakes – The underrated impact on the marine ecosystem*. Research Square. DOI: 10.21203/rs.3.rs-1720162/v1.
- Dahlheim, M. E., and D. K. Ljungblad. 1990. Preliminary hearing study on gray whales (*Eschrichtius robustus*) in the field. Pages 335–346 in J. A. Thomas and R. A. Kastelein (eds.), *Sensory Abilities of Cetaceans/Laboratory and Field Evidence*. Plenum, New York.
- Dähne, M., A. Gilles, K. Lucke, V. Pechko, S. Alder, K. Krügel, J. Sundermeyer, and U. Siebert. 2013. Effects of pile driving on harbour porpoises (*Phocoena phocoena*) at the first offshore wind farm in Germany. *Environmental Research Letters* 8:025002.

- Dam, M., and D. Bloch. 2000. Screening of mercury and persistent organochlorine pollutants in long-finned pilot whale (*Globicephala melas*) in the Faroe Islands. *Marine Pollution Bulletin* 40:1090–1099.
- Davis, G. E., M. F. Baumgartner, J. M. Bonnell, J. Bell, C. Berchok, J. B. Thornton, S. Brault, G. Buchanan, R. A. Charif, D. Cholewiak, and C. W. Clark. 2017. Long-term passive acoustic recordings track the changing distribution of North Atlantic right whales (*Eubalaena glacialis*) from 2004 to 2014. *Scientific Reports* 7:13460.
- Davis, G. E., M. F. Baumgartner, P. J. Corkeron. 2020. Exploring movement patterns and changing distributions of baleen whales in the western North Atlantic using a decade of passive acoustic data. *Global Change Biology* 26:4812–4840.
- Degraer, S., D. A. Carey, J. W. P. Coolen, and Z. L. Hutchison. 2020. Offshore wind farm artificial reefs affect ecosystem structure and functioning. A synthesis. *Oceanography* 33:48–57.
- Dernie, K. M., M. J. Kaiser, E. A. Richardson, and R. M. Warwick. 2003. Recovery rates of benthic communities following physical disturbance. *Journal of Animal Ecology* 72:1043–1056.
- Di Iorio, L., and C. W. Clark. 2010. Exposure to seismic survey alters blue whale acoustic communication. *Biology Letters* 6:51–54.
- Dickerson, C., K. J. Reine, and D. G. Clarke. 2001. *Characterization of underwater sounds produced by bucket dredging operations*. DOER Technical Notes Collection (ERDC TN-DOER-E14), U.S. Army Research and Development Center, Vicksburg, MS. 18 pp.
- Discovery of Sound in the Sea (DOSITS). 2019. Homepage. Available: <https://dosits.org/>.
- Dolman, S., V. Williams-Grey, R. Asmutis-Silvia, and S. Isaac. 2006. *Vessel Collisions and Cetaceans: What Happens when They Don't Miss the Boat*. A WDCS Science Report.
- Dominion Energy. 2022. Coastal Virginia Offshore Wind Commercial Project, Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf within Lease OCS-A 0483 and the Associated Offshore Export Cable Route Corridor.
- Dorrell, R. M., C. J. Lloyd, B. J. Lincoln, T. P. Rippeth, J. R. Taylor, C. P. Caulfield, J. Sharples, J. A. Polton, B. D. Scannell, D. M. Greaves, R. A. Hall, and J. H. Simpson. 2022. Anthropogenic mixing in seasonally stratified shelf seas by offshore wind farm infrastructure. *Frontiers in Marine Science* 9:830927.
- Dunlop, R. A., M. J. Noad, R. D. McCauley, L. Scott-Hayward, E. Kniest, R. Slade, D. Paton, and D. H. Cato. 2017. Determining the behavioural dose-response relationship of marine mammals to air gun noise and source proximity. *Journal of Experimental Biology* 220:2878–2886.
- Ecology and Environment Engineering. 2017. *New York State Offshore Wind Master Plan Marine Mammals and Sea Turtle Study Final Report*. Report 17-25.
- Edwards, E. F., C. Hall, T. J. Moore, C. Sheredy, and J. V. Redfern. 2015. Global distribution of fin whales Balaenoptera physalus in the post-whaling era (1980–2012). *Mammal Review* 45:197–214.

- Efroymson, R. A., W. Hodge Rose, S. Nemth, and G. W. Suter II. 2000. *Ecological Risk Assessment Framework for Low Altitude Overflights by Fixed-Wing and Rotary-Wing Military Aircraft*. Research sponsored by Strategic Environmental Research and Development Program of the U.S. Department of Defense under Interagency Agreement 2107-N218-S1. Publication No. 5010. Environmental Science Division, ORNL.
- Elliot, J., K. Smith, D. R. Gallien, and A. Khan. 2017. *Observing Cable Laying and Particle Settlement During the Construction of the Block Island Wind Farm*. OCS Study BOEM 2017-027. 225 pp.
- Elliott, J., A. A. Khan, Y. Lin, T. Mason, J. H. Miller, A. E. Newhall, G. R. Potty, and K. J. Vigness-Raposa. 2019. *Field Observations during Wind Turbine Operations at the Block Island Wind Farm, Rhode Island*. OCS Study BOEM 2019-028.
- Empire Offshore Wind, LLC (Empire). 2022. *Empire Offshore Wind: Empire Wind Project (EW 1 and EW 2), Request for Rulemaking and Letter of Authorization for Taking of Marine Mammals Incidental to Construction Activities on the Outer Continental Shelf (OCS) within Lease OCS-A 0512 and Associated Submarine Export Cable Routes*. July. Available: <https://www.fisheries.noaa.gov/action/incidental-take-authorization-empire-offshore-wind-llc-construction-empire-wind-project-ew1>.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- English, P. A., T. I. Mason, J. T. Backstrom, B. J. Tibbles, A. A. Mackay, M. J. Smith, and T. Mitchell. 2017. *Improving Efficiencies of National Environmental Policy Act Documentation for Offshore Wind Facilities Case Studies Report*. US Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study – BOEM 2017-026.
- Erbe, C., A. MacGillivray, and R. Williams. 2012. Mapping cumulative noise from shipping to inform marine spatial planning. *The Journal of the Acoustical Society of America* 132:EL423–EL428.
- Erbe, C., and C. McPherson. 2017. Underwater noise from geotechnical drilling and standard penetration testing. *The Journal of the Acoustical Society of America* 142(3):EL281–EL285.
- Erbe, C., R. Dunlop, and S. Dolman. 2018. Effects of noise on marine mammals. In H. Slabbekoorn, R. J. Dooling, A. N. Popper, and R. R. Fay, eds. *Effects of Anthropogenic Noise on Animals*, pp. 277–309.
- Erbe, C., S. A. Marley, R. P. Schoeman, J. N. Smith, L. E. Trigg, and C. B. Embling. 2019. The effects of ship noise on marine mammals—A review. *Frontiers in Marine Science* 6:Article 606.
- Erbe, C., C. Reichmuth, K. Cunningham, K. Lucke, and R. Dooling. 2016. Communication masking in marine mammals: A review and research strategy. *Marine Pollution Bulletin* 103:15–38.
- Estabrook, B. J., D. V. Harris, K. B. Hodge, D. P. Salisbury, D. Ponirakis, J. Zeh, S. E. Parks, and A. N. Rice. 2019. *Year 1 Annual Survey Report for New York Bight Whale Monitoring Passive Acoustic Surveys October 2017- July 2018*. Contract C009925. New York State Department of Environmental Conservation. East Setauket, NY.
- Evans, P. G., and A. Bjørge. 2013. Impacts of climate change on marine mammals. *Marine Climate Change Impacts Partnership (MCCIP) Science Review*:134–148.

- Evans, P., and J. Waggitt. 2020. *Impacts of climate change on marine mammals, relevant to the coastal and marine environment around the UK*. (MCCIP Science Review 2020). Marine Climate Change Impacts Partnership. Available: http://www.mccip.org.uk/media/2022/19_marine_mammals_2020.pdf.
- Exponent Engineering, P.C. 2018. *Deepwater Wind South Fork Wind Farm Onshore Electric and Magnetic Field Assessment*. Appendix K2 in Construction and Operations Plan South Fork Wind Farm.
- Fernández, A., J. F. Edwards, F. Rodríguez, A. Espinosa de los Monteros, P. Herráez, P. Castro, J. R. Jaber, V. Martín, and M. Arbelo. 2005. ‘Gas and Fat Embolic Syndrome’ involving a mass stranding of beaked whales (Family Ziphiidae) exposed to anthropogenic sonar signals. *Veterinary Pathology* 42:446–457.
- Finley, K. J., G. W. Miller, R. A. Davis, and C. R. Greene. 1990. Reactions of belugas, *Delphinapterus leucas*, and narwhals, *Monodon monoceros*, to ice-breaking ships in the Canadian High Arctic. *Canadian Bulletin of Fisheries and Aquatic Sciences* 224:97–117.
- Finneran, J. J. 2015. Noise-induced hearing loss in marine mammals: A review of temporary threshold shift studies from 1996–2015. *The Journal of the Acoustical Society of America* 138:1702–1726.
- Finneran, J. J. 2016. *Auditory Weighting Functions and TTS/PTS Exposure Functions for Marine Mammals Exposed to Underwater Noise*. Technical Report 3026. Space and Naval Warfare Systems Center Pacific.
- Finneran, J. J., E. Henderson, D. Houser, K. Jenkins, S. Kotecki, and J. Muslow. 2017. *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*. Technical Report. Space and Naval Warfare Systems Center Pacific. 194 pp.
- Floeter, J., T. Pohlmann, A. Harmer, and C. Mollmann. 2022. Chasing the offshore wind farm wind-wake-induced upwelling/downwelling dipole. *Frontiers in Marine Science* 9:884943.
- Gerstein, E., J. Blue, and S. Forsythe. 2006. Ship strike acoustics: A paradox and parametric solution. *Journal of the Acoustical Society of America* 119:3289–3289.
- Gill, A. B., I. Gloyne-Phillips, K. J. Neal, and J. A. Kimber. 2005. The Potential Effects of Electromagnetic Fields Generated by Sub-Sea Power Cables Associated with Offshore Wind Farm Developments on Electrically and Magnetically Sensitive Marine Organisms—A Review. Collaborative Offshore Wind Research into the Environment (COWRIE), Ltd, UK. Available: https://tethys.pnnl.gov/sites/default/files/publications/The_Potential_Effects_of_Electromagnetic_Fields_Generated_by_Sub_Sea_Power_Cables.pdf. Accessed: September 9, 2020.
- Golbazi, M., C. L. Archer, and S. Alessandrini. 2022. Surface impacts of large offshore wind farms. *Environmental Research Letters* 17:064021.
- Götz, T., G. Hastie, L. T. Hatch, O. Raustein, B. L. Southall, M. Tasker, and F. Thomsen. 2009. *Overview of the Impacts of Anthropogenic Underwater Sound in the Marine Environment*. OSPAR Commission.

- Graham, I. M., E. Pirotta, N. D. Merchant, A. Farcas, T. R. Barton, B. Cheney, G. D. Hastie, and P. M. Thompson. 2017. Responses of bottlenose dolphins and harbor porpoises to impact and vibration piling noise during harbor construction. *Ecosphere* 8(5):e01793.
- Guerra, M., S. M. Dawson, T. E. Brough, and W. J. Rayment. 2014. Effects of boats on the surface and acoustic behavior of an endangered population of bottlenose dolphins. *Endangered Species Research* 24:221–236.
- Hall, A. J., B. J. McConnell, L. H. Schwacke, G. M. Ylitalo, R. Williams, and T. K. Rowles. 2018. Predicting the effects of polychlorinated biphenyls on cetacean populations through impacts on immunity and calf survival. *Environmental Pollution* 233:407–418.
- Halpin, P. N., A. J. Read, E. Fujioka, B. D. Best., B. Donnelly, L. J. Hazen, C. Kot, K. Urian, E. LaBrecque, A. Dimatteo, J. Cleary, C. Good, L. B. Crowder, and K. D. Hyrenbach. 2009. OBIS-SEAMAP: The world data center for marine mammal, sea bird, and sea turtle distributions. *Oceanography* 22:104–115.
- Harnois, V., H. C. Smith, S. Benjamins, and L. Johanning. 2015. Assessment of entanglement risk to marine megafauna due to offshore renewable energy mooring systems. *International Journal of Marine Energy* 11:27–49.
- Hastie, G. D., B. Wilson, L. H. Tufft, and P. M. Thompson. 2003. Bottlenose dolphins increase breathing synchrony in response to boat traffic. *Marine Mammal Science* 19:74–84.
- Hatch, L. T., C. W. Clark, S. M. van Parijs, A. S. Frankel, and D. M. Ponirakis. 2012. Quantifying loss of acoustic communication space for right whales in and around a U.S. national marine sanctuary. *Conservation Biology* 26:983–994.
- Hayes, S. A., E. Josephson, K. Maze-Foley, and P. E. Rosel. 2018. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2017: (Second Edition). NOAA Tech. Mem. NMFS-NE-245. 371 pp.
- Hayes, S. A., E. Josephson, K. Maze-Foley, and P. E. Rosel. 2020. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2019. NOAA Tech. Mem. NMFS-NE-264. 479 pp.
- Hayes, S. A., E. Josephson, K. Maze-Foley, P. E. Rosel, and J. Turek. 2021. US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2020. NOAA Tech. Mem. NMFS-NE-271. 394 pp.
- Hayes, S. A., E. Josephson, K. Maze-Foley, P. E. Rosel, and J. Turek. 2021. Citing Wood, S. A., K. T. Murray, E. Josephson, and J. R. Gilbert. 2019. Rates of increase of gray seal (*Halichoerus grypus atlantica*) pupping at recolonized sites in the United States, 1988–2019. *Journal of Mammalogy* 101:121–128.
- Hayes, S. A., E. Josephson, K. Maze-Foley, P. E. Rosel, and J. Wallace. 2022. *US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2021*. 380 pp.
- Heinis, F., C. de Jong, M. Ainslie, W. Borst, and T. Vellinga. 2013. Monitoring programme for the Maasvlakte 2, Part III - The effects of underwater sound. *Terra et Aqua* 132:2132.

- Henderson, D., B. Hu, and E. Bielefeld. 2008. Patterns and mechanisms of noise-induced cochlear pathology. Pages 195–217 in J. Schacht, A. N. Popper, and R. R. Fay (eds.), *Auditory Trauma, Protection, and Repair*.
- Hoffman, C. A. 2012. Mitigating impacts of underwater noise from dredging on beluga whales in Cook Inlet, Alaska. *Advancements in Experimental Medicine and Biology* 730:617–619.
- Holt, M. M., D. P. Noren, V. Veirs, C. K. Emmons, and S. Veirs. 2009. Speaking up: Killer whales (*Orcinus orca*) increase their call amplitude in response to vessel noise. *Journal of the Acoustical Society of America* 125:EL27–EL32.
- Holt, M. M., J. B. Tennesen, M. B. Hanson, C. K. Emmons, D. A. Giles, J. T. Hogan, and M. J. Ford. 2021. Vessels and their sounds reduce prey capture effort by endangered killer whales (*Orcinus orca*). *Marine Environmental Research* 170:105429.
- Houser D. S., R. Howard, and S. Ridgway. 2001. Can diving-induced tissue nitrogen supersaturation increase the chance of acoustically driven bubble growth in marine mammals? *Journal of Theoretical Biology* 213:183–195.
- Hunt, K. E., R. Stimmelmayer, C. George, C. Hanns, R. Sudyam, H. Brower, and R. M. Rolland. 2014. Baleen hormones: A novel tool for retrospective assessment of stress and reproduction in bowhead whales (*Balaena mysticetus*). *Conservation Physiology* 2:1–12.
- Illingworth and Rodkin. 2017. *Final Report: Pile-Driving Noise Measurements at Atlantic Fleet Naval Installations: 28 May 2013–28 April 2016*. 152 pp. Available: https://www.navymarinespeciesmonitoring.us/files/4814/9089/8563/Pile-driving_Noise_Measurements_Final_Report_12Jan2017.pdf.
- Jansen, H. W., and C. A. F. de Jong. 2014. *Underwater Noise Measurements in the North Sea in and near the Princess Amalia Wind Farm in Operation*. TNO Report 2013 R11916. 55 pp.
- JASCO Applied Sciences Inc. (JASCO). 2022. New England Wind Offshore Wind Farm Application for Marine Mammal Protection Act (MMPA) Rulemaking and Letter of Authorization. July. Available: https://media.fisheries.noaa.gov/2022-08/NewEnglandWind_2023LOA_App_OPR1_508.pdf.
- Jefferson, T. A., M. A. Webber, and R. L. Pitman. 2015. *Marine Mammals of the World: A Comprehensive Guide to their Identification*. Second Edition. San Diego, CA: Academic Press.
- Jensen, F. H., L. Bejder, M. Wahlberg, N. Aguilar Soto, M. Johnson, and P. T. Madsen. 2009. Vessel noise effects on delphinid communication. *Marine Ecological Progress Series* 395:161–175.
- Jensen, A. S., G. K. Silber, and J. Calambokidis. 2003. *Large Whale Ship Strike Database*. NOAA Tech. Memo. NMFS-ORP-25.
- Jepson, P. D., M. Arbelo, R. Deaville, I. A. P. Patterson, P. Castro, J. R. Baker, E. Degollada, H. M. Ross, P. Herraiez, A. M. Pocknell, F. Rodriguez, F. E. Howie, A. Espinosa, R. J. Reid, J. R. Jaber, V. Martin, A. A. Cunningham, and A. Fernández. 2003. Gas-bubble lesions in stranded cetaceans. *Nature* 425:575–576.

- Jepson, P. D., R. Deaville, L. J. Barber, A. Aguilar, A. Borrell, S. Murphy, J. Barry, A. Brownlow, J. Barnett, S. Berrow, A. A. Cunningham, N. J. Davidson, M. ten Doeschate, R. Esteban, M. Ferreira, A. D. Foote, T. Genov, J. Giménez, J. Loveridge, A. Llavona, V. Martin, D. L. Maxwell, A. Papachlimitzou, R. Penrose, M. W. Perkins, B. Smith, R. de Stephanis, N. Tregenza, P. Verborgh, A. Fernandez, and R. J. Law. 2016. PCB pollution continues to impact populations of orcas and other dolphins in European waters. *Scientific Reports* 6:1–17.
- Johansson T., and M. Andersson. 2012. *FOI Ambient Underwater Noise Levels at Norra Midsjöbanken during Construction of the Nord Stream Pipeline*.
- Johnson, A., G. Salvador, J. Kenney, J. Robbins, S. Kraus, S. Landry, and P. Clapham. 2005. Fishing gear involved in entanglement of right and humpback whales. *Marine Mammal Science* 21:635–645.
- Johnson, T. L., J. J. van Berkel, L. O. Mortensen, M. A. Bell, I. Tiong, B. Hernandez, D. B. Snyder, F. Thomsen, and O. S. Petersen. 2021. *Hydrodynamic Modeling, Particle Tracking and Agent-Based Modeling of Larvae in the U.S. Mid-Atlantic Bight*. OCS Study BOEM 2021-049.
- Josephson, E., F. Wenzel, and M. C. Lyssikatos. 2021. *Serious Injury Determinations for Small Cetaceans and Pinnipeds Caught in Commercial Fisheries off the Northeast US Coast, 2014–2018*. US Department of Commerce, Northeast Fisheries Science Center Reference Document 21-04.
- Joy, R., D. Tollit, J. Wood, A. MacGillivray, Z. Li, K. Trounce, and O. Robinson. 2019. Potential benefits of vessel slowdowns on endangered southern resident killer whales. *Frontiers in Marine Science* 6:344.
- Kastelein, R. A., L. A. E. Huijser, S. Cornelisse, L. Helder-Hoek, N. Jennings, and C. A. F. de Jong. 2019. Effect of pile-driving playback sound level on fish catching efficiency in harbor porpoises (*Phocoena phocoena*). *Aquatic Mammals* 45:398–410.
- Kates Varghese, H., J. Miksis-Olds, N. DiMarzio, K. Lowell, E. Linder, L. Mayer, and D. Moretti. 2020. The effect of two 12 kHz multibeam mapping surveys on the foraging behavior of Cuvier's beaked whales off of Southern California. *Journal of the Acoustical Society of America* 147:3849–3858.
- Kates Varghese, H., K. Lowell, J. Miksis-Olds, N. DiMarzio, D. Moretti, and L. Mayer. 2021. Spatial analysis of beaked whale foraging during two 12 kHz multibeam echosounder surveys. *Frontiers in Marine Science* 8:654184.
- Kellar, N. M., T. R. Speakman, C. R. Smith, S. M. Lane, B. C. Balmer, M. L. Trego, K. N. Catelani, M. N. Robbins, C. D. Allen, R. S. Wells, E. S. Zolman, T. K. Rowles, and L. H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the Deepwater Horizon Disaster (2010–2015). *Endangered Species Research* 33:1432–158.
- Kellison, R. G. T., and G. R. Sedberry. 1998. The effects of artificial reef vertical profile and hole diameter on fishes off South Carolina. *Bulletin of Marine Sciences* 62:763–780.
- Kenney, R. D., and K. J. Vigness-Raposa. 2010. *Marine Mammals and Sea Turtles of Narragansett Bay, Block Island Sound, Rhode Island Sound, and Nearby Waters: An Analysis of Existing Data for the Rhode Island Ocean Special Area Management Plan*. Technical Report, Ocean Special Area Management Plan.

- Kenney, R. D., and H. E. Winn. 1986. Cetacean high-use habitats of the Northeast United States continental shelf. *Fishery Bulletin* 84:345–357.
- Ketten, D. R. 1991. The marine mammal ear: Specializations for aquatic audition and echolocation. Pages 717–750 in D. Webster, R. Fay, and A. Popper (eds.), *The Biology of Hearing*. Berlin: Springer-Verlag.
- Kight, C. R., and J. P. Swaddle. 2011. How and why environmental noise impacts animals: An integrative, mechanistic review. *Ecology Letters* 14:1052–1061.
- Kirschvink, J. L. 1990. Geomagnetic sensitivity in cetaceans: An update with live strandings recorded in the US. In J. Thomas and R. Kastelein, eds. *Sensory Abilities of Cetaceans*, pp. 639–649.
- Kite-Powell, H. L., A. Knowlton, and M. Brown. 2007. *Modeling the Effect of Vessel Speed on Right Whale Ship Strike Risk*. Unpublished Report for NOAA/NMFS Project NA04NMF47202394. 8 pp. Available: <https://tethys.pnnl.gov/sites/default/files/publications/Kite-Powell-et-al-2007.pdf>. Accessed: September 9, 2020.
- Knowlton, A. R., P. K. Hamilton, M. K. Marx, H. P. Pettis, and S. D. Kraus. 2012. Monitoring North Atlantic right whale *Eubalaena glacialis* entanglement rates: A 30-year retrospective. *Marine Ecology Progress Series* 466:293–302.
- Kraus, S. D., M. W. Brown, H. Caswell, C. W. Clark, M. Fujiwara, P. H. Hamilton, R. D. Kenney, A. R. Knowlton, S. Landry, C. A. Mayo, W. A. McLellan, M. J. Moore, D. P. Nowacek, D. A. Pabst, A. J. Read, and R. M. Rolland. 2005. North Atlantic right whales in crisis. *Science* 309:561–562.
- Kraus, S. D., R. D. Kenney, and L. Thomas. 2019. *A Framework for Studying the Effects of Offshore Wind Development on Marine Mammals and Turtles*. Prepared for the Massachusetts Clean Energy Center and the Bureau of Ocean Energy Management.
- Kraus, S. D., S. Leiter, K. Stone, B. Wikgren, C. Mayo, P. Hughes, R. D. Kenney, C. W. Clark, A. N. Rice, B. Estabrook, and J. Tielens. 2016. *Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles*. Final Report. OCS Study BOEM 2016-054.
- Laist, D. W., A. R. Knowlton, J. G. Mead, A. S. Collet, and M. Podesta. 2001. Collisions between ships and whales. *Marine Mammal Science* 17:35–75.
- Laist, D. W., A. R. Knowlton, and D. Pendleton. 2014. Effectiveness of mandatory vessel speed limits for protecting North Atlantic right whales. *Endangered Species Research* 23:133–147.
- Learmonth, J. A., C. D. MacLeod, M. B. Santos, G. J. Pierce, H. Q. P. Crick, and R. A. Robinson. 2006. Potential effects of climate change on marine mammals. *Oceanography and Marine Biology: An Annual Review* 44:431–464.
- Lentz, S. J. 2017. Seasonal warming of the Middle Atlantic Bight cold pool. *Journal of Geophysical Research: Oceans* 122:941–954.
- Lesage, V., C. Barrette, M. C. S. Kingsley, and B. Sjare. 1999. The effect of vessel noise on the vocal behavior of belugas in the St. Lawrence River Estuary, Canada. *Marine Mammal Science* 15:65–84.

- Lewiston, R. L., L. B. Crowder, B. P. Wallace, J. E. Moore, T. Cox, R. Zydalis, S. McDonald, A. DiMatteo, D. C. Dunn, C. Y. Kot, R. Bjorkland, S. Kelez, C. Soykan, K. R. Stewart, M. Sims, A. Boustany, A. J. Read, P. Halpin, W. J. Nichols, and C. Safina. 2014. Global patterns of marine mammal, seabird, and marine mammal bycatch reveal taxa-specific and cumulative megafauna hotspots. *Proceeding of the National Academy of Sciences of the United States of America* 111:5271–8276.
- Lindeboom, H. J., H. J. Kouwenhoven, M. J. N. Bergman, S. Bouma, S. Brasseur, R. Daan, R. C. Fijn, D. deHaan, S. Dirksen, R. van Hal, R. Hille Ris Lambers, R. ter Hofstede, K. L. Krijgveld, M. Leopold, and M. Scheidat. 2011. Short-term ecological effects of an offshore wind farm in the Dutch coastal zone: A compilation. *Environmental Research Letters* 6:035101.
- Long, C. 2017. *Analysis of the Possible Displacement of Bird and Marine Mammal Species Related to the Installation and Operation of Marine Energy Conversion Systems*. Scottish Natural Heritage Commissioned Report No. 947.
- Love, M. S., A. Baldera, C. Young, and C. Robbins. 2013. *The Gulf of Mexico Ecosystem: A Coastal and Marine Atlas*. New Orleans, LA: Ocean Conservancy, Gulf Restoration Center.
- Lucke, K., P. A. Lepper, M. A. Blanchet, B. Hoeve, E. Everaarts, N. Van Elk, and U. Siebert. 2008. *Auditory Studies on Harbour Porpoises in Relation to Offshore Wind Turbines*. 4 pp.
- Maar, M., T. G. Nielsen, K. Bolding, H. Burchard, and A. W. Visser. 2009. Grazing effects of blue mussel *Mytilus edulis* on the pelagic food web under different turbulence conditions. *Marine Ecology Progress Series* 339:199–213.
- Madsen, P. T., and A. Surlykke. 2013. Functional convergence in bat and toothed whale biosonar. *Physiology* 28:276–283.
- Madsen, P. T., M. Wahlberg, J. Tougaard, K. Lucke, and P. Tyack. 2006. Wind turbine underwater noise and marine mammals: Implications of current knowledge and data needs. *Marine Ecology Progress Series* 309:279–295.
- Malme, C. I., P. R. Miles, G. W. Miller, W. J. Richardson, D. G. Roseneau, D. H. Thomson, and C. R. Greene, Jr. 1989. Analysis and ranking of the acoustic disturbance potential of petroleum industry activities and other sources of noise in the environment of marine mammals in Alaska. Minerals Management Service. Report No. 6945. 307 pp.
- Malme, C. I., B. Würsig, J. E. Bird, and P. Tyack. 1986. *Behavioral responses of gray whales to industrial noise: Feeding observations and predictive modeling*. BBN Rep. 6265. OCS Study MMS 88-0048.
- Martin, J., Q. Sabatier, T. A. Gowan, C. Giraud, E. Gurarie, C. S. Calleson, J. G. Ortega-Ortiz, C. J. Deutsch, A. Rycyk, and S. M. Koslovsky. 2016. A quantitative framework for investigating risk of deadly collisions between marine wildlife and boats. *Methods in Ecology and Evolution* 7:42–50.
- Martins, M. C. I., L. Sette, E. Josephson, A. Bogomolni, K. Rose, S. M. Sharp, M. Niemeyer, and M. Moore. 2019. Unoccupied aerial system assessment of entanglement in Northwest Atlantic gray seals (*Halichoerus grypus*). *Marine Mammal Science* 35:1613–1624.

- Matte, A., and R. Waldhauer. 1984. *Mid-Atlantic Bight Nutrient Variability*. National Marine Fisheries Service, Sandy Hook Laboratory. SHL Report No. 84-15. Available: <https://tinyurl.com/3vpu3etj>. Accessed: September 3, 2020.
- Mazet, J. A. K., I. A. Gardner, D. A. Jessup, and L. J. Lowenstine. 2001. Effects of petroleum on mink applied as a model for reproductive success in sea otters. *Journal of Wildlife Diseases* 37:686–692.
- McCauley, R. D., M-N. Jenner, C. Jenner, K. A. McCabe, and J. Murdoch. 1998. The response of humpback whales (*Megaptera novaeangliae*) to offshore seismic survey noise: Preliminary results of observations about a working seismic vessel and experimental exposures. *The APPEA Journal* 38:692–707.
- McConnell, B. J., M. A. Fedak, P. Lovell, and P. S. Hammond. 1999. Movements and foraging areas of grey seals in the North Sea. *Journal of Applied Ecology* 36:573–590.
- McIntosh, R. R., R. Kirkwood, D. R. Sutherland, and P. Dann. 2015. Drivers and annual estimates of marine wildlife entanglement rates: A long-term case study with Australian fur seals. *Marine Pollution Bulletin* 101:716–725.
- McKinstry, C. A., A. J. Westgate, and H. N. Koopman. 2013. Annual variation in the nutritional value of Stage V *Calanus finmarchicus*: Implications for right whales and other copepod predators. *Endangered Species Research* 20:195–204.
- McQueen, A., B. C. Suedel, and J. L. Wilkens. 2019. Review of the adverse biological effects of dredging-induced underwater sounds. *WEDA Journal of Dredging* 17(1):1–28.
- Methratta, E. T., and W. R. Dardick. 2019. Meta-analysis of finfish abundance at offshore wind farms. *Reviews in Fisheries Science and Aquaculture* 27:242–260.
- Mid-Atlantic Fishery Management Council (MAFMC). 2023. Mid-Atlantic artificial reefs. Available: <https://www.mafmc.org/artificial-reefs>. Accessed: March 2023.
- Mikkelsen, L., M. Johnson, D. M. Wisniewska, A. van Neer, U. Siebert, P. T. Madsen, and J. Teilmann. 2019. Long-term sound and movement recording tags to study natural behavior and reaction to ship noise of seals. *Ecology and Evolution* 1999:2588–2601.
- Miles, J., T. Martin, and L. Goddard. 2017. Current and wave effects around windfarm monopile foundations. *Coastal Engineering* 121:167–178.
- Miller, J. H., and G. R. Potty. 2017. Overview of underwater acoustic and seismic measurements of the construction and operation of the Block Island Wind Farm. *Journal of the Acoustical Society of America* 141:3993–3993. DOI:10.1121/1.4989144.
- Minerals Management Service (MMS). 2007. *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf: Final Environmental Impact Statement*. U.S. Department of the Interior. OCS EIS/EA MMS 2007-046. Available: <https://www.boem.gov/Guide-To-EIS/>. Accessed: July 3, 2018.
- Mohr, F. C., B. Lasely, and S. Bursian. 2008. Chronic oral exposure to Bunker C fuel oil causes adrenal insufficiency in ranch mink. *Archive of Environmental Contamination and Toxicology* 54:337–347.

- Moore, M. J., and J. M. van der Hoop. 2012. The painful side of trap and fixed net fisheries: Chronic entanglement of large whales. *Journal of Marine Biology* 2012:Article 230653.
- Moore, M. J., J. van der Hoop, S. G. Barco, A. M. Costidis, F. M. Gulland, P. D. Jepson, K. T. Moore, S. Raverty, and W. A. McLellan. 2013. Criteria and case definitions for serious injury and death of pinnipeds and cetaceans caused by anthropogenic trauma. *Diseases of Aquatic Organisms* 103:229–264.
- Moulton, V. D., W. J. Richardson, M. T. Williams, and S. B. Blackwell. 2003. Ringed seal densities and noise near an icebound artificial island with construction and drilling. *Acoustics Research Letters Online* 4:112–117.
- Muir, D. C. G., R. Wagemann, N. P. Grift, R. J. Norstrom, M. A. Simon, and J. Lien. 1988. Organochlorine chemical and heavy metal contaminants in white-beaked dolphins (*Lagenorhynchus albirostris*) and pilot whales (*Globicephala melaena*) from the coast of Newfoundland, Canada. *Archives of Environmental Contamination and Toxicology* 17:613–629.
- Muirhead, C. A., A. M. Warde, I. S. Biedron, A. Nicole Mihnovets, C. W. Clark, and A. N. Rice. 2018. Seasonal acoustic occurrence of blue, fin, and North Atlantic right whales in the New York Bight. *Aquatic Conservation: Marine and Freshwater Ecosystems* 28:744–753.
- Murphy, S., R. J. Law, R. Deaville, J. Barnett, M. W. Perkins, A. Brownlow, R. Penrose, N. J. Davison, J. L. Barber, and P. D. Jepson. 2018. Organochlorine contaminants and reproductive implication in cetaceans: A case study of the common dolphin. Pages 3–38 in M. C. Fossi and C. Panti (eds.), *Marine Mammal Ecotoxicology*.
- National Aeronautics and Space Administration (NASA). 2023. The effects of climate change. Available: <https://climate.nasa.gov/effects/>. Accessed: March 2023.
- National Marine Fisheries Service (NMFS). 2005. Endangered Fish and Wildlife; Notice of Intent to Prepare an Environmental Impact Statement. *Federal Register* 70(7):1871–1875. Available: <https://www.govinfo.gov/content/pkg/FR-2005-01-11/pdf/05-525.pdf>.
- National Marine Fisheries Service (NMFS). 2015. *Biological Opinion. Deepwater Wind: Block Island Wind Farm and Transmission System*.
- National Marine Fisheries Service (NMFS). 2018. *2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0). Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts*. NOAA Tech. Memo. NMFS-OPR-59. 167 pp.
- National Marine Fisheries Service (NMFS). 2019. *Interim Recommendation for Sound Source Level and Propagation Analysis for High Resolution Geophysical (HRG) Sources*.
- National Marine Fisheries Service (NMFS). 2020a. *North Atlantic Right Whale (Eubalaena glacialis) Vessel Speed Rule Assessment*. 44 pp.
- National Marine Fisheries Service (NMFS). 2020b. Section 7 Effect Analysis: Turbidity in the Greater Atlantic Region. Available: <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effect-analysis-turbidity-greater-atlantic-region>. Accessed: August 27, 2020.

- National Marine Fisheries Service (NMFS). 2020b. Citing U.S. Environmental Protection Agency (USEPA). 1986. Quality Criteria for Water. EPA 440/5-86-001.
- National Marine Fisheries Service (NMFS). 2021a. Active and Closed Unusual Mortality Events. Available: <https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events>. Accessed: November 19, 2021.
- National Marine Fisheries Service (NMFS). 2021b. Biological Opinion. Construction, Operation, Maintenance, and Decommissioning of the South Fork Offshore Energy Project (Lease OCS-A 0517). GARFO-2021-00353.
- National Marine Fisheries Service (NMFS). 2021c. Fin Whale. Available: <https://www.fisheries.noaa.gov/species/fin-whale>. Accessed: November 19, 2021.
- National Marine Fisheries Service (NMFS). 2021d. North Atlantic Right Whale. Available: <https://www.fisheries.noaa.gov/species/north-atlantic-right-whale>. Accessed: November 19, 2021.
- National Marine Fisheries Service (NMFS). 2022a. Sei Whale. Available: <https://www.fisheries.noaa.gov/species/sei-whale>. Accessed: December 28, 2022.
- National Marine Fisheries Service (NMFS). 2022b. Sperm Whale. Available: <https://www.fisheries.noaa.gov/species/sperm-whale>. Accessed: December 28, 2022.
- National Marine Fisheries Service (NMFS). 2023a. 2017–2023 North Atlantic right whale unusual mortality event. Available: <https://www.fisheries.noaa.gov/national/marine-life-distress/2017-2023-north-atlantic-right-whale-unusual-mortality-event>.
- National Marine Fisheries Service (NMFS). 2023b. *Draft US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2022*. Available: https://www.fisheries.noaa.gov/s3/2023-01/Draft%202022%20Atlantic%20SARs_final.pdf. Accessed: April 2023.
- National Marine Fisheries Service (NMFS). 2023c. Letter of Concurrence for planned infrastructure improvements at South Brooklyn Marine Terminal. May 25, 2023.
- National Marine Fisheries Service (NMFS). 2023d. Proposed Rule. Taking marine mammals incidental to the Empire Wind Project, offshore New York. 88 *Federal Register* 22696.
- National Oceanic and Atmospheric Administration (NOAA). 2013. *Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals: Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts*. December 2013, 76 pp. Silver Spring, Maryland: NMFS Office of Protected Resources. Available: http://www.nmfs.noaa.gov/pr/acoustics/draft_acoustic_guidance_2013.pdf.
- National Research Council (NRC). 2003. *Ocean Noise and Marine Mammals*. Washington, DC: The National Academies Press.
- Nedwell, J. R., A. G. Brooker, and R. J. Barham. 2012. *Assessment of Underwater Noise During the Installation of Export Power Cables at the Beatrice Offshore Wind Farm*. Subacoustech Environmental Report No. E318R0106. 17pp.

- Nedwell J., J. Langworthy, and D. Howell. 2003. *Assessment of Sub-Sea Acoustic Noise and Vibration from Offshore Wind Turbines and its Impact on Marine Wildlife; Initial Measurements of Underwater Noise during Construction of Offshore Windfarms, and Comparison with Background Noise*. Report No. 544 R 0424.
- Nedwell, J., and D. Howell. 2004. *A Review of Offshore Windfarm Related Underwater Noise Sources*. Final Report submitted to COWRIE (Collective Offshore Wind Energy Research into the Environment). 57 pp. Available: <https://tethys.pnnl.gov/sites/default/files/publications/Nedwell-Howell-2004.pdf>. Accessed: September 3, 2020.
- New England Wind. 2022. New England Wind Offshore Wind Farm, Application for Marine Mammal Protection Act Rulemaking and Letter of Authorization. July.
- New York City Economic Development Corporation (NYCEDC). 2023a. South Brooklyn Marine Terminal Port Infrastructure Improvement Project, U.S. Army Corps of Engineers/New York State Department of Environmental Conservation (NYSDEC) Joint Permit Application Package. USACE Pre-Application # NAN-2022-00900-EMI. May.
- New York City Economic Development Corporation (NYCEDC). 2023b. Request for Concurrence that Incidental Take is Unlikely to Occur. South Brooklyn Marine Terminal (SBMT) Infrastructure Improvement Project. Brooklyn, New York. 7 pp.
- Nielsen, J. B., F. Nielsen, P. J. Jørgensen, and P. Grandjean. 2000. Toxic metals and selenium in blood from pilot whales (*Globicephala melas*) and sperm whales (*Physeter catodon*). *Marine Pollution Bulletin* 40:348–351.
- Normandeau Associates, Inc. (Normandeau), Exponent, Inc., T. Tricas, and A. Gill. 2011. *Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. Final Report*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09. Available: <https://espis.boem.gov/final%20reports/5115.pdf>. Accessed: September 9, 2020.
- Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2011. *2010 Annual Report to the Inter-Agency Agreement M10PG00075/0001: A Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*. Prepared by NMFS-NEFSC, Woods Hole, Massachusetts and NMFS-SEFSC, Miami, Florida.
- Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2012. *2011 Annual Report to the Inter-Agency Agreement M10PG00075/0001: A Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*.
- Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2013. *2012 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*.
- Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2014. *2013 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*.

- Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2015. *2014 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean*.
- Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2016. *2016 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean - AMAPPS II*.
- Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2018. *2017 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US waters of the Western North Atlantic Ocean – AMAPPS II*.
- Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2020. *2019 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US waters of the Western North Atlantic Ocean – AMAPPS II*.
- Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2022. *2021 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US Waters of the Western North Atlantic Ocean - AMAPPS III*.
- Nowacek, D. P., M. P. Johnson, and P. L. Tyack. 2004. North Atlantic right whales (*Eubalaena glacialis*) ignore ships but respond to alerting stimuli. *Proceedings of the Royal Society B* 271:227–231.
- Nowacek, D. P., L. H. Thorne, D. W. Johnston, and P. L. Tyack. 2007. Responses of cetaceans to anthropogenic noise. *Mammal Review* 37:81–115.
- Nowacek, S. M., R. S. Wells, and A. R. Solow. 2001. Short-term effects of boat traffic on bottlenose dolphins, *Tursiops truncatus*, in Sarasota Bay, Florida. *Marine Mammal Science* 17:673–688.
- Olson, J. K., D. M. Lambourn, J. L. Huggins, S. Raverty, A. A. Scott, and J. K. Gaydos. 2021. Trends in propeller strike-induced mortality in harbor seals (*Phoca vitulina*) of the Salish Sea. *Journal of Wildlife Diseases* 57:689–693.
- Orr, T. L., S. M. Herz, and D. L. Oakley. 2013. *Evaluation of Lighting Schemes for Offshore Wind Facilities and Impacts to Local Environments*. OCS Study BOEM 2013-0116.
- Pace, R. M., and G. K. Silber. 2005. Simple Analysis of Ship and Large Whale Collisions: Does Speed Kill? Presentation at the Sixteenth Biennial Conference on the Biology of Marine Mammals, San Diego, CA, December 2005.
- Pace, R. M., R. Williams, S. D. Kraus, A. R. Knowlton, and H. M. Pettis. 2021. Cryptic mortality of North Atlantic right whales. *Conservation Science and Practice* 2021:e346.
- Pacific Marine Environmental Laboratory (PMEL). 2020. Ocean Acidification: The Other Carbon Dioxide Problem. Available: <https://www.pmel.noaa.gov/CO2/story/Ocean+Acidification>. Accessed: February 11, 2020.
- Parks, S. E., C. W. Clark, and P. L. Tyack. 2007. Short- and long-term changes in right whale calling behavior: The potential effects of noise on acoustic communication. *Journal of the Acoustical Society of America* 122:3725.

- Parsons, E. C. M., D. Dolman, A. J. Wright, N. A. Rose, and W. C. G. Burns. 2008. Navy sonar and cetaceans: Just how much does the gun need to smoke before we act? *Marine Pollution Bulletin* 56:1248–1257.
- Patenaude, N. J., W. J. Richardson, M. A. Smultea, W. R. Koski, and G. W. Miller. 2002. Aircraft sound and disturbance to bowhead and beluga whales during spring migration in the Alaskan Beaufort Sea. *Marine Mammal Science* 18:309–335.
- Pezy, J. P., A. Raoux, J. C. Dauvin, and S. Degraer. 2018. An ecosystem approach for studying the impact of offshore wind farms: A French case study. *ICES Journal of Marine Science* 77:1238–1246. <https://academic.oup.com/icesjms/article-abstract/77/3/1238/5096674>.
- Pfleger, M., P. Mustain, M. Valentine, E. Gee, W. Webber, and B. Fenty. 2021. *Vessel Strikes Threaten North Atlantic Right Whales*. Oceana.
- Pierce, G. J., M. B. Santos, S. Murphy, J. A. Learmonth, A. F. Zuur, E. Rogan, P. Bustamante, F. Caurant, V. Lahaye, V. Ridoux, and B. N. Zegers. 2008. Bioaccumulation of persistent organic pollutants in female common dolphins (*Delphinus delphis*) and harbour porpoises (*Phocoena phocoena*) from western European seas: Geographical trends, causal factors and effects on reproduction and mortality. *Environmental Pollution* 153:401–415.
- Pirotta, E., B. E. Laesser, A. Hardaker, N. Riddoch, M. Marcoux, and D. Lusseau. 2013. Dredging displaces bottlenose dolphins from an urbanised foraging patch. *Marine Pollution Bulletin* 74:396–402.
- Putland, R. L., N. D. Merchant, A. Farcas, and C. A. Radford. 2017. Vessel noise cuts down communication space for vocalizing fish and marine mammals. *Global Change Biology* 2017:1–14.
- Quick, N., L. Scott-Hayward, D. Sadykova, D. Nowacek, and A. Read. 2017. Effects of a scientific echosounder on the behavior of short-finned pilot whales (*Globicephala macrorhynchus*). *Canadian Journal of Fisheries and Aquatic Sciences* 74:716–726.
- Raoux, A., S. Tecchio, J. P. Pezy, G. Lassalle, S. Degraer, S. Wilhelmsson, M. Cachera, B. Ernande, C. Le Guen, M. Haraldsson, K. Grangeré, F. Le Loc’h, J. C. Dauvin, and N. Niquil. 2017. Benthic and fish aggregation inside an offshore wind farm: Which effects on the trophic web functioning? *Ecological Indicators* 72:33–46.
- Read, A. J., P. Drinker, and S. Northridge. 2006. Bycatch of marine mammals in U.S. and global fisheries. *Conservation Biology* 20:163–169.
- Reeves, R. R., B. S. Stewart, P. J. Clapham, and J. A. Powell. 2002. *National Audubon Society Guide to Marine Mammals of the World*. New York: Knopf.
- Reichmuth, C. 2007. *Assessing the Hearing Capabilities of Mysticete Whales. A Proposed Research Strategy for the Joint Industry Programme on Sound and Marine Life on 12 September*. Available: <http://www.soundandmarinelife.org/Site/Products/MysticeteHearingWhitePaper-Reichmuth.pdf>.
- Revolution Wind LLC (Revolution Wind). 2022. Petition for Incidental Take Regulations for the Construction and Operation of the Revolution Wind Offshore Wind Farm. February.

- Richardson, W. J., C. R. Greene, C. Malme, and D. H. Thompson. 1995. *Marine Mammals and Noise*. San Diego, CA: Academic Press.
- Richardson, W. J., G. W. Miller, and C. R. Greene. 1999. Displacement of migrating bowhead whales by sounds from seismic surveys in shallow waters of the Beaufort Sea. *Journal of the Acoustical Society of America* 106:2281.
- Richardson, W. J., B. Würsig, and C. R. Greene. 1986. Reactions of bowhead whales, *Balaena mysticetus*, to seismic exploration in the Canadian Beaufort Sea. *Journal of the Acoustical Society of America* 79:1117–1128.
- Richardson, W. J., B. Würsig, and C. R. Greene. 1990. Reactions of bowhead whales, *Balaena mysticetus*, to drilling and dredging noise in the Canadian Beaufort Sea. *Marine Environmental Research* 29:135–160.
- Ridgway, S. H., and D. A. Carder. 2001. Assessing hearing and sound production in cetaceans not available for behavioural audiograms: Experiences with sperm, pygmy sperm, and gray whales. *Aquatic Mammals* 27:267–276.
- Robbins, J. 2012. *Scar-Based Inference into Gulf of Maine Humpback Whale Entanglement: 2010*. Report to the Northeast Fisheries Science Center. EA 133F09CN02543. Item 0003AB, Task 3.
- Robbins, J., and D. K. Mattila. 2001. *Monitoring Entanglements of Humpback Whales (Megaptera novaeangliae) in the Gulf of Maine on the Basis of Caudal Peduncle Scarring*. Scientific Committee meeting document SC/53/NAH25. International Whaling Commission, Cambridge, UK.
- Roberts J. J., B. D. Best, L. Mannocci, E. Fujioka, P. N. Halpin, D. L. Palka, L. P. Garrison, K. D. Mullin, T. V. N. Cole, C. B. Khan, W. M. McLellan, D. A. Pabst, and G. G. Lockhart. 2016a. Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico. *Scientific Reports* 6:22615. DOI: 10.1038/srep22615.
- Roberts J. J., L. Mannocci, and P. N. Halpin. 2016b. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2015-2016 (Base Year)*. Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.
- Roberts J. J., L. Mannocci, and P. N. Halpin. 2017. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1)*. Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.
- Roberts J. J., L. Mannocci, R. S. Schick, and P. N. Halpin. 2018. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2)*. Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.
- Roberts J. J., R. S. Schick, and P. N. Halpin. 2020. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2018-2020 (Option Year 3)*. Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.

- Roberts J. J., R. S. Schick, and P. N. Halpin. 2021a. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2020 (Opt. Year 4)*. Version 1.0. Report by Duke University Marine Geospatial Ecology Lab for Naval Facilities Engineering Command, Atlantic.
- Roberts, J. J., B. McKenna, L. Ganley, and C. Mayo. 2021b. *Right Whale Abundance Estimates for Cape Cod Bay in December*. Document version 3. Duke University Marine Geospatial Ecology Lab, Durham, NC.
- Roberts, J., T. Yack, and P. Halpin. 2022. Habitat-based Marine Mammal Density Models for the U.S. Atlantic. Updated June 20, 2022. Available: <https://seamap.env.duke.edu/models/Duke/EC/>.
- Robinson, S. P., P. D. Theobald, G. Hayman, L. S. Wang, P. A. Lepper, V. Humphrey, and S. Mumford. 2011. *Measurement of noise arising from marine aggregate dredging operations. Marine Aggregate Levy Sustainability Fund (MALSF)* (MEPF Reference number 09/P108), ISBN 978 0907545 57 6.
- Rolland, R. M., K. E. Hunt, S. D. Kraus, and S. K. Wasser. 2005. Assessing reproductive status of right whales (*Eubalaena glacialis*) using fecal hormone metabolites. *General and Comparative Endocrinology* 142:308–317.
- Rolland, R. M., S. E. Parks, K. E. Hunt, M. Castellote, P. J. Corkeron, D. P. Nowacek, S. K. Wasser, and S. D. Kraus. 2012. Evidence that ship noise increases stress in right whales. *Proceedings of the Royal Society B*. 279:2363–2368. DOI:10.1098/rspb.2011.2429.
- Rosenbaum, H. R., M. Rekdahl, and L. Del Greco. 2021. *Assessing Cetacean Presence in the New York Harbor Using Passive Acoustic Monitoring*. Final Report to the Hudson River Foundation. Available: <https://www.hudsonriver.org/wp-content/uploads/2021/08/WCS-Final-Report-New-York-Cetaceans-2021.pdf>. Accessed: March 9, 2023.
- Ruppel, C. D., T. C. Weber, E. R. Staaterman, S. J. Labek, and P. E. Hart. 2022. Categorizing active marine acoustic sources based on their potential to affect marine mammals. *Journal of Marine Science and Engineering* 2022:1278.
- Russell, D. J. F., G. D. Hastie, D. Thompson, V. M. Janik, P. S. Hammond, L. A. S. Scott-Hayward, J. Matthiopoulos, E. L. Jones, and B. J. McConnell. 2016. Avoidance of wind farms by harbour seals is limited to pile driving activities. *Journal of Applied Ecology* 53:1642–1652.
- Russell, D. J. F., S. M. J. M. Brasseur, D. Thompson, G. D. Hastie, V. M. Janik, and G. Aarts. 2014. Marine mammals trace anthropogenic structures at sea. *Current Biology* 24:R638–R639.
- Saunders J. C., S. P. Dear, and M. E. Schneider. 1985. The anatomical consequences of acoustic injury: A review and tutorial. *Journal of the Acoustical Society of America* 78:833–860.
- Schakner, Z. A., and D. T. Blumstein. 2013. Behavioral biology of marine mammal deterrents: A review and prospectus. *Biological Conservation* 167:380–389.
- Scheidat, M., J. Tougaard, S. Brasseur, J. Carstensen, T. van Polanen Petel, J. Teilmann, and P. Reijnders. 2011. Harbour porpoises (*Phocoena phocoena*) and wind farms: A case study in the Dutch North Sea. *Environmental Research Letters* 6:025102. DOI:10.1088/1748-9326/6/2/025102.

- Scheifele, P. M., S. Andrew, R. A. Cooper, M. Darre, F. E. Musiek, and L. Max. 2005. Indication of a lombard vocal response in the St. Lawrence River beluga. *Journal of the Acoustical Society of America* 117:1486–1492.
- Schultze, L. K. P., L. M. Merckelbach, J. Horstmann, S. Raasch, and J. R. Carpenter. 2020. Increased mixing and turbulence in the wake of offshore wind farm foundations. *Journal of Geophysical Research: Oceans* 125:e2019JC015858.
- Slavik, K., C. Lemmen, W. Zhang, O. Kerimoglu, K. Klingbell, and K. W. Wirtz. 2019. The large-scale impact of offshore wind farm structures on pelagic primary productivity in the southern North Sea. *Hydrobiologia* 845:35–53. DOI:10.1007/s10750-018-3653-5.
- Smith, C. R., T. K. Rowles, L. B. Hart, F. I. Townsend, R. S. Wells, E. S. Zolman, B. C. Balmer, B. Quigley, M. Ivnic, W. McKercher, M. C. Tumlin, K. D. Mullin, J. D. Adams, Q. Wu, W. McFee, T. K. Collier, and L. H. Schwacke. 2017. Slow recovery of Barataria Bay dolphin health following the Deepwater Horizon Oil Spill (2013–2014), with evidence of persistent lung disease and impaired stress response. *Endangered Species Research* 33:127–142.
- Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene Jr., D. Kastak, D. R. Ketten, J. H. Miller, P. E. Nachtigall, W. J. Richardson, J. A. Thomas, and P. L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. *Aquatic Mammals* 33:411–521.
- Southall, B. L., J. J. Finneran, C. Reichmuth, P. E. Nachtigall, D. R. Ketten, A. E. Bowles, W. T. Ellison, D. P. Nowacek, and P. L. Tyack. 2019. Marine mammal noise exposure criteria: Updated scientific recommendations for residual hearing effects. *Aquatic Mammals* 45:125–232.
- Southall, B. L., J. J. Finneran, C. Reichmuth, P. E. Nachtigall, D. R. Ketten, A. E. Bowles, W. T. Ellison, D. P. Nowacek, and P. L. Tyack. 2019. Citing Ketten, D. R., and D. C. Mountain. 2014. Inner ear frequency maps: First stage audiograms of low to infrasonic hearing in mysticetes. *The 5th International Conference on the Effects of Sound in the Ocean on Marine Mammals*. Amsterdam, The Netherlands.
- Southall, B., W. Ellison, C. Clark, D. Tollit, and J. Amaral. 2021a. *Marine Mammal Risk Assessment for New England Offshore Windfarm Construction and Operational Scenarios*. OCS Study BOEM 2021-080.
- Southall, B. L., D. P. Nowacek, A. E. Bowles, V. Senigaglia, L. Bejder, and P. L. Tyack. 2021b. Marine mammal noise exposure criteria: Assessing the severity of marine mammal behavioral responses to human noise. *Aquatic Mammals* 47:421–464.
- Sprogis, K. R., S. Videson, and P. T. Madsen. 2020. Vessel noise levels drive behavioural responses of humpback whales with implications for whale-watching. *eLife* 2020:e56760.
- Stöber, U., and F. Thomsen. 2021. How could operational underwater sounds from future offshore wind turbines impact marine life? *The Journal of the Acoustic Society of America* 149(3):1791–1795.
- Stone, K. M., S. M. Leiter, R. D. Kenney, B. C. Wikgren, J. L. Thompson, J. K. Taylor, and S. D. Kraus. 2017. Distribution and abundance of cetaceans in a wind energy development area offshore of Massachusetts and Rhode Island. *Journal of Coastal Conservation* 21:527–543.

- Sullivan, L., T. Brosnan, T. K. Rowles, L. Schwacke, C. Simeone, and T. K. Collier. 2019. *Guidelines for Assessing Exposure and Impacts of Oil Spills on Marine Mammals*. NOAA Tech. Memo. NMFS-OPR-62. 82 pp.
- Sunrise Wind LLC (Sunrise Wind). 2022. Petition for Incidental Take Regulations for the Construction and Operation of the Sunrise Wind Offshore Wind Farm. May.
- Takeshita, R., L. Sullivan, C. Smith, T. Collier, A. Hall, T. Brosnan, T. Rowles, and L. Schwacke. 2017. The Deepwater Horizon Oil Spill marine mammal injury assessment. *Endangered Species Research* 33:96–106.
- Taormina B., J. Bald, A. Want, G. Thouzeau, M. Lejart, N. Desroy, and A. Carlier. 2018. A review of potential impacts of submarine cables on the marine environment: Knowledge gaps, recommendations, and future directions. *Renewable and Sustainable Energy Reviews* 96:380–391.
- Taruski, A. G., C. E. Olney, and H. E. Winn. 1975. Chlorinated hydrocarbons in cetaceans. *Journal of the Fisheries Board of Canada* 32:2205–2209.
- Teilmann, J., and J. Cartensen. 2012. Negative long-term effects on harbour porpoises from a large scale offshore wind farm in the Baltic—Evidence of slow recovery. *Environmental Research Letters* 7:045101.
- Tetra Tech and LGL. 2019. *Annual Survey Report Year 2 for New York Bight Whale Monitoring Aerial Surveys March 2018 – February 2019*. Technical Report produced By Tetra Tech and LGL for NYSDEC under contract C009926.
- Tetra Tech and LGL. 2020. *Final Comprehensive Report Years 1-3 for New York Bight Whale Monitoring Aerial Surveys March 2017 – February 2020*. Technical Report produced By Tetra Tech and LGL for NYSDEC under Tetra Tech contract C009926.
- Tetra Tech and Smultea Sciences. 2018. *Annual Survey Report Year 1 for New York Bight Whale Monitoring Aerial Surveys March 2018 – February 2018*. Technical Report produced by Tetra Tech and Smultea Sciences for NYSDEC under contract C009926.
- Todd, V. L. G., W. D. Pearse, N. C. Tregenza, P. A. Lepper, and I. B. Todd. 2009. Diel echolocation activity of harbour porpoises (*Phocoena phocoena*) around North Sea offshore gas installations. *ICES Journal of Marine Science* 66:734–745.
- Todd, V. L. G., I. B. Todd, J. C. Gardiner, E. C. N. Morrin, N. A. MacPherson, N. A. DiMarzio, and F. Thomsen. 2015. A review of impacts of marine dredging activities on marine mammals. *ICES Journal of Marine Science* 72:328–340.
- Todd, V. L. G., L. D. Williamson, J. Jiang, S. E. Cox, I. B. Todd, and M. Ruffert. 2020. Proximate underwater soundscape of a North Sea offshore petroleum exploration jack-up drilling rig in the Dogger Bank. *Journal of the Acoustical Society of America* 148:3971.
- Tougaard, J., J. Carstensen, J. Teilmann, N. I. Bech. 2005. *Effects of the Nysted Offshore Wind Farm on Harbor Porpoises – Annual Status Report for the T-POD Monitoring Program*. NERI Technical Report. 49 pp.

- Tougaard, J., J. Carstensen, J. Teilmann, H. Skov, and P. Rasmussen. 2009a. Pile driving zone of responsiveness extends beyond 20 km for harbour porpoises (*Phocoena phocoena*). *Journal of the Acoustical Society of America* 126:11–14.
- Tougaard, J., O. D. Henriksen, and L. A. Miller. 2009b. Underwater noise from three types of offshore wind turbines: Estimation of impact zones for harbor porpoises and harbor seals. *Journal of the Acoustical Society of America* 125:3766–3773.
- Tougaard, J., L. Hermannsen, and P. T. Madsen. 2020. How loud is the underwater noise from operating offshore wind turbines? *Journal of the Acoustical Society of America* 148:2885–2892.
- Trumble, S. J., S. A. Norman, D. D. Crain, F. Mansouri, Z. C. Winfield, R. Sabin, C. W. Potter, C. M. Gabriele, and S. Usenko. 2018. Baleen whale cortisol levels reveal a physiological response to 20th century whaling. *Nature Communications* 9:4587.
- Tsujii, K., T. Akamatsu, R. Okamoto, K. Mori, Y. Mitani, and N. Umeda. 2018. Change in singing behavior of humpback whales caused by shipping noise. *PLOS ONE* 13:e0204112.
- Urick, R. J. 1983. *Principles of Underwater Sound*. Third edition. New York: McGraw-Hill.
- U.S. Department of the Navy (Navy). 2018. Hawaii-Southern California Training and Testing EIS/OEIS. Available: https://www.hstteis.com/portals/hstteis/files/hstteis_p3/feis/section/HSTT_FEIS_3.08_Reptiles_October_2018.pdf. Accessed: September 3, 2020.
- U.S. Environmental Protection Agency (USEPA). 2022. Climate change indicators: Oceans. Available: <https://www.epa.gov/climate-indicators/oceans>. Accessed: March 2023.
- van Berkel, J., H. Burchard, A. Christensen, L. O. Mortensen, O. S. Petersen, and F. Thomsen. 2020. The effects of offshore wind farms on hydrodynamics and implications for fishes. *Oceanography* 33:108–117.
- Van Dalftsen, J. A., and K. Essink. 2001. Benthic community response to sand dredging and shoreface nourishment in Dutch coastal waters. *Senckenbergiana Maritima* 31:329–32.
- van der Hoop, J., A. Vanderlaan, and C. Taggart. 2012. Absolute probability estimates of lethal vessel strikes to North Atlantic right whales in Roseway Basin, Scotian Shelf. *Ecological Applications* 22:2021–2033.
- Van Waerebeek, K., A. Baker, F. Felix, J. Gedamke, M. Iniguez, G. P. Sanino, E. D. Secchi, D. Sutaria, A. N. van Helden, and Y. Wang. 2007. Vessel collisions with small cetaceans worldwide and with large whales in the southern hemisphere, an initial assessment. *Latin American Journal of Aquatic Mammals* 6:43–49.
- Vanderlaan, A. S. M., and C. T. Taggart. 2007. Vessel collisions with whales: The probability of lethal injury based on vessel speed. *Marine Mammal Science* 23:144–156.
- Veirs, S., V. Veirs, and J. D. Wood. 2016. Ship noise extends to frequencies used for echolocation by endangered killer whales. *PeerJ* 4:e1657.
- Vires, G. 2011. *Echosounder Effects on Beaked Whales in the Tongue of the Ocean, Bahamas*. Master's Thesis. Duke University.

- Wang, J. W., and S. C. Yang. 2006. Unusual stranding events of Taiwan in 2004 and 2005. *Journal of Cetacean Research and Management* 8:283–292.
- Wang, J., X. Zou, W. Yu, D. Zhang, and T. Wang. 2019. Effects of established offshore wind farms on energy flow of coastal ecosystems: A case study of the Rudong Offshore Wind Farms in China.” *Ocean & Coastal Management* 171:111–118.
- Waring, G. T., E. Josephson, K. Maze-Foley, and P. E. Rosel. 2015. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2014*. NOAA Technical Memorandum NMFS-NE-231.
- Wartzok, D., and D. R. Ketten. 1999. Marine mammal sensory systems. Pages 117–175 in J. Reynolds and S. Rommel (eds.), *Biology of Marine Mammals*. Washington, DC: Smithsonian Institution Press.
- Weilgart, L. S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. *Canadian Journal of Zoology* 85:1091–1116.
- Weisbrod, A. V., D. Shea, M. J. Moore, and J. J. Stegeman. 2000. Bioaccumulation patterns of polychlorinated biphenyls and chlorinated pesticides in Northwest Atlantic pilot whales. *Environmental Toxicology and Chemistry: An International Journal* 19:667–677.
- Wells, R. S., and M. D. Scott. 1997. Seasonal incidence of boat strikes on bottlenose dolphins near Sarasota, Florida. *Marine Mammal Science* 3:475–480.
- Werner, S., A. Budziak, J. van Franeker, F. Galgani, G. Hanke, T. Maes, M. Matiddi, P. Nilsson, L. Oosterbaan, E. Priestland, R. Thompson, J. Veiga, and T. Vlachogianni. 2016. *Harm Caused by Marine Litter*. MSFD GES TG Marine Litter—Thematic Report; JRC Technical report; EUR 28317 EN. DOI:10.2788/690366. Available: <https://publications.jrc.ec.europa.eu/repository/bitstream/JRC104308/lbna28317enn.pdf>. Accessed: September 9, 2020.
- Whitt, A. D., K. Dudzinski, and J. R. Laliberte. 2013. North Atlantic right whale distribution and seasonal occurrence in nearshore waters off New Jersey, USA and implications for management. *Endangered Species Research* 20:50–69.
- Whitt, A., J. A. Powell, A. G. Richardson, and J. R. Bosyk. 2015. Abundance and distribution of marine mammals in nearshore waters off New Jersey, USA. *Journal of Cetacean Research Management* 15:45–59.
- Williams, T. M., S. B. Blackwell, O. Tervo, E. Garde, M. S. Sinding, B. Richter, and M. P. Heide-Jorgensen. 2022. Physiological responses of narwhals to anthropogenic noise: A case study with seismic airguns and vessel traffic in the Arctic. *Functional Ecology* 2022:2251–2266.
- Willis, M. R., M. Broudic, M. Bhurosah, and I. Masters. 2010. Noise associated with small scale drilling operations. Third International Conference on Ocean Energy. October 6, 2010.
- Wisniewska, D. M., M. Johnson, J. Teilmann, U. Siebert, A. Galatius, R. Dietz, and P. T. Madsen. 2018. High rates of vessel noise disrupt foraging in wild harbour porpoises (*Phocoena phocoena*). *Proceedings of the Royal Society B* 285:20172314.
- Woo, K. L., and K. L. Biolsi. 2018. In situ observations of pinnipeds in New York City, 2011–2017. *Aquatic Mammals* 44:244–249.

- Wright, A. J., N. A. Soto, A. L. Baldwin, M. Bateson, C. M. Beale, C. Clark, T. Deak, E. F. Edwards, A. Fernández, A. Godinho, L. T. Hatch, A. Kakuschke, D. Lusseau, D. Martineau, L. M. Romero, L. S. Weilgart, B. A. Wintle, G. Notarbartolo-di-Sciara, and V. Martin. 2007. Do marine mammals experience stress related to anthropogenic noise? *International Journal of Comparative Psychology* 20:274–316.
- Würsig, B. 2017. Chapter 13: Marine Mammals of the Gulf of Mexico. Pages 1489–1550 in C. H. Ward (ed.), *Habitats and Biota of the Gulf of Mexico: Before the Deepwater Horizon Oil Spill, Volume II*. Springer, New York, NY.
- Würsig, B., S. K. Lynn, T. A. Jefferson, and K. D. Mullin. 1998. Behaviour of cetaceans in the Northern Gulf of Mexico relative to survey ships and aircraft. *Aquatic Mammals* 24:41–50.
- Würsig, B., C. R. Greene, and T. A. Jefferson. 2000. Development of an air bubble curtain to reduce underwater noise of percussive piling. *Marine Environmental Research* 49:79–93.
- Yost, W. A. 2007. *Fundamentals of Hearing: An Introduction*. Fifth Edition. New York: Academic Press.

B.3.16 Section 3.16, Navigation and Vessel Traffic

- Board of Commissioners of Pilots of the State of New York. 2020a. *Annual Report*. Available: <https://nypilotcommission.org/>. Accessed: December 13, 2021.
- Board of Commissioners of Pilots of the State of New York. 2020b. State Pilotage System Operations and Statistics; State Pilot Operational Bases and Floating Equipment. Available: <https://nypilotcommission.org/>. Accessed: December 13, 2021.
- Detweiler, George, LCDR USCG (Ret). 2021. Marine Transportation Specialist, Navigation Standards Division (CG-NAV-2), Office of Navigation Systems (CG-NAV). Emailed communication to Brian Krevor, Lead Environmental Protection Specialist, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Environment Branch for Renewable Energy. July 20.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- International Maritime Organization (IMO). 2019. “Ships’ routing.” Available: <https://www.imo.org/en/OurWork/Safety/Pages/ShipsRouting.aspx>.
- National Academies of Sciences, Engineering, and Medicine 2022. *Wind Turbine Generator Impacts to Marine Vessel Radar*. Washington, DC: The National Academies Press. Available: <https://doi.org/10.17226/26430>.
- National Oceanic and Atmospheric Administration (NOAA). 2022. Coast Pilot Volume 2 – 51st Edition. Available: <https://nauticalcharts.noaa.gov/publications/coast-pilot/index.html>. Accessed: January 8, 2022.
- New York City Economic Development Corporation (NYCEDC). 2023. South Brooklyn Marine Terminal Port Infrastructure Improvement Project, U.S. Army Corps of Engineers/New York State Department of Environmental Conservation (NYSDEC) Joint Permit Application Package. USACE Pre-Application # NAN-2022-00900-EMI. May.

New York Department of Small Business Services (NYDSBS). 2021. *SBMT 35th Street Pier Expansion Project NYC Department of Small Business Services FY2021 Port Infrastructure Development Program (PIDP) Grant Application*. July.

Northeast Regional Ocean Council. 2018. Northeast Ocean Data Portal. Available: <https://www.northeastoceandata.org/>.

Port Authority of New York and New Jersey. 2019. *Port Master Plan 2050*. Available: <https://www.panynj.gov/port/en/index.html>. Accessed: November 27, 2021.

U.S. Army Corps of Engineers (USACE). 2020. *New York and New Jersey Harbor Anchorages Final General Reevaluation Report and Environmental Assessment*. Available: <https://usace.contentdm.oclc.org/digital/collection/p16021coll7/id/14379>. Accessed: January 22, 2022.

U.S. Coast Guard (USCG). 2016a. *Atlantic Coast Port Access Route Study*. USCG-2011-0351. February 2016. Available: <https://www.navcen.uscg.gov/?pageName=PARSReports>. Accessed: October 12, 2021.

U.S. Coast Guard (USCG). 2016b. *Ports and Waterways Safety Assessment Workshop Report*. October. Available: <https://www.navcen.uscg.gov/>. Accessed: December 19, 2021.

U.S. Coast Guard (USCG). 2019. *Navigation and Vessel Inspection Circular 01-19*. Available: <https://www.mafmc.org/s/190801-Nav-Vess-Insp-Circ-01-19.pdf>. Accessed: August 1, 2019.

U.S. Coast Guard (USCG). 2020. *The Areas Offshore of Massachusetts and Rhode Island Port Access Route Study*. USCG 2019-0131. May 14. Available: https://www.navcen.uscg.gov/pdf/PARS/FINAL_REPORT_PARS_May_14_2020.pdf. Accessed: October 13, 2021.

U.S. Coast Guard (USCG). 2021a. *Seacoast of New Jersey Including Offshore Approaches to the Delaware Bay, Delaware Port Access Route Study: Draft Report*. USCG-2020-0172. Available: <https://downloads.regulations.gov/USCG-2020-0172-0044/content.pdf>. Accessed: October 12, 2021.

U.S. Coast Guard (USCG). 2021b. *Northern New York Bight Port Access Route Study: Final Report*. USCG-2020-0278. December 2021. Available: <https://www.regulations.gov/document/USCG-2020-0278-0067>. Accessed: January 8, 2022.

U.S. Coast Guard (USCG). 2021c. *Search and Rescue Operations Near Offshore Wind Energy Projects*. Fiscal Year 2020 Report to Congress. June 16.

U.S. Coast Guard (USCG). 2023. *Consolidated Port Approaches Port Access Route Studies (PARS)*. USCG-2011-0351-0173. Available: <https://www.regulations.gov/document/USCG-2011-0351-0173>. Accessed: May 8, 2023.

B.3.17 Section 3.17, Other Uses (Marine Minerals, Military Use, Aviation)

Battista, T., W. Sautter, M. Poti, E. Ebert, L. Kracker, J. Kraus, A. Mabrouk, B. Williams, D. S. Dorfman, R. Husted, and C. J. Jenkins. 2019. *Comprehensive Seafloor Substrate Mapping and Model Validation in the New York Bight*. OCS Study BOEM 2019-069 and NOAA Technical Memorandum NOS NCCOS 255. 187 pages.

- Bureau of Ocean Energy Management (BOEM). 2014. “BOEM and New York State Sign Agreement to Identify Sand Resources for Coastal Resilience and Restoration Planning.” Available: <https://www.boem.gov/press05202014/>. Accessed: December 6, 2021.
- Bureau of Ocean Energy Management (BOEM). 2018. Marine Minerals: Requests and Active Leases. Last updated August 27, 2018. Available: <https://www.boem.gov/Requests-and-Active-Leases/>. Accessed: December 6, 2021.
- Bureau of Ocean Energy Management (BOEM). 2020. “Radar Interference Analysis for Renewable Energy Facilities on the Atlantic Outer Continental Shelf.” Available: https://www.boem.gov/sites/default/files/documents/environment/Final-Report-Radar-Interference-Atlantic-Offshore-Wind_0.pdf. Accessed: May 31, 2022.
- Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: <https://www.boem.gov/vineyard-wind>. Accessed: December 7, 2021.
- Crist, Joy. 2021. “Dare awards \$26M bid for Avon, Buxton nourishment.” Available: <https://coastalreview.org/2021/12/dare-awards-26m-bid-for-avon-buxton-nourishment/>. Accessed: March 2, 2022.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Empire Offshore Wind, LLC (Empire). 2023. Citing National Oceanic and Atmospheric Administration (NOAA) 2016. “Danger Zones and Restricted Areas.” Last updated November 8, 2017. Available: <https://www.fisheries.noaa.gov/inport/item/48876>. Accessed: December 7, 2021.
- Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, E. EstelaGomez. 2017. *Habitat Mapping and Assessment of Northeast Wind Energy Areas*. Sterling, VA: US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088. 312 p.
- Hare, J., B. Blythe, K. Ford, S. Godfrey-McKee, B. Hooker, B. Jensen, A. Lipsky, C. Nachman, L. Pfeiffer, M. Rasser, and K. Renshaw. 2022. *NOAA Fisheries and BOEM Federal Survey Mitigation Strategy – Northeast U.S. Region*. Available: https://media.fisheries.noaa.gov/2022-12/TechMemo-292-revised-title-page_0.pdf. Accessed: December 13, 2022.
- New York State Energy Research and Development Authority (NYSERDA). 2022. Ongoing Environmental Research. Available: <https://www.nyserdanyc.gov/All-Programs/Offshore-Wind/Focus-Areas/Ocean-Environment/Ongoing-Environmental-Research>. Accessed: March 2, 2022.
- Sample, Steven J. 2021. Executive Director, Military Aviation and Installation Assurance Siting Clearinghouse. Letter regarding results of the Department of Defense review of the Empire Wind COP sent to David MacDuffee, Chief, Projects and Coordination Branch, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. April 23, 2021.

B.3.18 Section 3.18, Recreation and Tourism

- Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2021-0012. Available: <https://www.boem.gov/vineyard-wind>. Accessed: August 2021.
- Carr-Harris, A., and C. Lang. 2019. Sustainability and Tourism: The Effect of the United States' First Offshore Wind Farm on the Vacation Rental Market. *Resource and Energy Economics* 57. August. Available: <https://www.sciencedirect.com/science/article/abs/pii/S0928765518302902>.
- Carter, Diana. 2023. Assistant Division Director for Planning and Analysis, New York State Office of Parks, Recreation & Historic Preservation. Personal communication on May 23.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Empire State Development. No date. Tourism, Exploring New York State is an amazing business. Retrieved from: <https://esd.ny.gov/industries/tourism>.
- Haughton, J., D. Giuffre, and J. Barrett. 2003. *Blowing in the Wind: Offshore Wind and the Cape Cod Economy*. The Beacon Hill Institute. October 2003.
- Kirkpatrick, A. J., S. Benjamin, G. S. DePiper, T. Murphy, S. Steinback, and C. Demarest. 2017. Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic. Volume I—Report Narrative. U.S Dept. of the Interior, Bureau of Ocean Energy Management, Atlantic OCS Region, Washington, D.C. OCS Study BOEM 2017-012. 150 pp. Available: <https://espis.boem.gov/final%20reports/5580.pdf>. Accessed: October 22, 2021.
- Lutzeyer, S., D. J. Phaneuf, and L. O. Taylor. 2017. *The Amenity Costs of Offshore Windfarms: Evidence from a Choice Experiment*. (CEnREP Working Paper No. 17-017). Raleigh, NC: Center for Environmental and Resource Economic Policy. August 2017.
- National Marine Fisheries Service (NMFS). 2023. *Fisheries Economics of the United States 2020*. Available: <https://www.fisheries.noaa.gov/resource/document/fisheries-economics-united-states-2020>. Accessed: March 2023.
- National Park Service (NPS). 2014. *Gateway National Recreation Area Final General Management Plan Environmental Impact Statement*. April. Available: <https://www.nps.gov/gate/learn/management/gmp-2012.htm>. Accessed: November 26, 2022.
- New Jersey Department of Environmental Protection (NJDEP). 2021. Division of Coastal Engineering Home. Available: <https://www.nj.gov/dep/shoreprotection/>.
- Orr, Terry L., Susan M. Herz, and Darrell L. Oakley. 2013. *Evaluation of Lighting Schemes for Offshore Wind Facilities and Impacts to Local Environments*. Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-0116. Available: <https://espis.boem.gov/final%20reports/5298.pdf>.

- Parsons, George, and Jeremy Firestone. 2018. *Atlantic Offshore Wind Energy Development: Values and Implications for Recreation and Tourism*. U.S. Department of the Interior, Bureau of Ocean Energy Management. Available: <https://www.semanticscholar.org/paper/Atlantic-Offshore-Wind-Energy-Development%3A-Values-Parsons-Firestone/91b0ede146b8701cb44d72c58f09b29533df3cdf>.
- Parsons, G., J. Firestone, L. Yan, and J. Toussaint. 2020. *The Effect of Offshore Wind Power Projects on Recreational Beach Use on the East Coast of the United States: Evidence from Contingent-Behavior Data*. *Energy Policy*, volume 144. September 2020. Available: <https://www.sciencedirect.com/science/article/abs/pii/S030142152030389X>.
- Smythe, T., H. Smith, A. Moore, D. Bidwell, and J. McCann. 2018. Analysis of the Effects of Block Island Wind Farm (BIWF) on Rhode Island Recreation and Tourism Activities. U.S. Department of the Interior, Bureau of Ocean Energy Management. Sterling, VA. OCS Study BOEM 2018-068. Available: https://espis.boem.gov/final%20reports/BOEM_2018-068.pdf.
- Tourism Economics. 2019. Economic Impact of Tourism In New Jersey. Available: https://visitsomersetnj.org/wp-content/uploads/2021/04/2019-nj-economic-impact_6-1-20.pdf.
- Wood. 2015. *Acoustic Environment and Soundscape Resource Summary Gateway National Recreation Area*. U.S. Department of the Interior, National Park Service. Available: <https://irma.nps.gov/DataStore/DownloadFile/534104>.

B.3.19 Section 3.19, Sea Turtles

- APEM and Normandeau Associates (Normandeau). 2018. *Digital Aerial Baseline Survey of Marine Wildlife in Support of Offshore Wind Energy prepared for New York State Energy Research and Development Authority - OPA 2016*. Data downloaded from OBIS-SEAMAP. Available: <http://seamap.env.duke.edu/dataset/1817>.
- Bald, J., C. Hernández, A. Uriarte, J. A. Castillo, P. Ruiz, N. Ortega, Y. T. Enciso, and D. Marina. 2015. Acoustic Characterization of Submarine Cable Installation in the Biscay Marine Energy Platform (BIMEP). [Presentation]. Presented at Bilbao Marine Energy Week, Bilbao, Spain. Available: <https://tethys.pnnl.gov/publications/acoustic-characterization-submarine-cable-installation-biscay-marine-energy-platform>. Accessed: September 3, 2020.
- Bartol, S. M., and I. K. Bartol. 2011. *Hearing Capabilities of Loggerhead Sea Turtles (Caretta caretta) Throughout Ontogeny: An Integrative Approach Involving Behavioral and Electrophysical Techniques*. Final report. Submitted to the Joint Industries Programme.
- Bartol, S. M., and D. R. Ketten. 2006. Turtle and tuna hearing. In Y. Swimmer and R. Hill, eds. *Sea Turtle and Pelagic Fish Sensory Biology: Developing Techniques to Reduce Sea Turtle Bycatch in Longline Fisheries*, pp. 98–105. NOAA Technical Memorandum. NMFS-PIFSC-7.
- Bass, A. L., and W. N. Witzell. 2000. Demographic composition of immature green turtles (*Chelonia mydas*) from the east central Florida coast: Evidence from mtDNA markers. *Herpetologica* 56:357–367.

- Bejarano, A., J. Michel, J. Rowe, Z. Li, D. F. McCay, and D. S. Etkin. 2013. *Environmental Risks, Fate, and Effects of Chemicals Associated with Wind Turbines on the Atlantic Outer Continental Shelf*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-213. Available: <https://espis.boem.gov/final%20reports/5330.pdf>. Accessed: September 3, 2020.
- Bellman, M. A., A. May, T. Wendt, S. Gerlach, P. Remmers, and J. Brinkmann. 2020. *Underwater noise during percussive pile driving: Influencing factors on pile-driving noise and technical possibilities to comply with noise mitigation values*. ERA Report. 128 pp.
- Bembenek-Bailey, S. A., J. N. Niemuth, P. D. McClellan-Green, M. H. Godfrey, C. A. Harms, H. Gracz, and M. K. Stoskopf. 2019. NMR metabolomics analysis of skeletal muscle, heart, and liver of hatchling loggerhead sea turtles (*Caretta caretta*) experimentally exposed to crude oil and/or Corexit. *Metabolites* 9. DOI:10.3390/metabo9020021.
- Berreiros J. P., and V. S. Raykov. 2014. Lethal lesions and amputation caused by plastic debris and fishing gear on the loggerhead turtle *Caretta caretta* (Linnaeus, 1758). Three case reports from Terceira Island, Azores (NE Atlantic). *Marine Pollution Bulletin* 86:518–522.
- Bjorndal, K. 1997. Foraging ecology and nutrition of sea turtles. In P. L. Lutz and J. A. Musick, eds. *The biology of sea turtles*, pp. 189–231.
- Bolten, A. B., L. B. Crowder, M. G. Dodd, A. M. Lauritsen, J. A. Musick, B. A. Schroeder, and B. E. Witherington. 2019. Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*). Second Revision. Assessment of Progress Towards Recovery. 21 pp.
- Bugoni, L., L. Krause, and M. V. Petry. 2001. Marine debris and human impacts on sea turtles in southern Brazil. *Marine Pollution Bulletin* 42:1330–1334.
- Bureau of Ocean Energy Management (BOEM). 2017. Gulf of Mexico OCS Oil and Gas Lease Sales 2012-2017. Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261. Final Multisale Environmental Impact Statement. Available: <https://www.boem.gov/oil-gas-energy/2017-2022-gulf-mexico-multisale-environmental-impact-statement>.
- Bureau of Ocean Energy Management (BOEM). 2019a. *Vineyard Wind Offshore Wind Energy Project Biological Assessment*. For the National Marine Fisheries Service.
- Bureau of Ocean Energy Management (BOEM). 2019b. *Evaluation of Potential EMF Effects on Fish Species of Commercial of Recreational Fishing Importance in Southern New England*. Available: https://espis.boem.gov/final%20reports/BOEM_2019-049.pdf. Accessed: July 14, 2021.
- Bureau of Ocean Energy Management (BOEM). 2021b. *Data Collection and Site Survey Activities for Renewable Energy on the Atlantic Outer Continental Shelf*. Biological Assessment.
- Bureau of Ocean Energy Management (BOEM). 2021c. *Guidelines for Lighting and Marking of Structures Supporting Renewable Energy Development*. Available: <https://www.boem.gov/sites/default/files/documents/renewable-energy/2021-Lighting-and-Marking-Guidelines.pdf>. Accessed: November 28, 2021.

- Camacho, M., O. P. Luzardo, L. D. Boada, L. F. L. Jurado, M. Medina, M. Zumbado, and J. Orós. 2013. Potential adverse health effects of persistent organic pollutants on sea turtles: Evidence from a cross-sectional study on Cape Verde loggerhead sea turtles. *Science of the Total Environment* 458–460:283–289.
- Carpenter, J. R., L. Merckelbach, U. Callies, S. Clark, L. Gaslikova, and B. Baschek. 2016. Potential impacts of offshore wind farms on North Sea stratification. *PLOS ONE* 11:e0160830. DOI:10.1371/journal.pone.0160830.
- Causon, P. D., and A. B. Gill. 2018. Linking ecosystem services with epibenthic biodiversity change following installation of offshore wind farms.” *Environmental Science and Policy* 89:340–347.
- Cetacean and Turtle Assessment Program (CETAP). 1981. *A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the U.S. outer continental shelf*. Cetacean and Turtle Assessment Program, University of Rhode Island. Final Report #AA55 1-CT8-48 to the Bureau of Land Management, Washington, DC. Available: https://tethys.pnml.gov/sites/default/files/publications/A_Characterization_of_Marine_Mammals_and_Turtles.pdf.
- Chen, Z., E. Curchitser, R. Chant, and D. Kang. 2018. Seasonal variability of the cold pool over the Mid-Atlantic Bight Continental Shelf. *Journal of Geophysical Research: Oceans* 123. DOI:10.1029/2018JC014148.
- Dernie, K. M., M. J. Kaiser, E. A. Richardson, and R. M. Warwick. 2003. Recovery rates of benthic communities following physical disturbance. *Journal of Animal Ecology* 72:1043–1056.
- Dodd, C. K. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service Biological Report 88:1–110.
- Dow Piniak, W. E., D. A. Mann, S. A. Eckert, and C. A. Harms. 2012a. Amphibious Hearing in Sea Turtles. In A. N. Popper and A. Hawkins, eds. *The Effects of Noise on Aquatic Life*, pp. 83–87.
- Dow Piniak, W. E., S. A. Eckert, C. A. Harms, and E. M. Stringer. 2012b. *Underwater Hearing Sensitivity of the Leatherback Sea Turtle (Dermochelys coriacea): Assessing the Potential Effect of Anthropogenic Noise*. OCS Study BOEM 2012-01156. 25 pp.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Epperly, S., L. Avens, L. Garrison, T. Henwood, W. Hoggard, J. Mitchell, J. Nance, J. Poffenberger, C. Sasso, E. Scott-Denton, and C. Yeung. 2002. *Analysis of Sea Turtle Bycatch in the Commercial Shrimp Fisheries of Southeast U.S. Waters and the Gulf of Mexico*. NOAA Technical Memorandum NMFS-SEFSC-490.
- Ernst, C. H., R. W. Barbour, and J. E. Lovich. 1994. *Turtles of the United States and Canada*. Washington, D.C.: Smithsonian Institution Press.
- Foley, A. M., K. E. Singel, P. H. Dutton, T. M. Summers, A. E. Redlow, and J. Lessman. 2007. Characteristics of a green turtle (*Chelonia mydas*) assemblage in northwestern Florida determined during a hypothermic stunning event. *Gulf of Mexico Science* 25:131–143.

- Fuentes, M. M. P. B., and D. Abbs. 2010. Effects of projected changes in tropical cyclone frequency on sea turtles. *Marine Ecology Progress Series* 412:283–292.
- Gall, S. C., and R. C. Thompson. 2015. The impact of marine debris on marine life. *Marine Pollution Bulletin* 92:170–179.
- Gitschlag, G. R., and B. A. Herczeg. 1994. Sea turtle observations at explosive removals of energy structures. *Marine Fisheries Review* 56:1–8.
- Gitschlag, G., and M. Renauld. 1989. Sea Turtles and the Explosive Removal of Offshore Oil and Gas Structures. In S. A. Eckert, K. L. Eckert, and T. H. Richardson, eds. *Proceedings of the Ninth Annual Workshop on Sea Turtle Conservation and Biology*, pp. 67–68. 7–11 February 1989. Jekyll Island, Georgia.
- Gless, J. M., M. Salmon, and J. Wyneken. 2008. Behavioral responses of juvenile leatherbacks *Dermochelys coriacea* to lights used in the longline fishery. *Endangered Species Research* 5:239–247.
- Gregory, M. R. 2009. Environmental implications of plastic debris in marine settings – Entanglement, ingestion, smothering, hangers-on, hitch-hiking, and alien invasion. *Philosophical Transactions of the Royal Society B* 364:2013–2025.
- Halpin, P. N., A. J. Read, E. Fujioka, B. D. Best., B. Donnelly, L. J. Hazen, C. Kot, K. Urian, E. LaBrecque, A. Dimatteo, J. Cleary, C. Good, L. B. Crowder, and K. D. Hyrenbach. 2009. OBIS-SEAMAP: The world data center for marine mammal, sea bird, and sea turtle distributions. *Oceanography* 22:104–115. DOI:10.5670/oceanog.2009.42.
- Hastings, R. W., L. H. Ogren, and M. T. Marbry. 1976. Observations of fish fauna associated with offshore platforms in the Northeastern Gulf of Mexico. *Fisheries Bulletin* 74:387–402.
- Hawkes, L. A., A. C. Broderick, M. H. Godfrey, and B. J. Godley. 2009. Climate change and marine turtles. *Endangered Species Research* 7:137–154.
- Hazel, J., I. R. Lawler, H. Marsh, and S. Robson. 2007. Vessel speed increases collision risk for the green turtle *Chelonia mydas*. *Endangered Species Research* 3:105–113.
- Henwood, T. A., and W. E. Stuntz. 1987. Analysis of sea turtle captures and mortalities during commercial shrimp trawling. *Fisheries Bulletin* 85:814–817.
- Hoarau, L., L. Ainley, C. Jean, and S. Ciccione. 2014. Ingestion and defecation of marine debris by loggerhead sea turtles, from by-catches in the south-west Indian Ocean. *Marine Pollution Bulletin* 84:90–96.
- Janzen, F. J. 1994. Climate change and temperature-dependent sex determination in reptiles. *Proceedings of the National Academy of Science* 91:7487–7490.
- Johnson, T. L., J. J. van Berkel, L. O. Mortensen, M. A. Bell, I. Tiong, B. Hernandez, D. B. Snyder, F. Thomsen, and O. Svenstrup Petersen. 2021. *Hydrodynamic Modeling, Particle Tracking, and Agent-Based Modeling of Larvae in the U.S. Mid-Atlantic Bight*. OCS Study BOEM 2021-049. 229 pp.

- Kenney, R. D., and K. J. Vigness-Raposa. 2010. *Marine Mammals and Sea Turtles of Narragansett Bay, Block Island Sound, Rhode Island Sound, and Nearby Waters: An Analysis of Existing Data for the Rhode Island Ocean Special Area Management Plan*. Technical Report, Ocean Special Area Management Plan.
- Kraus, S. D., S. Leiter, K. Stone, B. Wikgren, C. Mayo, P. Hughes, R. D. Kenney, C. W. Clark, A. N. Rice, B. Estabrook, and J. Tielens. 2016. *Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles. Final Report*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Sterling, Virginia. OCS Study BOEM 2016-054. Available: <https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/Northeast-Large-Pelagic-Survey-Collaborative-Aerial-and-Acoustic-Surveys-for-Large-Whales-and-Sea-Turtles.pdf>. Accessed: September 9, 2020.
- Lentz, S. J. 2017. Seasonal warming of the middle Atlantic bight cold pool. *Journal of Geophysical Research: Oceans* 122:941–954.
- Luschi, P., S. Benhamou, C. Girard, S. Ciccione, D. Roos, J. Sudre, and S. Benvenuti. 2007. Marine turtles use geomagnetic cues during open sea homing. *Current Biology* 17:126–133.
- Lutcavage, M. E., and P. L. Lutz. 1997. Diving physiology. In P. L. Lutz and J. A. Musick, eds. *The biology of sea turtles*, pp. 277–296.
- Martin, K. J., S. C. Alessi, J. C. Gaspard, A. D. Tucker, G. B. Bauer, and D. A. Mann. 2012. Underwater hearing on the loggerhead turtle (*Caretta Caretta*): A comparison of behavioral and auditory evoked potential audiograms. *Journal of Experimental Biology* 215:3001–3009.
- Matte, A., and R. Waldhauer. 1984. *Mid-Atlantic Bight Nutrient Variability*. National Marine Fisheries Service, Sandy Hook Laboratory. SHL Report No. 84-15. Available: <https://www.nefsc.noaa.gov/publications/series/shlr/shlr84-15.pdf>. Accessed: March 13, 2020.
- Matuschek, R., and K. Betke. 2009. Measurements of construction noise during pile driving of offshore research platforms and wind farms. Proceedings of the International Conference on Acoustics NAG/DAGA, Rotterdam, March 23–26.
- Michel, J., A. C. Bejarano, C. H. Peterson, and C. Voss. 2013. *Review of Biological and Biophysical Impacts from Dredging and Handling of Offshore Sand*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Herndon, VA. OCS Study BOEM 2013-0119. 258 pp.
- Miles, J., T. Martin, and L. Goddard. 2017. Current and wave effects around windfarm monopile foundations. *Coastal Engineering* 121:167–178.
- Miller, J. H., and G. R. Potty. 2017. Overview of underwater acoustic and seismic measurements of the construction and operation of the Block Island Wind Farm. *Journal of the Acoustical Society of America* 141:3993–3993. DOI:10.1121/1.4989144.
- Minerals Management Service (MMS). 2007. Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf: Final Environmental Impact Statement. U.S. Department of the Interior. OCS EIS/EA MMS 2007-046. Available: <https://www.boem.gov/Guide-To-EIS/>. Accessed: July 3, 2018.

- Mitchelmore, C. L., C. A. Bishop, and T. K. Collier. 2017. Toxicological estimation of mortality of oceanic sea turtles oiled during the Deepwater Horizon Oil Spill. *Endangered Species Research* 33: 39–50.
- National Marine Fisheries Service (NMFS). 2016. *Endangered Species Act Section 7 Consultation on the Continued Prosecution of Fisheries and Ecosystem Research Conducted and Funded by the Northeast Fisheries Science Center and the Issuance of a Letter of Authorization under the Marine Mammal Protection Act for the Incidental Take of Marine Mammals Pursuant to those Research Activities PCTS ID: NER-2015-12532*. Available: https://media.fisheries.noaa.gov/dammigration/nefsc_rule2016_biop.pdf. Accessed: April 1, 2022.
- National Marine Fisheries Service (NMFS). 2017. Biological Opinion. CENAP-OP-R-2016-0181-39 DRP Gibbstown shipping Port and logistic center. NER-2017-14371. GARFO-2017-00176. 223 pp.
- National Marine Fisheries Service (NMFS). 2018. *Biological Opinion. Construction and Maintenance of Chesapeake Bay Entrance Channels and use of sand borrow areas for beach nourishment*. F/NER/2018/14816. GARFO-2018-00353. 332 pp. Available: <https://repository.library.noaa.gov/view/noaa/23043>.
- National Marine Fisheries Service (NMFS). 2019. ESA Section 7 Mapper. Available: <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-species-critical-habitat-information-maps-greater>.
- National Marine Fisheries Service (NMFS). 2020a. Section 7 Effect Analysis: Turbidity in the Greater Atlantic Region. Available: <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effect-analysis-turbidity-greater-atlantic-region>. Accessed: August 27, 2020.
- National Marine Fisheries Service (NMFS). 2020a. Citing Environmental Protection Agency (EPA). 1986. Quality Criteria for Water. EPA 440/5-86-001.
- National Marine Fisheries Service (NMFS). 2020b. South Atlantic Regional Biological Opinion for Dredging and Material Placement Activities in the Southeast United States. 646 pp. Available: <https://www.fisheries.noaa.gov/webdam/download/109184041>. Accessed: September 3, 2020.
- National Marine Fisheries Service (NMFS). 2021a. Green Turtle. Available: <https://www.fisheries.noaa.gov/species/green-turtle#overview>. Accessed: October 28, 2021.
- National Marine Fisheries Service (NMFS). 2021b. Leatherback Turtle. Available: <https://www.fisheries.noaa.gov/species/leatherback-turtle>. Accessed: October 29, 2021.
- National Marine Fisheries Service (NMFS). 2021c. Loggerhead Turtle. Available: <https://www.fisheries.noaa.gov/species/loggerhead-turtle#overview>. Accessed: November 3, 2021.
- National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1991. Recovery Plan for U.S. Population of the Atlantic Green Turtle (*Chelonia mydas*).
- National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1992. Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico (*Dermochelys coriacea*).

- National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2007. Green Sea Turtle (*Chelonia mydas*) 5-Year Review: Summary and Evaluation.
- National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2015. Kemp's Ridley Sea Turtle (*Lepidochelys kempii*) 5-Year Review: Summary and Evaluation. 62 pp.
- National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2015. Citing Gallaway, B. J., C. W. Caillouet, P. T. Plotikin, W. J. Gazey, J. G. Cole, and S. W. Raborn. 2013. *Kemp's Ridley Stock Assessment Project*. Final Report to the Gulf States Marine Fisheries Commission. 291 pp.
- National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 2020. Endangered Species Act Status Review of the Leatherback Turtle (*Dermochelys coraicea*) 2020. 396 pp.
- National Research Council (NRC). 1990. *Decline of the Sea Turtles: Causes and Prevention*. Washington, D.C.: National Academy Press.
- National Science Foundation (NSF) and U.S. Geological Survey (USGS). 2011. *Final Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey*. 514 pp. Available: https://www.nsf.gov/geo/oce/envcomp/usgs-nsf-marine-seismic-research/nsf-usgs-final-eis-oeis_3june2011.pdf. Accessed: September 3, 2020.
- Nedwell, J., and D. Howell. 2004. *A Review of Offshore Windfarm Related Underwater Noise Sources*. Final Report submitted to COWRIE (Collective Offshore Wind Energy Research into the Environment). 57 pp. Available: <https://tethys.pnnl.gov/sites/default/files/publications/Nedwell-Howell-2004.pdf>. Accessed: September 3, 2020.
- Nelms, S. E., E. M. Duncan, A. C. Broderick, T. S. Galloway, M. H. Godfrey, M. Hamann, P. K. Lindeque, and B. J. Godley. 2016. Plastic and marine turtles: A review and call for research. *ICES Journal of Marine Science* 73:165–181.
- Newson, S. E., S. Mendes, H. Q. P. Crick, N. K. Dulvy, J. D. R. Houghton, G. C. Hayes, A. M. Huston, C. D. MacLeod, G. J. Pierce, and R. A. Robinson. 2009. Indicators of the impact of climate change on migratory species. *Endangered Species Research* 7:101–113.
- Normandeau Associates, Inc. (Normandeau), Exponent, Inc., T. Tricas, and A. Gill. 2011. *Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species. Final Report*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09. Available: <https://espis.boem.gov/final%20reports/5115.pdf>. Accessed: September 9, 2020.
- Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2011. *Preliminary Summer 2010 Regional Abundance Estimate of Loggerhead Turtles (Caretta caretta) in Northwestern Atlantic Ocean Continental Shelf Waters*. Northeast Fisheries Science Center Reference Document 11-03.

- Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2018. *2017 Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US waters of the Western North Atlantic Ocean – AMAPPS II*.
- Northeast Fisheries Science Center (NEFSC) and Southeast Fisheries Science Center (SEFSC). 2020. *Annual Report of a Comprehensive Assessment of Marine Mammal, Marine Turtle, and Seabird Abundance and Spatial Distribution in US waters of the Western North Atlantic Ocean – AMAPPS II*.
- Orr, T. L., S. M. Herz, and D. L. Oakley. 2013. *Evaluation of Lighting Schemes for Offshore Wind Facilities and Impacts to Local Environments*. Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-0116. Available: <https://espis.boem.gov/final%20reports/5298.pdf>. Accessed: September 2, 2020.
- Paxton, A. B., E. A. Newton, A. M. Adler, R. V. Van Hoeck, E. S. Iversen, J. C. Taylor, C. H. Peterson, and B. R. Silliman. 2020. Artificial habitats host elevated densities of large reef-associated predators. *PLOS ONE* 15:e0237374.
- Ramirez, A., C. Y. Kot, and D. Piatkowski. 2017. *Review of the Sea Turtle Entrainment Risk by Trailing Suction Hopper Dredges in the US Atlantic and Gulf of Mexico and the Development of ASTER Decision Support Tool*. OCS Study BOEM 2017-084. 275 pp.
- Ramirez, A., C. Y. Kot, and D. Piatkowski. 2017. Citing Dickerson, D. D., D. A. Nelson, and G. Banks. 1990. *Alternative Dredging Equipment and Operational Methods to Minimize Sea Turtle Mortalities*. Environmental Effects of Dredging Technical Notes EEDP-09-6. Vicksburg (MS): US Army Engineer Waterways.
- Ramirez, A., C. Y. Kot, and D. Piatkowski. 2017. Citing Dickerson, D., J. J. Richardson, J. S. Ferris, A. L. Bass, and M. Wolf. 1991. Entrainment of sea turtles by hopper dredges in Cape Canaveral and King's Bay ship channels. *Environmental Effects of Dredging* 91:1–9.
- Ramirez, A., C. Y. Kot, and D. Piatkowski. 2017. Citing Reine, K. J., D. D. Dickerson, and D. G. Clark. 1998. Environmental Windows Associated with Dredging Operations. Defense Technical Information Center Document. Available: <http://www.dtic.mil/dtic/tr/fulltext/u2/a361195.pdf>. Accessed: November 30, 2015.
- Ramirez, A., C. Y. Kot, and D. Piatkowski. 2017. Citing Richardson, J. I. 1990. The sea turtles of the King's Bay area and the endangered species observer program associated with construction dredging of the St. Mary's entrance ship channel. In D. D. Dickerson and D. A. Nelson, eds. *Proceedings of the National Workshop on Methods to Minimize Dredging Impacts on Sea Turtles*, pp. 32–46. May 11–12, 1988, Jacksonville, FL.
- Roberts J. J., B. D. Best, L. Mannocci, E. Fujioka, P. N. Halpin, D. L. Palka, L. P. Garrison, K. D. Mullin, T. V. N. Cole, C. B. Khan, W. M. McLellan, D. A. Pabst, and G. G. Lockhart. 2016a. Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico. *Scientific Reports* 6:22615. DOI: 10.1038/srep22615.

- Roberts J. J., L. Mannocci, and P. N. Halpin. 2016b. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2015-2016 (Base Year)*. Document version 1.0. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.
- Roberts J. J., L. Mannocci, and P. N. Halpin. 2017. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2016-2017 (Opt. Year 1)*. Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.
- Roberts J. J., L. Mannocci, R. S. Schick, and P. N. Halpin. 2018. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2017-2018 (Opt. Year 2)*. Document version 1.2. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.
- Roberts J. J., R. S. Schick, and P. N. Halpin. 2020. *Final Project Report: Marine Species Density Data Gap Assessments and Update for the AFTT Study Area, 2018-2020 (Option Year 3)*. Document version 1.4. Report prepared for Naval Facilities Engineering Command, Atlantic by the Duke University Marine Geospatial Ecology Lab, Durham, NC.
- Rosman, I., G. S. Boland, L. Martin, and C. Chandler. 1987. *Underwater Sightings of Sea Turtles in the Northern Gulf of Mexico*. U.S. Dept. of the Interior, Minerals Management Service. OCS Study/1VHVIS 87/0107. 37 pp.
- Samuel, Y., S. J. Morreale, C. W. Clark, C. H. Greene, and M. E. Richmond. 2005. Underwater, low-frequency noise in a coastal sea turtle habitat. *Journal of the Acoustical Society of America* 117: 1465–1472.
- Sasso, C. R., and S. P. Epperly. 2006. Seasonal sea turtle mortality risk from forced submergence in bottom trawls. *Fisheries Research* 81:86–88.
- Schultze, L. K. P., L. M. Merckelbach, J. Horstmann, S. Raasch, and J. R. Carpenter. 2020. Increased Mixing and Turbulence in the Wake of Offshore Wind Farm Foundations. *J. Geophys. Res. Oceans* 125:e2019JC015858. DOI: 10.1029/2019JC015858.
- Schuyler, Q. A., C. Wilcox, K. Townsend, B. D. Hardesty, and N. J. Marshall. 2014. Mistaken identity? Visual similarities of marine debris to natural prey items of sea turtles. *BMC Ecology* 14. DOI:10.1186/1472-6785-14-14.
- Seminoff, J. A., C. D. Allen, G. H. Balazs, P. H. Dutton, T. Eguchi, H. L. Haas, S. A. Hargrove, M. Jensen, D. L. Klemm, A. M. Lauritsen, S. L. MacPherson, P. Opay, E. E. Possardt, S. Pultz, E. Seney, K. S. Van Houtan, and R. S. Waples. 2015. *Status Review of the Green Turtle (Chelonia mydas) under the Endangered Species Act*. NOAA Tech. Mem. NMFS-SWFSC-539. 571 pp.
- Shigenaka, G., S. Milton, P. Lutz, R. Hoff, R. Yender, and A. Mearns. 2010. *Oil and Sea Turtles: Biology, Planning, and Response*. Reprinted in 2010. NOAA Office of Restoration and Response Publication. 116 pp.
- Shoop, C. R., and R. D. Kenney. 1992. Seasonal distributions and abundances of loggerhead and leatherback sea turtles in waters of the northeastern United States. *Herpetological Monographs* 6:43–67.

- Slavik, K., C. Lemmen, W. Zhang, O. Kerimoglu, K. Klingbell, and K. W. Wirtz. 2019. The large-scale impact of offshore wind farm structures on pelagic primary productivity in the southern North Sea. *Hydrobiologia* 845:35–53. DOI:10.1007/s10750-018-3653-5.
- Snoek, R., R. de Swart, K. Didderen, W. Lengkeek, and M. Teunis. 2016. *Potential Effects of Electromagnetic Fields in the Dutch North Sea*. Final Report submitted to Rijkswaterstaat Water, Verkeer en Leefgeving. 95 pp.
- Taormina B., J. Bald, A. Want, G. Thouzeau, M. Lejart, N. Desroy, and A. Carlier. 2018. A review of potential impacts of submarine cables on the marine environment: Knowledge gaps, recommendations, and future directions. *Renewable and Sustainable Energy Reviews* 96:380–391.
- Tetra Tech and LGL. 2019. *Annual Survey Report Year 2 for New York Bight Whale Monitoring Aerial Surveys March 2018 – February 2019*. Technical Report produced By Tetra Tech and LGL for NYSDEC under contract C009926.
- Tetra Tech and LGL. 2020. *Final Comprehensive Report Years 1-3 for New York Bight Whale Monitoring Aerial Surveys March 2017 – February 2020*. Technical Report produced By Tetra Tech and LGL for NYSDEC under Tetra Tech contract C009926.
- Tetra Tech and Smultea Sciences. 2018. *Annual Survey Report Year 1 for New York Bight Whale Monitoring Aerial Surveys March 2018 – February 2018*. Technical Report produced by Tetra Tech and Smultea Sciences for NYSDEC under contract C009926.
- Thomsen, F., A. B. Gill, M. Kosecka, M. Andersson, M. André, S. Degraer, T. Folegot, J. Gabriel, A. Judd, T. Neumann, A. Norro, D. Risch, P. Sigray, D. Wood, and B. Wilson. 2015. *MaRVEN—Environmental Impacts of Noise, Vibrations and Electromagnetic Emissions from Marine Renewable Energy*. DOI:10.2777/272281. Luxembourg: Publications Office of the European Union, 2015. Available: https://www.researchgate.net/publication/301296662_MaRVEN_-_Environmental_Impacts_of_Noise_Vibrations_and_Electromagnetic_Emissions_from_Marine_Renewable_Energy. Accessed: September 9, 2020.
- Tomás, J., R. Guitart, R. Mateo, and J. A. Raga. 2002. Marine debris ingestion in loggerhead turtles, *Caretta caretta*, from the western Mediterranean. *Marine Pollution Bulletin* 44:211–216.
- Tougaard, J., L. Hermannsen, and P. T. Madsen. 2020. How loud is the underwater noise from operating offshore wind turbines? *Journal of the Acoustical Society of America* 148:2885–2892.
- U.S. Department of the Navy (Navy). 2018. Hawaii-Southern California Training and Testing EIS/OEIS. Available: https://www.hstteis.com/portals/hstteis/files/hstteis_p3/feis/section/HSTT_FEIS_3.08_Reptiles_October_2018.pdf. Accessed: October 7, 2020.
- van Berkel, J., H. Burchard, A. Christensen, L. O. Mortensen, O. S. Petersen, and F. Thomsen. 2020. The effects of offshore wind farms on hydrodynamics and implications for fishes. *Oceanography* 33:108–117.
- Van Dalfsen, J. A., and K. Essink. 2001. Benthic community response to sand dredging and shoreface nourishment in Dutch coastal waters. *Senckenbergiana Maritima* 31:329–32.

- Vargo, S., P. Lutz, D. Odell, E. Van Vleet, and G. Bossart. 1986. *Effects of Oil on Marine Turtles*. Final Report prepared for the Minerals Management Service (MMS). 12 pp. Available: http://www.seaturtle.org/PDF/VargoS_1986a_MMSTechReport.pdf. Accessed: September 3, 2020.
- Vegter, A. C., M. Barletta, C. Beck, J. Borrero, H. Burton, M. L. Campbell, M. F. Costa, M. Eriksen, C. Eriksson, A. Estrades, K. V. K. Gilardi, B. D. Hardesty, J. A. Ivar do Sul, J. L. Lavers, B. Lazar, L. Lebreton, W. J. Nichols, C. A. Ribic, P. G. Ryan, Q. A. Schuyler, S. D. A. Smith, H. Takada, K. A. Townsend, C. C. C. Wabnitz, C. Wilcox, L. C. Young, and M. Hamann. 2014. Global research priorities to mitigate plastic pollution impacts on marine wildlife. *Endangered Species Research* 25:225–247.
- Wang, J., X. Zou, W. Yu, D. Zhang, and T. Wang. 2019. Effects of established offshore wind farms on energy flow of coastal ecosystems: A case study of the Rudong Offshore Wind Farms in China.” *Ocean & Coastal Management* 171:111–118.
- Witt, M. J., L. A. Hawkes, M. H. Godfrey, B. J. Godley, and A. C. Broderick. 2010. Predicting the impacts of climate change on a globally distributed species: The case of the loggerhead turtle. *The Journal of Experimental Biology* 213:901–911.

B.3.20 Section 3.20, Scenic and Visual Resources

- Atlantic Shores Offshore Wind, LLC (Atlantic Shores). 2021. *Atlantic Shores Offshore Wind Construction and Operations Plan*. Lease Area OCS-A 0499. Prepared by Environmental Design & Research and Epsilon Associates Inc. September.
- Bureau of Ocean Energy Management (BOEM). 2021c. *Assessment of Seascape, Landscape, and Visual Impacts of Offshore Wind Energy Developments on the Outer Continental Shelf of the United States*. OCS Study BOEM 2021-032. April.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Landscape Institute and Institute of Environmental Management and Assessment. 2016. *Guidelines for Landscape and Visual Assessment 3rd Edition*. Spon Press.
- National Association of Environmental Professionals (NAEP). 2012. *Offshore Wind Turbine Visibility and Visual Impact Thresholds*. Available: https://blmwyomingvisual.anl.gov/docs/EnvPractice_Offshore%20Wind%20Turbine%20Visibility%20and%20Visual%20Impact%20Threshold%20Distances.pdf.
- New York City Economic Development Corporation (NYCEDC). 2023. South Brooklyn Marine Terminal Port Infrastructure Improvement Project, U.S. Army Corps of Engineers/New York State Department of Environmental Conservation (NYSDEC) Joint Permit Application Package. USACE Pre-Application # NAN-2022-00900-EMI. May.

B.3.21 Section 3.21, Water Quality

- Bejarano, A. C., J. Michel, J. Rowe, Z. Li, D. French McCay, L. McStay, and D. S. Etkin. 2013. *Environmental Risks, Fate and Effects of Chemicals Associated with Wind Turbines on the Atlantic Outer Continental Shelf*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-213.
- Bureau of Ocean and Energy Management (BOEM). 2021c. *Hydrodynamic Modeling, Particle Tracking and Agent-Based Modeling of Larvae in the U.S. Mid-Atlantic Bight*. OCE Study, BOEM 2021-049. Available: https://espis.boem.gov/final%20reports/BOEM_2021-049.pdf. Accessed: October 29, 2021.
- Carpenter, J. R., L. Merckelbach, U. Callies, S. Clark, L. Gaslikova, and B. Baschek. 2016. "Potential Impacts of Offshore Wind Farms on North Sea Stratification." *PLOS ONE* 11(8): e0160830. Available: <https://doi.org/10.1371/journal.pone.0160830>.
- Cartwright, R.A. 2002. *History and Hydrologic Effects of Groundwater Use in Kings, Queens, and Western Nassau Counties, Long Island, New York, 1800s through 1997*. U.S. Geological Survey Water-Resources Investigations Report 01-4096. Available: <https://pubs.usgs.gov/wri/2001/4096/wri20014096.pdf>. Accessed: October 22, 2021.
- Cazenave, Pierre William, Ricardo Torres, and J. Icarus Alen. 2016. "Unstructured Grid Modelling of Offshore Wind Farm Impacts on Seasonally Stratified Shelf Seas." *Progress in Oceanography* 145(2016) 25–41.
- Center for Coastal Studies (CCS). 2017. *Water Quality Parameters*. Available: <http://coastalstudies.org/cape-cod-bay-monitoring-program/monitoring-stations/>. Accessed: June 18, 2018.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Bureau of Ocean Energy Management (BOEM). 2018. *Vineyard Wind Offshore Wind Energy Project Draft Environmental Impact Statement*. OCS EIS/EA BOEM 2018-060. December 2018.
- Empire Offshore Wind, LLC (Empire). 2023. Citing DNV GL. 2016. *Support structures for wind turbines*. April 2016. DNVGL-ST-0126.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Epsilon Associates, Inc. 2018. *Draft Construction and Operations Plan Vineyard Wind Farm, Appendix Volume III-K, Scour Potential Evaluation at Vineyard Wind*. Submitted to BOEM. October 22, 2018.
- Empire Offshore Wind, LLC (Empire). 2023. Citing New York – New Jersey Harbor and Estuary Program (HEP). 2012. *The State of the Estuary 2012: Environmental Health and Trends of the New York-New Jersey Harbor Estuary*.
- Empire Offshore Wind, LLC (Empire). 2023. Citing New York City Environmental Protection (NYCEP). 2009. *New York Harbor Survey Program Celebrating 100 Years 1909-2009*.

- Empire Offshore Wind, LLC (Empire). 2023. Citing Nielsen, A. W., B. M. Sumer, and T. U. Peterson. 2014. *Sinking of Scour Protections at Horns Rev 1 Offshore Wind Farm*. Coastal Engineering 2014.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Suffolk County. 2019. Beach Data for Portal. Available: <http://gis3.suffolkcountyny.gov/bathingbeaches/>. Accessed: August 2019.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Temple, J. van der, M. B. Zaaier, and H. Subroto. 2004. *The Effects of Scour of the Design of Offshore Wind Turbines*. Delft University of Technology, the Netherlands.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Whitehouse, Richard J. S, J. M. Harris, J. Sutherland, and J. Rees. 2011. The Nature of Scour Development and Scour Protection at Offshore Windfarm Foundations. *Marine Pollution Bulletin* 62(1):73–88.
- Floeter, J., J. E. E. van Beusekom, D. Auch, U. Callies, J. Carpenter, T. Dudeck, et al. 2017. Pelagic Effects of Offshore Wind Farm Foundations in the Stratified North Sea. *Prog. Oceanography* 156:154–173. DOI: 10.1016/j.pocean.2017.07.003.
- Harris, J., R. Whitehouse, and J. Sutherland. 2011. “Marine Scour and Offshore Wind: Lessons Learnt and Future Challenges. Proceedings of the International Conference on Offshore Mechanics and Arctic Engineering” OMAE. 5. 10.1115/OMAE2011-50117.
- Kaplan, B., ed. 2011. *Literature Synthesis for the North and Central Atlantic Ocean*. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEMRE 2011-012. Available: <https://www.boem.gov/ESPIS/5/5139.pdf>. Accessed: October 30, 2018.
- Kirchgeorg, T., I. Weingberg, M. Hornig, R. Baier, M. J. Schmid, B. Brockmeyer. 2018. Emissions from Corrosion Protection Systems of Offshore Wind Farms: Evaluation of the Potential Impact on the Marine Environment. *Marine Pollution Bulletin* 136:257–268.
- Latham, Pam, Whitney Fiore, Michael Bauman, and Jennifer Weaver. 2017. *Effects Matrix for Evaluating Potential Impacts of Offshore Wind Energy Development on U.S. Atlantic Coastal Habitats*. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2017-014. Available: <https://www.boem.gov/Effects-Matrix-Evaluating-Potential-Impacts-of-Offshore-Wind-Energy-Development-on-US-Atlantic-Coastal-Habitats/>. Accessed: October 30, 2018.
- Li, X., L. Chi, X. Chen, Y. Ren, and S. Lehner. 2014. SAR observation and numerical modeling of tidal current wakes at the East China Sea offshore wind farm. *Journal of Geophysical Research: Oceans* 119(8):4958–4971.
- National Oceanic and Atmospheric Administration (NOAA). 2018. NOAA Deep Sea Coral Data Portal. Available: <http://deepseacoraldata.noaa.gov>. Accessed: August 2, 2018.
- National Oceanic and Atmospheric Administration (NOAA). 2021a. Annual Mean Chlorophyll-a Concentration from 2010-06-15 to 2010-08-15. NOAA National Centers for Environmental Information. Available: <https://www.fisheries.noaa.gov/inport/item/54369>.

- National Oceanic and Atmospheric Administration (NOAA). 2021b. Nitrate Mean Concentration from 2010-06-15 to 2010-08-15. NOAA National Centers for Environmental Information. Available: <https://www.fisheries.noaa.gov/inport/item/59972>.
- New York State Department of Environmental Conservation (NYSDEC). 2004. *Division of Water*. Technical & Operational Guidance Series (TOGS) 5.1.9. Available: https://www.dec.ny.gov/docs/water_pdf/togs519.pdf.
- New York State Department of Environmental Conservation (NYSDEC). 2020. 2018 Section 303(d) List of Impaired Waters. Available: https://www.dec.ny.gov/docs/water_pdf/section303d2018.pdf. Accessed: July 29, 2022.
- Schultze, L. K. P., L. M. Merckelbach, J. Horstmann, S. Raasch, and J. R. Carpenter. 2020. Increased Mixing and Turbulence in the Wake of Offshore Wind Farm Foundations. *J. Geophys. Res. Oceans* 125:e2019JC015858. DOI: 10.1029/2019JC015858.
- Segtnan, O. H., and K. Christakos. 2015. Effect of Offshore Wind Farm Design on the Vertical Motion of the Ocean. 12th Deep Sea Offshore Wind R&D Conference, EERA DeepWind 2015. *Energy Procedia* 80 (2015):213–222.
- South Carolina Department of Health and Environmental Control (SCDHEC). 2022. *The State of South Carolina's 2020 and 2022 Integrated Report (IR) Part 1: Section 303(d) Listing of Impaired Waters*. 112 pp. Available: https://scdhec.gov/sites/default/files/media/document/South%20Carolina%202020-2022%20303%28d%29%20List_1.pdf.
- South Carolina Department of Natural Resources (SCDNR). 2009. *South Carolina State Water Assessment*, Second Edition. South Carolina Department of Natural Resources: Land, Water, and Conservation Division. Columbia, South Carolina. 408 pp.
- Texas Commission on Environmental Quality (TCEQ). 2022. 2022 Texas Integrated Report – Texas 303(d) List (Category 5). Available: <https://www.tceq.texas.gov/downloads/water-quality/assessment/integrated-report-2022/2022-303d.pdf>. Accessed: July 29, 2022.
- U.S. Environmental Protection Agency (USEPA). 2000. *Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras*. Office of Water. EPA-822-R-00-012. Available: <https://nepis.epa.gov/Exe/ZyPDF.cgi/20003HYA.PDF?Dockkey=20003HYA.PDF>. Accessed: November 8, 2018.
- U.S. Environmental Protection Agency (USEPA). 2015. *National Coastal Condition Assessment 2010*. Office of Water and Office of Research and Development. EPA 841-R-15-006. Available: https://www.epa.gov/sites/production/files/2016-01/documents/ncca_2010_report.pdf. Accessed: October 30, 2018.
- U.S. Geological Survey (USGS). 2017. Long Island Water Table and Surface Maps. New York Water Science Center. GIS data obtained and reviewed, including via the USGS Long Island Depth to Water Viewer. Available: <https://ny.water.usgs.gov/maps/li-dtw/?year=2016>; <https://www.usgs.gov/centers/new-york-water-science-center/science/long-island-water-table-and-surface-maps#>; <https://www.sciencebase.gov/catalog/item/56f5a777e4b07d796bf72f17>. Accessed: February 22, 2023.

- U.S. Geological Survey (USGS). 2023. Groundwater Monitoring Data for Monitoring Well N11002.01. Available: <https://waterdata.usgs.gov/monitoring-location/403505073401301/#parameterCode=72019&period=P10Y>. Accessed: February 22, 2023.
- Van Berkel, J., H. Burchard, A. Christensen, L. O. Mortensen, O. Svenstrup Petersen, and F. Thomsen. 2020. The Effects of Offshore Wind Farms on Hydrodynamics and Implications for Fishes. *Oceanography* 33(4):108–117.
- Vanhellemont, Q., and K. Ruddick. 2014. Turbid Wakes Associated with Offshore Wind Turbines Observed with Landsat 8. *Remote Sensing of Environment* 145:105–115.
- Verbruggen, W., R. van Weerdenburg, F. Scheel, and R. Hoekstra. 2022. *Empire Wind 1 Sediment Transport Study: Modeling of trenching-induced sediment dispersion during the installation of the EW 1 export cables*. Deltares 11207423-002-HYE-0004, July 4, 2022. 263 pp.
- Verbruggen et al. 2022 citing Fugro. 2020. Volume 3: Data interpretation and evaluation of representative geotechnical parameters, *Geotechnical Investigation, Empire Wind*, Offshore New York. Doc. No.:0219021558-3 03. Final Report. February 2020.

B.3.22 Section 3.22, Wetlands

- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- U.S. Army Corps of Engineers (USACE). 2022. Regulatory Public Notice: NAN-2022-00902-EMI. New York District. Published Nov. 4. Available: <https://www.nan.usace.army.mil/Missions/Regulatory/Regulatory-Public-Notices/Article/3210518/nan-2022-00902-emi/>. Accessed: March 3, 2023.
- U.S. Fish and Wildlife Service (USFWS). 2021. National Wetlands Inventory GIS data. Available: <https://www.fws.gov/wetlands/Data/State-Downloads.html>. Accessed: December 1, 2021.

Appendix C. List of Preparers and Reviewers, & Glossary

C.1. List of Preparers and Reviewers

Table C-1 Bureau of Ocean Energy Management Contributors

Name	Role/Resource Area
National Environmental Policy Act (NEPA) Coordinator	
Sangunett, Brandi	Environmental Protection Specialist
Resource Scientists and Contributors	
Baker, Arianna	Navigation and Vessel Traffic
Baker, Kyle	Marine Mammals; Sea Turtles; NMFS BA
Bigger, David	Birds; Bats; Coastal Habitat and Fauna; USFWS BA
Brune, Genevieve	Land Use and Coastal Infrastructure
Bucatari, Jennifer	Other Uses
Chaiken, Emma	Commercial Fisheries and For-Hire Recreational Fishing; Recreation and Tourism
Cornelison, Meghan	Environmental Justice
De Zeeuw, Maureen	Birds
Dobbs, Kerby	Other Uses
Draher, Jennifer	Water Quality
Feinberg, Lucas	Project Coordinator
Hesse, Jeffrey T.	Other Uses
Horrell, Christopher	Cultural Resources; FOE; Section 106 Consultation
Howson, Ursula	Benthic Resources; Coastal Habitat and Fauna; Commercial Fisheries and For-Hire Recreational Fishing; Finfish, Invertebrates, and Essential Fish Habitat; Other Uses; Recreation and Tourism; Wetlands, NMFS BA; EFH Assessment
Jensen, Mark	Demographics, Employment, and Economics; Recreation and Tourism
Klein, Kimberly	Marine Mammals, Planned Activities Scenario
McCarty, John	Visual Resources; Recreation and Tourism
McCoy, Angel	Meteorologist, Technical Design Elements
Miller, Jennifer	Other Uses
Moshier, Marissa	Cultural Resources; FOE; Section 106 Consultation
Richards, Renee	Other Uses
Schnitzer, Laura	Cultural Resources; FOE; Section 106 Consultation
Slayton, Ian	Air Quality, Planned Activities Scenario
Stokely, Sarah	Cultural Resources; FOE; Section 106 Consultation
Sullivan, Kim	Environmental Justice

FOE = Findings of Effect

Table C-2 BOEM and Cooperating Agency Reviewers

Name	Title	Agency
BOEM and DOI Reviewers		
Baker, Karen	Chief, Environment Branch for Renewable Energy	BOEM
Brown, William	Chief Environmental Officer	BOEM
Melendez-Arreaga, Pedro	Lead Attorney-Advisor, Office of the Solicitor	DOI
Ottman, Noel	Attorney-Advisor, Office of the Solicitor	DOI
Stromberg, Jessica	Deputy Branch Chief, Environment Branch for Renewable Energy	BOEM
Vorkoper, Stephen	Attorney-Advisor, Office of the Solicitor	DOI
Cooperating and Participating Agency Reviewers		
Crocker, Julie	Endangered Fish Branch Chief, GARFO Protected Resources Division	NMFS
Desautels, Michele	District 1	USCG
Heckman, Andrea	Lead Environmental Protection Specialist	BSEE
Hanson, Keith	Marine Habitat Resource Specialist, GARFO Habitat and Ecosystem Services Division	NMFS
Kallgren, Maureen	Marine Transportation Specialist	USCG
Krueger, Mary	Energy Specialist, Interior Region 1, North Atlantic - Appalachian	NPS
McLean, Laura	Ocean and Lakes Policy Analyst	NYSDOS
Minck, Chris	New York District, Regulatory, Project Manager	USACE
NYSDEC	Division of Air Resources Division of Environmental Permits Division of Fish and Wildlife Division of Marine Resources	NYSDEC
Petriman, Viorica	Environmental Engineer, Air & Radiation Division, Permitting Section, USEPA Region 2	USEPA
Tuxbury, Susan	Wind Program Coordinator, GARFO Habitat and Ecosystems Division	NMFS
USCG	Sector New York and Sector Long Island Sound	USCG

DOI = U.S. Department of the Interior; GARFO = Greater Atlantic Regional Fisheries Office; HESD = Habitat and Ecosystem Services; NPS = National Park Service; NYSDOS = New York State Department of State

Table C-3 Consultants

Name	Company	Role/Resource Area
Baer, Sarah	ICF	Environmental Justice
Byram, Saadia	ICF	Editor
Copeland, Tanya	ICF	Project Manager
Diller, Elizabeth	ICF	Project Director
Ernst, David	ICF	Air Quality
Johnson, Dave	ICF	Bats; Birds; Coastal Habitat and Fauna; Wetlands; Water Quality; USFWS BA
Jost, Rebecca	ICF	Other Uses; Land Use and Coastal Infrastructure; Recreation and Tourism
Paulson, Merlyn	ICF	Scenic and Visual Resources

Name	Company	Role/Resource Area
Stoll, Jean	ICF	Cultural Resources; FOE; CHRVEA
Tavel, January	ICF	Cultural Resources; FOE; CHRVEA
Valley, Nathalie	ICF	Navigation and Vessel Traffic
Baggett, Lesley	AKRF	Benthic
DeFalco, Lorianne	AKRF	Demographics, Employment and Economics
Krebs, Justin	AKRF	QA/QC; NMFS BA; EFH Assessment
Lozano, Carlos	AKRF	Finfish, Invertebrates, EFH
Manhard, Chris	AKRF	Commercial Fisheries and For-Hire Recreational Fisheries
Manhard, Rachael	AKRF	Marine Mammals; Sea Turtles; NMFS BA

CHRVEA = Cumulative Historic Resources Visual Effects Analysis; QA/QC = quality assurance/quality control

C.2. Glossary

Term	Definition
affected environment	Environment as it exists today that could be potentially affected by the proposed Projects
algal blooms	Rapid growth of the population of algae, also known as algae bloom
allision	A moving (drift or powered) vessel hitting a stationary object
anthropogenic	Generated by human activity
Applicant-proposed measures	Applicant-proposed measures to avoid, minimize, or mitigate potential impacts
attenuation	The gradual loss of acoustic energy from absorption and scattering as sound propagates through a medium
below grade	Below ground level
benthic	Related to the bottom of a body of water
benthic resources	The seafloor surface, the substrate itself, and the communities of bottom-dwelling organisms that live within these habitats
Cetacea	Order of aquatic mammals made up of whales, dolphins, porpoises, and related lifeforms
coastal habitat	Coastal areas where flora and fauna live, including salt marshes and aquatic habitats
coastal waters	Waters in nearshore areas where bottom depth is less than 98.4 feet (30 meters)
coastal zone	The lands and waters starting at 3 nm from the land and ending at the first major land transportation route
collision	Two or more moving vessels hitting each other
commercial fisheries	Areas or entities raising and catching fish for commercial profit
commercial-scale wind energy facility	Wind energy facility usually greater than 1 MW that sells the produced electricity
criteria pollutant	One of six common air pollutants for which USEPA sets National Ambient Air Quality Standards: CO, lead, nitrogen dioxide, ozone, particulate matter, or SO ₂
critical habitat	Geographic area containing features essential to the conservation of threatened or endangered species

Term	Definition
cultural resource	Precontact or contact districts, objects, places, sites, buildings, structures, shipwrecks, and archaeological sites and collections on the American landscape, as well as sites of traditional, religious, or cultural significance to cultural groups, including Native American tribes
cumulative impacts	Impacts that could result from the incremental impact of a specific action, such as the proposed Projects, when combined with other past, present, or reasonably foreseeable future actions or other projects; can occur from individually minor, but collectively significant actions that take place over time
demersal	Living close to the ocean floor
design envelope	The range of proposed Project characteristics defined by the applicant and used by BOEM for purposes of environmental review and permitting
dredging	Removal of sediments and debris from the bottom of lakes, rivers, harbors, and other waterbodies
duct bank	Underground structure that houses the onshore export cables, which consists of polyvinyl chloride pipes encased in concrete
Earth curvature	Mathematical calculation of the Earth curvature over the ocean's surface defines the physical structure height(s) at which the Projects' WTGs and OSS are visible from offshore and onshore view receptors
ecosystem	Community of interacting living organisms and nonliving components (such as air, water, soil)
electromagnetic field	A field of force produced by electrically charged objects and containing both electric and magnetic components
embayment	Recessed part of a shoreline
endangered species	A species that is in danger of extinction in all or a significant portion of its range
Endangered Species Act-listed species	Species listed under the ESA of 1973 (as amended)
ensonification	The process of filling with sound
environmental consequences	The potential direct, indirect, and cumulative impacts that the construction, O&M, and decommissioning of the proposed Projects would have on the environment
environmental justice communities	Minority and low-income populations affected by the proposed Projects
epifauna	Fauna that lives on the surface of a seabed (or riverbed), or is attached to underwater objects or aquatic plants or animals
essential fish habitat	"Those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (50 CFR 600)
export cables	Cables connecting the wind facility to the onshore electrical grid power
export cable corridor	Area identified for routing the entire length of the onshore and offshore export cables
federal aids to navigation	Visual references operated and maintained by USCG, including radar transponders, lights, sound signals, buoys, and lighthouses, that support safe maritime navigation
field of view	The horizontal or vertical extent of the observable landscape seen at any given moment, usually measured in degrees
finfish	Vertebrate and cartilaginous fishery species, not including crustaceans, cephalopods, or other mollusks

Term	Definition
for-hire commercial fishing	Commercial fishing on a for-hire vessel (i.e., a vessel on which the passengers make a contribution to a person having an interest in the vessel in exchange for carriage)
for-hire recreational fishing	Fishing from a vessel carrying a passenger for hire who is engaged in recreational fishing
foundation	The bases to which the WTGs and OSS are installed on the seabed; for example, piled jacket or monopile
geomagnetic	Relating to the magnetism of the Earth
hard-bottom habitat	Benthic habitats composed of hard-bottom (e.g., cobble, rock, and ledge) substrates
historic property	Prehistoric or historic district, site, building, structure, or object that is eligible for or already listed in the NRHP; also includes any artifacts, records, and remains (surface or subsurface) related to and located within such a resource
historical resource	Prehistoric or historic district, site, building, structure, or object that is eligible for or already listed in the NRHP; also includes any artifacts, records, and remains (surface or subsurface) related to and located within such a resource
horizontal directional drilling	Trenchless technique for installing underground cables, pipes, and conduits using a surface-launched drilling rig
hull	Watertight frame or body of a ship or buoy
impact-producing factors	Resulting from the construction and installation, operations and maintenance, and decommissioning of the Projects
impulsive sound	Sound that is typically brief and intermittent with rapid rise time and decay back to ambient levels (for example, impact pile driving)
infauna	Fauna living in the sediments of the ocean floor (or river or lake beds)
interarray cables	Cables connecting the WTGs to each other and to the OSS
invertebrate	Animal with no backbone
jacket foundation	Latticed steel frame with three or four supporting piles driven into the seabed
jack-up vessel	Mobile and self-elevating platform with buoyant hull
jet excavation	Process of moving or removing soil with a jet
jet plowing	Plowing in which the jet plow, with an adjustable blade, or plow rests on the seafloor and is towed by a surface vessel; the jet plow creates a narrow trench at the designated depth, while water jets fluidize the sediment within the trench; in the case of the proposed Projects, the cables would then be feed through the plow and laid into the trench as it moves forward; the fluidized sediments then settle back down into the trench and bury the cable
knot	Unit of speed equaling 1 nm per hour
landfall site	The shoreline landing site at which the offshore cable transitions to onshore
marine mammal	Aquatic vertebrate distinguished by the presence of mammary glands, hair, three middle ear bones, and a neocortex (a region of the brain)
marine waters	Waters in offshore areas where bottom depth is more than 98.4 feet (30 meters)

Term	Definition
mechanical cutter	Method of submarine cable installation equipment that involves a cutting wheel or excavation chain to cut a narrow trench into the seabed allowing the cable to sink under its own weight or be pushed to the bottom of the trench via a cable depressor
mechanical plow	Method of submarine cable installation equipment that involves pulling a plow along the cable route to lay and bury the cable. The plow's share cuts into the soil, opening a temporary trench, which is held open by the side walls of the share, while the cable is lowered to the base of the trench via a depressor. Some plows may use additional jets to fluidize the soil in front of the share.
monopile or monopile foundation	A long steel tube driven into the seabed that supports a tower
nautical mile	A unit used to measure sea distances and equivalent to approximately 1.15 miles (1.85 kilometers)
offshore substation	The interconnection point between the WTGs and the export cable; the necessary electrical equipment needed to connect the inter-array cables to the offshore export cables
onshore substation	Substation connecting the proposed Projects to the existing bulk power grid system
operations and maintenance facilities	Would include offices, control rooms, warehouses, shop space, and pier space
Outer Continental Shelf	All submerged land, subsoil, and seabed belonging to the United States but outside of states' jurisdiction
permanent threshold shift	A permanent loss of hearing sensitivity caused by excessive noise exposure (considered an auditory injury)
pile	A type a foundation akin to a pole
pile driving	Installing foundation piles by driving them into the seafloor
pinnipeds	Carnivorous, semiaquatic marine mammals with fins, also known as seals
pin pile	Small-diameter pipe driven into the ground as foundation support
plume	Column of fluid moving through another fluid
point of interconnection	Location where the power generated by the Projects is connected to the existing electric power grid.
private aids to navigation	Visual references on structures positioned in or near navigable waters of the United States, including radar transponders, lights, sound signals, buoys, and lighthouses, that support safe maritime navigation; permits for the aids are administered by USCG
Project area	The combined onshore and offshore area where proposed Project components would be located
protected species	Endangered or threatened species that receive federal protection under the ESA of 1973 (as amended)
scour protection	Protection consisting of rock and stone that would be placed around all foundations to stabilize the seabed near the foundations as well as the foundations themselves
scrublands	Plant community dominated by shrubs and often also including grasses and herbs

Term	Definition
seascape and landscape impact assessment	Seascape and landscape impact assessment methodologies analyze impacts on both the physical elements and features that make up a landscape, seascape, or open ocean; and the aesthetic, perceptual, and experiential aspects of the landscape, seascape, or open ocean that make it distinctive
sessile	Attached directly by the base
silt substrate	Substrate made of a granular material originating from quartz and feldspar, and whose size is between sand and clay
soft-bottom habitat	Benthic habitats include soft-bottom (i.e., unconsolidated sediments) and hard-bottom (e.g., cobble, rock, ledge) substrates, as well as biogenic habitat (e.g., eelgrass, mussel beds, worm tubes) created by structure-forming species
substrate	Earthy material at the bottom of a marine habitat; the natural environment that an organism lives in
suspended sediments	Very fine soil particles that remain in suspension in water for a considerable period of time without contact with the bottom; such material remains in suspension due to the upward components of turbulence and currents, or by suspension
temporary threshold shift	Temporary loss of hearing sensitivity caused by excessive noise exposure
threatened species	A species that is likely to become endangered within the foreseeable future
tidal energy project	Project related to the conversion of the energy of tides into usable energy, usually electricity
tidal flushing	Replacement of water in an estuary or bay because of tidal flow
transition bay	A clean, dry environment for jointing the offshore and onshore cable and providing protection to the cable joint during operation
trawl	A large fishing net dragged by a vessel at the bottom or in the middle of sea or lake water
turbidity	A measure of water clarity
utility right-of-way	Registered easement on private land that allows utility companies to access the utilities or services located there
viewshed	Area visible from a specific location
visual impact assessment	Visual impact assessment analyzes and evaluates the impacts on people of adding the proposed development to views from selected viewpoints
visual resource	The visible physical features on a landscape, including natural elements such as topography, landforms, water, vegetation, and manmade structures
Waters of the United States	“Waters of the United States” applies to the jurisdictional limits of the authority of USACE under the CWA. Waters of the United States include those waters listed in § 328.3(a). The lateral limits of jurisdiction in those waters may be divided into three categories. The categories include the territorial seas, tidal waters, and non-tidal waters (see 33 CFR 328.4(a), (b), and (c), respectively).
wetland	Land saturated with water; marshes; swamps
wind energy	Electricity from naturally occurring wind
wind energy area	Areas with significant wind energy potential and defined by BOEM

Term	Definition
wind turbine generator	Component that puts out electricity in a structure that converts kinetic energy from wind into electricity

Appendix D. Analysis of Incomplete or Unavailable Information

In accordance with Section 1502.21 of the CEQ regulations implementing NEPA, when an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an EIS and when information is incomplete or unavailable, the agency shall make clear that such information is lacking. When incomplete or unavailable information was identified, BOEM considered whether the information was relevant to the assessment of impacts and essential to its analysis of alternatives based upon the resource analyzed. If essential to a reasoned choice among the alternatives, BOEM considered whether it was possible to obtain the information and if the cost of obtaining it was exorbitant. If it could not be obtained, or if the cost of obtaining it was exorbitant, BOEM considered the best available scientific information and applied generally accepted scientific methodologies to inform the analysis.

D.1. Incomplete or Unavailable Information Analysis for Resource Areas

D.1.1 Air Quality

Although a quantitative emissions inventory analysis of the region, or regional modeling of pollutant concentrations, over the next 35 years would more accurately assess the overall impacts of the changes in emissions from the Projects, any action alternative would lead to reduced emissions regionally and can only lead to a net improvement in regional air quality. The differences among action alternatives with respect to direct emissions due to construction, O&M, and decommissioning of the Projects are expected to be small. As such, the analysis provided in this EIS is sufficient to support sound scientific judgments and informed decision-making related to the use of the offshore portions of the Wind Farm Development Area and offshore export cable route corridor. Therefore, BOEM does not believe that there is incomplete or unavailable information on air quality that is essential to a reasoned choice among alternatives.

D.1.2 Bats

There will always be some level of incomplete information on the distribution and habitat use of bats in the offshore portions of the Wind Farm Development Area, as habitat use and distribution varies among seasons and species. Additionally, because U.S. offshore wind development is in its infancy, with only two offshore wind projects having been constructed at the time of this analysis, there is some level of uncertainty regarding the potential collision risk to individual bats that may be present within the offshore portions of the Wind Farm Development Area. However, sufficient information on collision risk to bats observed at land-based U.S. wind projects exists and was used to analyze and corroborate the potential for this impact as a result of the proposed Projects. In addition, as described in Section 3.5, the likelihood of a bat encountering an operating WTG during migration is very low and, therefore, the differences among action alternatives with respect to bats for the Projects are expected to be small. As such, the analysis provided in this EIS is sufficient to support sound scientific judgments and informed decision-making related distribution and use of the offshore portions of the Wind Farm Development Area as well as to the potential for collision risk of bats. Therefore, BOEM does not believe that there is incomplete or unavailable information on bat resources that is essential to a reasoned choice among alternatives.

D.1.3 Benthic Resources

Although there is uncertainty regarding the spatial and temporal distribution of benthic (faunal) resources and periods during which they might be especially vulnerable to disturbance, Empire's surveys of benthic resources and other broad-scale studies (Battista et al. 2019; NYSERDA 2017; Guida et al. 2017; NEFMC 2017; MAFMC 2016, 2017) provided a suitable basis for generally predicting the species,

abundances, and distributions of benthic resources within the geographic analysis area. Uncertainty also exists regarding the impact of some IPFs on benthic resources. For example, specific stimulus-response related to acoustics and EMF is not well studied, although there is some emerging information from benthic monitoring at European wind facilities and the Block Island Wind Farm in the United States that has begun to provide some new information to support a better understanding of the impacts. Further studies on the effects of underwater noise and EMF and the species-specific responses to these factors are needed, however, before a well-informed understanding can be achieved. Similarly, specific secondary impacts, such as changes in diets throughout the food web resulting from habitat modification and synergistic behavioral impacts from multiple IPFs, are not fully known. Again, results of benthic monitoring at European wind facilities and the Block Island Wind Farm in the United States provide general knowledge of the overall impacts of these IPFs combined, if not individually. Therefore, the analysis provided in this EIS, which is based on those results, is supported by the best available science, despite the fact that additional study would provide greater understanding to more fully support sound scientific judgments and informed decision-making related to the overall impacts of these factors on benthic resources. For these reasons, BOEM does not believe that there is incomplete or unavailable information on benthic resources that is essential to a reasoned choice among alternatives.

D.1.4 Birds

Habitat use and distribution of marine birds varies between seasons, species, and years and, as a result, there will always be some level of incomplete information on the distribution and habitat use of marine birds in the offshore portions of the geographic analysis area. In addition, because U.S. offshore wind development is in its infancy, there will always be some level of uncertainty regarding the potential for collision risk and avoidance behaviors for some of the bird species that may be present within the offshore portions of the geographic analysis area. For this EIS, publicly available avian survey data and Project-specific avian sighting data that cover the Projects (see COP Volume 2b, Section 5.3, Appendix P, and Appendix Q; Empire 2023) were used to inform the predictive models and analysis of potential adverse impacts on bird resources.

Bird mortality data are available for onshore wind facilities and, based on a number of assumptions regarding their applicability to offshore environments, were used to inform the analysis of bird mortality associated with the offshore WTGs analyzed in the EIS. However, uncertainties exist regarding the use of the onshore bird mortality rate to estimate the offshore bird mortality rate due to differences in species groups present and life history and behavior of species as well as differences in the offshore marine environment compared to onshore habitats.

Modeling is commonly used to predict the potential mortality rates for marine bird species in Europe and the United States (BOEM 2015, 2021b). Due to inherent data limitations, these models often represent only a subset of species potentially present. However, the datasets used by both Empire and BOEM to assess the potential for exposure of marine birds to the Wind Farm Development Area represent the best available data and provide context at both local and regional scales. Furthermore, sufficient information on collision risk and avoidance behaviors observed in related species at European offshore wind projects is available and was used to analyze and corroborate the potential for these impacts as a result of the proposed Projects (e.g., Petersen et al. 2006; Skov et al. 2018). As such, the analysis provided in the EIS is sufficient to support sound scientific judgments and informed decision-making related to distribution and use of the offshore portions of the geographic analysis area as well as to the potential for collision risk and avoidance behaviors in bird resources. Furthermore, the similarity between the layouts analyzed for the different action alternatives does not render any of this incomplete and unavailable information essential to a reasoned choice among alternatives. Therefore, BOEM does not believe that there is incomplete or unavailable information on avian resources that is essential to a reasoned choice among alternatives.

D.1.5 Coastal Habitat and Fauna

Although the preferred habitats of terrestrial and coastal fauna are generally known, specific data on abundances and distributions within the geographic analysis area of various fauna within these habitats are likely to remain unknown without site-specific surveys. However, the species inventories and other general information about the area provide an adequate basis for evaluating the fauna likely to inhabit the onshore geographic analysis area. The geographic analysis area is within urbanized landscapes in the New York metropolitan area, and vegetation in the terrestrial onshore environment where onshore Project components would be sited almost entirely consists of landscape plants, including trees, shrubs, other ornamental plants, and maintained grass. Wildlife would be limited to those species adapted to living in urban environments. Additionally, the onshore activities proposed involve only common, industry-standard activities for which impacts are generally understood. Therefore, BOEM believes that the analysis provided in this EIS is sufficient to make a reasoned choice among the alternatives.

D.1.6 Commercial Fisheries and For-Hire Recreational Fishing

Fisheries are managed in the context of an incomplete understanding of fish stock dynamics and effects of environmental factors on fish populations. The commercial fisheries information used in this assessment has limitations. For example, vessel trip report data are only an approximation because this information is self-reported and may not account for all trips. Available historical data lack consistency, making comparisons challenging. However, these data represent the best available data, and sufficient information exists to support the findings presented in this EIS.

A second limitation is that recent annual revenue exposed for for-hire recreational fishing in the Lease Area is not available. The economic analysis conducted by BOEM of recreational for-hire boats, as well as for-hire and private-boat angler trips that might be affected by the overall New York WEA, including the Lease Area, was conducted for 2007–2012 (Kirkpatrick et al. 2017). Although these data are presented in Section 3.9 and used for findings, updated data for the period of 2013 to the present are not available. BOEM supplemented the data from the economic analysis with data compiled by NMFS (2021a) regarding the annual revenue (2008–2018) for for-hire recreational fishing in the Lease Area and the percentage of each permit holder's total trips coming from within the Lease Area during 2008–2018 to analyze differences in the importance of fishing grounds in the Lease Area for the for-hire recreational fishery. Using both sets of data, BOEM does not believe that there is incomplete or unavailable information on commercial fisheries and for-hire recreational fishing resources that is essential to a reasoned choice among alternatives.

D.1.7 Cultural Resources

Undiscovered terrestrial archaeological resources, submerged archaeological resources (shipwrecks and other anthropogenic features), ancient submerged landforms, and as-yet undocumented TCPs represent incomplete or unavailable information. However, the differences among alternatives with respect to cultural, historic, and archaeological resources are not expected to be significant. BOEM will use the ROD as an agreement document to establish commitments for an inadvertent submerged archaeological resources discovery plan, inadvertent terrestrial archaeological resources discovery plan, cultural resources treatment plans, and archaeological monitoring during construction within the APE in accordance with BOEM's existing *Guidelines for Providing Archaeological and Historic Property Information Pursuant to Title 30 Code of Federal Regulations Part 585*, ensuring potential historic properties are identified, effects assessed, and adverse effects resolved. Therefore, BOEM does not believe this incomplete or unavailable information on historic properties is essential to a reasoned choice among alternatives.

D.1.8 Demographics, Employment, and Economics

Empire's economic analysis estimated the employment and outputs for the Proposed Action. This provided sufficient information for the evaluation of demographics, employment, and economics to support a reasoned choice among alternatives. There is some inherent uncertainty in forecasting how economic variables in various areas will evolve over time. However, the differences among action alternatives with respect to demographics, employment, and economics are not expected to be significant. Therefore, BOEM does not believe that there is specific incomplete or unavailable information on demographics, employment, and economics that is essential to a reasoned choice among alternatives.

D.1.9 Environmental Justice

The analysis of disproportionately high and adverse effects on minority and low-income populations is tiered to the assessment of impacts on other resources analyzed in this EIS. As a result, incomplete or unavailable information related to other resources, as described in this appendix, also affect the completeness of the analysis of impacts for environmental justice. As discussed in other sections, BOEM has determined that incomplete and unavailable information for other resources on which the analysis of environmental justice impacts rely was either not relevant to the assessment of reasonably foreseeable high and adverse effects; was not essential to a reasoned choice among alternatives; alternative data or methods could be used to predict potential impacts and provided the best available information; or the overall costs of obtaining the information was exorbitant or the means to do so were unknown. Therefore, BOEM does not believe that there is incomplete or unavailable information for environmental justice that is essential to a reasoned choice among alternatives.

D.1.10 Finfish, Invertebrates, and Essential Fish Habitat

Although there is some uncertainty regarding the spatial and temporal distribution of finfish and invertebrate resources and periods during which they might be especially vulnerable to disturbance, Empire's aquatic resource surveys and other broad-scale studies (e.g., Guida et al. 2017) provided a suitable basis for general predictions of finfish and invertebrate resources with respect to species, densities, and distributions within the geographic analysis area. Additional information related to ESA-listed species and EFH will be addressed in the forthcoming BA and EFH Assessment. While impacts on these specific finfish and invertebrate species are not anticipated to vary from the general impacts provided in the EIS, specific impact discussion for ESA-listed species and EFH will be provided in the BA and EFH Assessment.

Uncertainty also exists regarding the impact of some IPFs on invertebrate resources, such as the effects of EMFs and underwater noise (e.g., generated from pile driving). The available information on invertebrate sensitivity to EMF is equivocal (Hutchinson et al. 2020), and sensitivity to sound pressure and particle motion effects is not well understood for many species, nor are synergistic or antagonistic impacts from multiple IPFs. Similarly, specific secondary impacts such as changes in diets throughout the food chain resulting from habitat modification are not well known for finfish and invertebrates. Where applicable, the assessment drew upon information in the available literature and an increasing number of monitoring and research studies related to wind development, other undersea development, or artificial reefs in Europe and the United States, several of which were recently drafted or published. These monitoring studies help provide a broad understanding of the overall impacts of these IPFs combined, if not individually.

For these reasons, the analysis provided in this EIS is sufficient to support sound scientific judgments and informed decision-making related to the overall impacts. Therefore, BOEM does not believe that there is incomplete or unavailable information on finfish, invertebrate, and EFH resources that is essential to a reasoned choice among alternatives.

D.1.11 Land Use and Coastal Infrastructure

There is no incomplete or unavailable information related to the analysis of impacts on land use and coastal infrastructure.

D.1.12 Marine Mammals

NMFS has summarized the most current information about marine mammal population status, occurrence, and use of the region in its draft 2021 stock status report for the Atlantic OCS and Gulf of Mexico (NMFS 2021b). These studies provided a suitable basis for predicting the species, abundances, and distributions of marine mammals in the geographic analysis area. However, population trend data from NMFS are unavailable for six of the 10 species likely to occur in the Project area. As a result, there is uncertainty regarding how Project activities and cumulative effects may affect these populations. In addition to species distribution information, effects of some IPFs on marine mammals are also uncertain or ambiguous, as described below.

Potential effects of EMF have not been scaled to consider impacts on marine mammal populations or their prey in the geographic analysis area (Taormina et al. 2018). The widespread ranges of marine mammals and difficulty obtaining permits make experimental studies challenging. As a result, no scientific studies have been conducted that examine the effects of altered EMF on marine mammals. Although scientific studies summarized by Normandeau et al. (2011) demonstrate that marine mammals are sensitive to, and can detect, small changes in magnetic fields (Section 3.15), potential impacts would likely only occur within a few feet of cable segments. The current literature does not support a conclusion that EMF could lead to changes in behavior that would cause significant adverse effects on marine mammal populations.

The behavioral effects of anthropogenic noises on marine mammals are increasingly being studied; however, behavioral responses vary depending on a variety of factors such as life stage, previous experience, and current behavior (e.g., feeding, nursing) and are therefore difficult to predict. In addition, the current NMFS disturbance criteria apply a single threshold for all marine mammals for impulsive noise sources and do not consider the overall duration, exposure, or frequency distribution of the sound to account for species-dependent hearing acuity. While elevated underwater sound could startle or displace animals, behavioral responses are not necessarily predictable from source levels alone (Southall et al. 2007).

In addition, research regarding the potential behavioral effects of pile-driving noise has generally focused on harbor porpoises and seals; studies that examine the behavioral responses of baleen whales to pile driving are absent from the literature. Of the available research, most studies conclude that, although pile-driving activities could cause avoidance behaviors or disruption of feeding activities, individuals would likely return to normal behaviors once the activity had stopped. However, uncertainty remains regarding the long-term cumulative acoustic impacts associated with multiple pile-driving projects that may occur over a number of years. This also applies to other Project activities such as vessel movements, HRG surveys, geotechnical drilling, and dredging activities that may elicit behavioral reactions in marine mammals. As a result, it is not possible to predict with certainty the potential long-term behavioral effects on marine mammals from Project-related pile driving or other activities, as well as ongoing concurrent and cumulative pile driving and other activities.

To address this uncertainty, the assessment used the best available information when considering behavioral effects related to underwater noise. To better characterize these impacts, graded probability of response frequency-weighted metrics developed by Wood et al. (2012) were used in addition to the NMFS disturbance threshold, as described in Section 3.15, *Marine Mammals*. Monitoring studies would provide insight into species-specific behavioral reactions to Project-generated underwater noise. Long-term monitoring of concurrent and multiple projects could inform the understanding of long-term effects

and subsequent consequences from cumulative underwater noise activities on marine mammal populations.

There is a lack of research regarding the responses of large whale species to extensive networks of new structures due to the novelty of this type of development on the Atlantic OCS. Although new structures are anticipated from multiple offshore wind projects under the planned activities scenario, it is expected that spacing will allow large whales to access areas within and between wind facilities. No physical obstruction of marine mammal migration routes or habitat areas are anticipated, but whether avoidance of offshore wind lease areas will occur due to new structures is unknown. Additionally, while there is some uncertainty regarding how hydrodynamic changes around foundations may affect prey availability, these changes are expected to have limited impacts on the local conditions around WTG foundations. The potential consequences of these impacts on marine mammals of the Atlantic OCS are unknown. Monitoring studies would provide insight into species-specific avoidance behaviors and other potential behavioral reactions to Project structures.

At present, this EIS has no basis to conclude that these IPFs would result in significant adverse impacts on marine mammal populations.

BOEM determined that the overall costs of obtaining the missing information for or addressing these uncertainties are exorbitant, or the means to obtain it are not known. Therefore, to address these gaps, BOEM extrapolated or drew assumptions from known information for similar species and studies using generally accepted scientific methodologies, as presented in Section 3.15 and in the BA submitted to NMFS (BOEM 2022). The information and methods used to predict potential impacts on marine mammals represent the best available information, and the analysis provided in this EIS is sufficient to support sound scientific judgments and informed decision-making. Therefore, BOEM does not believe that there is incomplete or unavailable information on marine mammal resources that is essential to a reasoned choice among alternatives.

D.1.13 Navigation and Vessel Traffic

Vessel traffic in the NSRA Study Area was characterized using AIS data recorded via satellite and coastal receivers between August 2017 and July 2018. These data were compared to and supplemented with data collected (through visual observations and radar) from project survey vessels working in the Lease Area (COP Volume 2e, page 8-80; Empire 2023). The project survey vessel observations (collected from March to December 2018) have the added advantage of collecting additional data for vessels that may turn off their AIS tracking system or are not required to install and transmit AIS (such as vessels under 65 feet [20 meters]). The NSRA analysis also drew upon NOAA VMS fishing-specific data (2015 to 2016) from the Northeast Ocean Data Portal (Northeast Regional Ocean Data Portal 2018). Fishing vessels at least 65 feet long were not required to carry AIS until March 2015 (80 *Federal Register* 5282); therefore, AIS data prior to March 2015 are more limited than data available after March 2015. The combination of AIS and VMS data described above with informed assumptions about smaller vessel numbers represents the best available vessel traffic data and is sufficient to enable BOEM to make a reasoned choice among alternatives.

As stated in Section 3.16, WTG and OSS structures could potentially interfere with marine radars. Marine radars have varied capabilities and the ability of radar equipment to properly detect objects is dependent on radar type, equipment placement, and operator proficiency; however, trained radar operators, properly installed and adjusted vessel equipment, marked WTGs, and the use of AIS all would enable safe navigation with minimal loss of radar detection (USCG 2020). Based on the foregoing, BOEM does not believe that there is incomplete or unavailable information on navigation and vessel traffic that is essential to a reasoned choice among alternatives.

D.1.14 Other Uses

There is no incomplete or unavailable information related to the analysis of impacts on other uses.

D.1.15 Recreation and Tourism

Evaluations of impacts on recreation and tourism rely on the assessment of impacts on other resources. As a result, incomplete or unavailable information related to other resources, as described in this document, also affects the completeness of the analysis of impacts on recreation and tourism. BOEM has determined that incomplete and unavailable resource information for recreation and tourism or for other resources on which the analysis of recreation and tourism impacts rely was either not relevant to the assessment of adverse impacts; was not essential to a reasoned choice among alternatives; alternative data or methods could be used to predict potential impacts and provided the best available information; or the overall costs of obtaining the information was exorbitant or the means to do so were unknown. Therefore, the information provided in the EIS is sufficient to support sound scientific judgments and informed decision-making related to the alternatives.

D.1.16 Sea Turtles

There is incomplete information on the distribution and abundance of sea turtle species that occur in the Atlantic OCS and the Lease Area. The NMFS BA (BOEM 2022) provides a thorough overview of the available information about potential species occurrence and exposure to Project-related IPFs. The studies summarized therein provide a suitable basis for predicting potential species occurrence, relative abundance, and probable distribution of sea turtles in the geographic analysis area.

Some uncertainty exists about the effects of certain IPFs on sea turtles and their habitats. The effects of EMF on sea turtles are not completely understood. However, the available relevant information is summarized in the BOEM-sponsored report by Normandeau et al. (2011). Although the thresholds for EMF disturbing various sea turtle behaviors are not known, the evidence suggests that impacts may only occur on hatchlings over short distances, and no adverse effects on sea turtles have been documented to occur from the numerous submarine power cables around the world. In addition, no nesting beaches, critical habitat, or other biologically important habitats were identified in the offshore export cable corridor.

There is also uncertainty about sea turtle responses to proposed Project construction activities, and data are not available to evaluate potential changes to movements of juvenile and adult sea turtles due to elevated suspended sediments. However, although some exposure may occur, total suspended solid impacts would be limited in magnitude and duration and would occur within the range of exposures periodically experienced by these species. On this basis, any resulting impact on sea turtle behavior due to sediment plumes would likely be too small to be biologically meaningful, and no adverse impacts would be expected (NOAA 2020). Some potential exists for sea turtle displacement, but it is unclear if this would result in adverse impacts (e.g., because of lost foraging opportunities or increased exposure to potentially fatal vessel interactions). Additionally, it is currently unclear whether concurrent construction of multiple projects, increasing the extent and intensity of impacts over a shorter duration, or spreading out project construction with lower-intensity impacts over multiple years would result in the least potential harm to sea turtles. There is also uncertainty regarding the cumulative acoustic impacts associated with pile-driving activities. It is unknown whether sea turtles affected by construction activities would resume normal feeding, migrating, or breeding behaviors once daily pile-driving activities cease, or if secondary impacts would continue. Under the planned activities scenario, individual sea turtles may be exposed to acoustic impacts from multiple projects in a single day or from one or more projects over the course of multiple days. Although the consequences of these exposure scenarios have been analyzed with

the best available information, some level of uncertainty remains due to the lack of observational data on species' responses to pile driving.

Some uncertainty exists regarding the potential for sea turtle responses to FAA hazard lights and navigation lighting associated with offshore wind development. Empire would limit lighting on WTGs and OSS to minimum levels required by regulation for worker safety, navigation, and aviation. Although sea turtles' sensitivity to these minimal light levels is unknown, sea turtles do not appear to be adversely affected by oil and gas platform operations, which produce far more artificial light than offshore wind structures. The placement of new structures would be far from nesting beaches, so no impacts on nesting female or hatchling sea turtles are anticipated.

Considerable uncertainty exists about how sea turtles would interact with the long-term changes in biological productivity and community structure resulting from the reef effect of offshore wind farms across the geographic analysis area. Artificial reef and hydrodynamic impacts could influence predator-prey interactions and foraging opportunities in ways that influence sea turtle behavior and distribution. Also, the extent of sea turtle entanglement on artificial reefs and shipwrecks is not captured in sea turtle stranding records and the significance and potential scale of sea turtle entanglement in lost fishing gear are not quantified. These impacts are expected to interact with the ongoing influence of climate change on sea turtle distribution and behavior over broad spatial scales, but the nature and significance of these interactions are not predictable. BOEM anticipates that ongoing monitoring of offshore energy structures will provide some useful insights into these synergistic effects.

BOEM considered the level of effort required to address the uncertainties described above for sea turtles and determined that the methods necessary to do so are lacking or the associated costs would be exorbitant. Therefore, where appropriate, BOEM inferred conclusions about the likelihood of potential biologically significant impacts from available information for similar species and situations. These methods are described in greater detail in Section 3.19, *Sea Turtles*, and in the BA submitted to NMFS (BOEM 2022). Therefore, the analysis provided is sufficient to support sound scientific judgments and informed decision-making about the proposed Projects with respect to impacts on sea turtles. For these reasons, BOEM does not believe that there is incomplete or unavailable information on turtles that is essential to a reasoned choice among alternatives.

D.1.17 Scenic and Visual Resources

No incomplete or unavailable information related to the analysis of impacts on scenic and visual resources was identified.

D.1.18 Water Quality

No incomplete or unavailable information related to the analysis of impacts on water quality was identified.

D.1.19 Wetlands

No incomplete or unavailable information related to the analysis of impacts on wetlands was identified.

D.2. References Cited

Battista, T., W. Sautter, M. Poti, E. Ebert, L. Kracker, J. Kraus, A. Mabrouk, B. Williams, D. S. Dorfman, R. Husted, and C. J. Jenkins. 2019. Comprehensive seafloor substrate mapping and model validation in the New York Bight. OCS Study BOEM 2019-069 and NOAA Technical Memorandum NOS NCCOS 255: 187 Pages.

- Bureau of Ocean Energy Management (BOEM). 2015. *Virginia Offshore Wind Technology Advancement Project on the Atlantic Outer Continental Shelf Offshore Virginia: Revised Environmental Assessment*. Office of Renewable Energy Programs. OCS EIS/EA BOEM 2015-031. Available: <https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/VA/VOWTAP-EA.pdf>. Accessed: September 1, 2020.
- Bureau of Ocean Energy Management (BOEM). 2021b. *South Fork Wind Farm and South Fork Export Cable Project Final Environmental Impact Statement*. OCS EIS/EA BOEM 2020-057. Available: <https://www.boem.gov/renewable-energy/state-activities/sfwf-feis>.
- Bureau of Ocean Energy Management. 2023. *Empire Wind Project (EW 1 and EW 2) Biological Assessment for National Marine Fisheries Service*. March.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, and E. Estela-Gomez. 2017. *Habitat Mapping and Assessment of Northeast Wind Energy Areas*. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088. November 1, 2013. Prepared in collaboration between Gulf of Maine Research Institute and University of Maine.
- Hutchinson, Z. L., D. H. Secor, and A. B. Gill. 2020. The interaction between resource species and electromagnetic fields associated with electricity production by offshore wind farms. *Oceanography* 33(4):96–107.
- Kirkpatrick, A. J., S. Benjamin, G. S. DePiper, S. S. T. Murphy, and C. Demarest. 2017. *Socio-Economic Impact of Outer Continental Shelf Wind Energy Development on Fisheries in the U.S. Atlantic*. Vol. II—Appendices. U.S. Department of the Interior, Bureau of Ocean Energy Management, Atlantic OCS Region. Washington, D.C.
- Mid-Atlantic Fishery Management Council (MAFMC). 2016. *Ecosystem Approach to Fisheries Management Guidance Document*: 69 pages.
- Mid-Atlantic Fishery Management Council (MAFMC). 2017. *Unmanaged Forage Omnibus Amendment: Amendment 20 to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan, Amendment 18 to the Mackerel, Squid, and Butterfish Fishery Management Plan, Amendment 19 to the Surf Clam and Ocean Quahog Fishery Management Plan, Amendment 6 to the Bluefish Fishery Management Plan, Amendment 5 to the Tilefish Fishery Management Plan, Amendment 5 to the Spiny Dogfish Fishery Management Plan, Including an Environmental Assessment, Regulatory Impact Review, and Regulatory Flexibility Act Analysis*. Dover, DE.
- National Marine Fisheries Service (NMFS). 2021a. *Descriptions of Selected Fishery Landings and Estimates of recreational Party and Charter Vessel Revenue from Areas: A Planning-level Assessment July 2021*. Available: https://www.greateratlantic.fisheries.noaa.gov/ro/fso/reports/WIND/WIND_AREA_REPORTS/party_charter_reports/Ocean_Wind_1_rec.html.
- National Marine Fisheries Service (NMFS). 2021b. *Draft US Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2020*. Available: <https://media.fisheries.noaa.gov/2021-10/Draft%202021%20NE%26SE%20SARs.pdf>. Accessed: November 19, 2021.

- National Oceanic and Atmospheric Administration (NOAA). 2020. Section 7 Effect Analysis: Turbidity in the Greater Atlantic Region. NOAA Greater Atlantic Regional Fisheries Office. Available: <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effect-analysis-turbidity-greater-atlantic-region>. Accessed: November 11, 2021.
- New England Fishery Management Council (NEFMC). 2017. Omnibus Essential Fish Habitat Amendment 2, Including a Final Environmental Impact Statement. Available: <https://www.nefmc.org/library/omnibus-habitat-amendment-2>. Accessed: February 4, 2019.
- New York State Energy Research and Development Authority (NYSERDA). 2017. *New York State Offshore Wind Master Plan: Fish and Fisheries Study Final Report*: 202 pages.
- Normandeau Associates, Inc. (Normandeau), Exponent, Inc., T. Tricas, and A. Gill. 2011. *Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species*. OCS Study BOEMRE 2011-09. Camarillo, California: U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region.
- Northeast Regional Ocean Council. 2018. Northeast Ocean Data Portal. Available: <https://www.northeastoceandata.org/>.
- Petersen, Ib Krag, Thomas Kjær Christensen, Johnny Kahlert, Mark Desholm, and Anthony D. Fox. 2006. *Final Results of Bird Studies at the Offshore Wind Farms at Nysted and Horns Rev, Denmark*. National Environmental Research Institute, Ministry of the Environment, Denmark. Available: https://tethys.pnnl.gov/sites/default/files/publications/NERI_Bird_Studies.pdf. Accessed: September 1, 2020.
- Skov, H., S. Heinanen, T. Norman, R. M. Ward, S. Mendez-Roldan, and I. Ellis. 2018. *ORJIP Bird Collision and Avoidance Study*. Final report. The Carbon Trust. United Kingdom. April 2018.
- Southall, B. L., A. E. Bowles, W. T. Ellison, J. J. Finneran, R. L. Gentry, C. R. Greene, Jr., and P. L. Tyack. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals* 33(4):411–521.
- Taormina, B., J. Bald, A. Want, G. Thouzeau, M. Lejart, N. Desroy, and A. Carlier. 2018. A review of potential impacts of submarine power cables on the marine environment: Knowledge gaps, recommendations and future directions. *Renewable and Sustainable Energy Reviews*, Elsevier, 2018, 96, pp. 380–391. 10.1016/j.rser.2018.07.026. hal-02405630.
- U.S. Coast Guard (USCG). 2020. *The Areas Offshore of Massachusetts and Rhode Island Port Access Route Study. USCG 2019-0131*. May 14. Available: https://www.navcen.uscg.gov/pdf/PARS/FINAL_REPORT_PARS_May_14_2020.pdf. Accessed: October 13, 2021.
- Wood, J. D., B. L. Southall, and D. J. Tollit. 2012. *PG&E offshore 3-D Seismic Survey Project Environmental Impact Report—Marine Mammal Technical Draft Report*. Report by SMRU Ltd. 121 p.

Appendix E. Project Design Envelope and Maximum-Case Scenario

Empire proposes the Project using a PDE concept. This concept allows Empire to define and bracket proposed Project characteristics for environmental review and permitting while maintaining a reasonable degree of flexibility for selection and purchase of Project components such as WTGs, foundations, export cables, and OSS.¹

BOEM provides Empire and other lessees with the option to submit COPs using the PDE concept—providing sufficiently detailed information within a reasonable range of parameters to analyze a “maximum-case scenario” within those parameters for each affected environmental resource. BOEM identified and verified that the maximum-case scenario based on the PDE provided by Empire and analyzed in this Final EIS could reasonably occur if approved. This approach is intended to provide flexibility for lessees and allow BOEM to analyze environmental impacts in a manner that minimizes the need for subsequent environmental and technical reviews as design changes occur.

This Final EIS assesses the impacts of the reasonable range of Project designs that are described in the COP by using the maximum-case scenario process. The maximum-case scenario analyzes the aspects of each design parameter that would result in the greatest impact for each physical, biological, and socioeconomic resource. This Final EIS considers the interrelationship among aspects of the PDE rather than simply viewing each design parameter independently. This Final EIS also analyzes the planned action impacts of the maximum-case scenario together with other past, present, and reasonably foreseeable future actions.

A summary of Empire’s PDE parameters is provided in Table E-1 and Table E-2. Table E-3 details the full range of maximum-case design parameters for the proposed Project and which parameters are relevant to the analysis for each EIS section in Chapter 3, *Affected Environment and Environmental Consequences*.

Table E-1 Summary of PDE Parameters

Parameter	EW 1	EW 2	Total
Type of foundation (WTGs)	Monopile	Monopile	Monopile
Type of foundations (OSS)	Piled jacket	Piled jacket	Piled jacket
Number of foundations	58	91	149
Number of OSS	1	1	2
Number of WTGs	57	90	147
Rotor diameter	853 feet (260 meters)	853 feet (260 meters)	853 feet (260 meters)
Hub height	525 feet (160 meters)	525 feet (160 meters)	525 feet (160 meters)
Upper blade tip height	951 feet (290 meters)	951 feet (290 meters)	951 feet (290 meters)
Voltage of interarray cables	66 kV	66 kV	66 kV

¹ Additional information and guidance related to the PDE concept can be found here: <https://www.boem.gov/Draft-Design-Envelope-Guidance>.

Parameter	EW 1	EW 2	Total
Total length of interarray cables	116 nm (214 kilometers)	144 nm (267 kilometers)	260 nm (481 kilometers)
Voltage of submarine export cables	230 kV	345 kV	-
Total length of submarine export cable route ¹	41 nm (76 kilometers)	26 nm (48 kilometers)	67 nm (124 kilometers)

¹ This length refers to the distance along the centerline of the submarine export cable route and is measured from the edge of the Lease Area to the export cable landfall. Multiple cables may be included within each cable route.

Table E-2 Summary of Project Siting Options in the PDE

Project Element	EW 1	EW 2
POI	Gowanus	Oceanside
Submarine export cable route	EW 1 Route B	EW 2 Route C
Onshore substation	EW 1	EW 2 Onshore Substation A and EW 2 Onshore Substation C
Submarine export cable landfall	EW 1	EW 2 Landfall A: Riverside Boulevard and East Broadway EW 2 Landfall B: Shore Road and Monroe Boulevard EW 2 Landfall C: Lido Beach West Town Park EW 2 Landfall E: Laurelton Boulevard and West Broadway
Onshore cable route	EW 1	LB-A through LB-H, LB Variant, and IP-A through IP-H

Table E-3 Maximum-Case Design Parameters for the Empire Wind Project (an “X” indicates that the parameter is relevant to an EIS resource analysis)

Design Parameter	Empire Wind 1	Empire Wind 2	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual	3.21 Water Quality	3.22 Wetlands
Wind Farm																					
Wind farm capacity	816 MW	1,260 MW	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Wind Turbines																					
Approximate total number ¹	57	90	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
Hub height above HAT	525 feet (160 meters)			X		X		X	X	X	X		X		X	X	X		X		
Upper blade tip above HAT	951 feet (290 meters)			X		X		X	X	X	X		X		X	X	X		X		
Lower blade tip above HAT ²	85 feet (26 meters)			X		X		X	X	X	X		X		X	X	X		X		
Rotor diameter	853 feet (260 meters)			X		X		X	X	X	X		X		X	X	X		X		
Wind Turbine Oil/Grease/Fuel																					
Transformer oil	2,378 gallons (9,000 liters)		X		X	X				X		X			X			X		X	
Main bearing grease	95 gallons (360 liters)		X		X	X				X		X			X			X		X	
Yaw grease	32 gallons (120 liters)		X		X	X				X		X			X			X		X	
Yaw gear oil	95 gallons (360 liters)		X		X	X				X		X			X			X		X	
Main bearing grease	95 gallons (360 liters)		X		X	X				X		X			X			X		X	
Hydraulic oil	317 gallons (1,200 liters)		X		X	X				X		X			X			X		X	
Cooling (water/glycerol)	872 gallons (3300 liters)		X		X	X				X		X			X			X		X	
Pitch lubrication (grease)	53 gallons (200 liters)		X		X	X				X		X			X			X		X	
Pitch system hydraulic accumulators (nitrogen)	17,171 gallons (65,000 liters)		X		X	X				X		X			X			X		X	
Pitch gearbox oil	18 gallons (70 liters)		X		X	X				X		X			X			X		X	
Gearbox oil (gear oil)	1,057 gallons (4,000 liters)		X		X	X				X		X			X			X		X	
Sulfur hexafluoride (SF ₆ gas)	287 pounds (130 kilograms)		X		X					X		X			X			X			
Monopile Foundation																					
Base diameter	36 feet (11 meters)				X	X		X	X			X		X	X		X	X			
Seabed penetration	180 feet (55 meters)				X			X	X			X		X	X		X	X			
Seabed footprint (without scour protection) ³	1,023 square feet (95 m ²)				X	X		X	X			X		X	X		X	X		X	
Seabed footprint (with scour protection) ⁴	39,902 square feet (3,707 m ²)				X	X		X	X			X		X	X		X	X		X	
Diameter at MSL	33 feet (10 meters)							X				X			X		X		X		
Monopile Foundation Scour Protection																					
Depth of scour protection	16.4 feet (5 meters)				X			X	X			X					X			X	
Diameter for monopile (including foundation)	207 feet (63 meters)				X	X		X				X		X	X		X	X	X	X	

Design Parameter	Empire Wind 1	Empire Wind 2	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual	3.21 Water Quality	3.22 Wetlands
Volume for monopile ⁵	13,080 cubic yards (10,000 cubic meters)				X			X				X		X	X		X	X			
Monopile Foundation Parameters																					
Pile hammer size	5,500 kilojoules			X	X	X		X				X		X			X	X			
Maximum blows per minute per pile at maximum energy setting	40			X	X	X		X				X		X			X	X			
Average piling time per pile	3 hours																				
Wind Turbine Installation Parameters																					
Seafloor footprint of wind turbine installation vessels ⁶	0.5 acre (0.2 hectare)				X			X	X	X		X		X	X		X	X		X	
Seafloor penetration of wind turbine installation vessels ⁶	82 feet (25 meters)				X			X	X			X					X			X	
Estimated time per component (hours/wind turbine)	48 hours/wind turbine			X		X					X				X		X			X	
Offshore Substation																					
Piled Jacket Foundation⁷																					
Leg spacing at seabed	197 feet x 197 feet (60 meters x 60 meters)														X		X				
Pile diameter	8 feet (2.5 meters)				X							X		X	X		X	X			
Seabed penetration	197 feet (60 meters)				X				X			X					X				
Seabed footprint (without scour protection) ³	38,750 square feet (3,600 m ²)				X	X			X			X		X	X		X	X		X	
Seabed footprint (with scour protection) ⁸	93,560 square feet (8,692 m ²)				X	X			X			X		X	X		X	X		X	
Leg spacing at MSL	164 feet x 164 feet (50 meters x 50 meters)														X				X		
Piled Jacket Foundation Scour Protection⁹																					
Depth for piled jacket	6.6 feet (2 meters)								X												
Area (including foundation)	93,560 (8,692 m ²)								X						X						
Total Volume ⁵	30,698 cubic yards (23,470 cubic meters)					X									X						
Offshore Substation Commissioning																					
Seafloor footprint of OSS commissioning accommodation vessel ¹⁰	0.5 acre (0.2 hectare)				X			X	X		X			X	X		X	X		X	
Seafloor penetration of installation OSS commissioning accommodation vessel ^{10,11}	82 feet (25 meters)				X			X	X		X						X			X	
Piled Jacket Foundation Parameters																					
Pile hammer size	4,000 kilojoules			X	X	X		X			X			X				X			
Maximum blows per minute per pile at maximum energy setting	40			X		X											X				
Average piling time per pile ¹²	4.2 hours																				
Offshore Substation Topside Maximum Parameters																					
Voltage	230 kV	345 kV																			
Width	230 feet (70 meters)			X		X		X	X						X				X		

Design Parameter	Empire Wind 1	Empire Wind 2	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual	3.21 Water Quality	3.22 Wetlands
Length	230 feet (70 meters)			X		X		X	X						X				X		
Height ¹³	92 feet (28 meters)	108 feet (33 meters)		X		X		X	X						X	X			X		
Height AMSL (topside only) ³¹	174 feet (53 meters)	190 feet (58 meters)		X		X			X						X				X		
Height AMSL (with ancillary structures)	295 feet (90 meters)	312 feet (95 meters)		X		X			X						X				X		
Offshore Substation Oil/Grease/Fuel Maximum Parameters¹⁴																					
Transformer/reactor oil	158,503 gallons (600,000 liters)		X		X	X						X		X	X			X		X	
Sulfur hexafluoride (SF ₆ gas)	11,023 pounds (5,000 kilograms)	16,535 pounds (7,500 kilograms)	X									X		X	X			X			
Diesel fuel	7,925 gallons (30,000 liters)		X		X	X						X		X	X			X		X	
UPS batteries	66,139 pounds (30,000 kilograms)				X							X		X	X			X			
Submarine Export Cables																					
Number of routes	1	1			X	X		X	X	X		X	X	X	X	X	X	X	X	X	X
Number of cables per route	2	2			X	X		X	X	X		X	X	X	X	X	X	X	X	X	X
Total length ¹⁵	41 nm (76 kilometers)	26 nm (48 kilometers)			X	X		X	X	X		X	X	X	X	X	X	X	X	X	X
Voltage	230 kV	345 kV													X						
Diameter (3 core cable)	1 foot (300 millimeters)								X	X					X	X					
Minimum target burial depth ¹⁶	6 feet (1.8 meters) 15 feet (4.5 meters) ¹⁷				X	X		X	X	X		X	X	X	X	X	X	X	X	X	X
Trench depth ¹⁶	8 feet (2.4 meters) 18 feet (5.5 meters) ¹⁷				X	X		X	X	X		X	X	X	X	X	X	X	X	X	X
Seafloor disturbance width ¹⁸	33 feet (10 meters)				X	X		X	X	X		X	X	X	X	X	X	X	X	X	X
Separation distance	33 to 300 feet (10 to 91 meters)				X	X		X	X	X		X	X	X	X	X	X	X	X	X	X
Trench width ¹⁹	5 feet (1.5 meters)				X	X		X	X	X		X	X	X	X	X	X	X	X	X	X
Anchor corridor width ²⁰	1,250 feet (381 meters) ²¹				X			X	X	X		X	X	X	X		X	X	X	X	X
Siting corridor width ²²	500 feet (152 meters)	900 feet (274 meters)			X	X		X	X	X			X		X		X			X	
Permanent easement width ²³	200 feet (60 meters)								X	X			X		X		X			X	
Submarine Export Cable Protection Maximum Parameters (Provided per cable within each siting corridor)																					
Width at base	36 feet (11 meters)				X	X		X	X			X			X	X	X			X	
Width at top	5 feet (1.5 meters)				X	X		X	X			X			X	X	X			X	
Depth	5 feet (1.5 meters)				X	X		X	X			X		X	X	X	X	X	X	X	X
Interarray Cable																					
Total length	116 nm (214 kilometers)	144 nm (267 kilometers)	X		X	X		X	X	X		X		X	X	X	X	X	X	X	X

Design Parameter	Empire Wind 1	Empire Wind 2	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual	3.21 Water Quality	3.22 Wetlands	
Voltage	66 kV														X							
Diameter	0.6 foot (170 millimeters)								X	X					X	X	X					
Target burial depth ¹⁶	6 feet (1.8 meters)				X	X		X	X	X		X		X	X	X	X	X		X		
Trench width ²⁴	5 feet (1.5 meters)				X	X		X	X	X		X		X	X	X	X	X		X		
Seafloor disturbance width ¹⁸	33 feet (10 meters)				X	X		X	X	X		X		X	X	X	X	X		X		
Interarray Cable Protection Maximum Parameters (Provided per cable within each siting corridor)																						
Width at base	16 feet (5 meters)				X	X		X	X	X		X			X	X	X			X		
Width at top	3 feet (1 meters)				X	X		X	X	X		X			X	X	X			X		
Depth	3 feet (1 meters)				X			X	X	X		X		X	X	X	X	X		X		
Cable and Pipeline Crossings (Provided per cable within each siting corridor)																						
Width at base	53 feet (16 meters)				X	X		X	X	X		X	X		X	X	X			X		
Width at top	6.6 feet (2 meters)				X	X		X	X	X		X	X		X	X	X			X		
Depth	6.6 feet (2 meters)				X			X	X	X		X	X	X	X	X	X	X		X		
Onshore Export Cable Maximum Parameters																						
Number of cables	N/A	6+2 fiber optic cables		X		X	X		X	X	X		X						X	X	X	
Route length ²⁵	N/A	5.6 miles (9.1 kilometers)	X	X		X	X		X	X	X		X						X	X	X	
Number of routes	N/A	2	X	X		X	X		X	X	X		X						X	X	X	
Voltage	N/A	345 kV									X											
Diameter	N/A	0.4 foot (133 millimeters)							X	X	X											
Construction corridor width (open cut)	N/A	150 feet (46 meters) ²⁶		X		X	X		X	X	X		X						X	X	X	
Operational corridor width ²⁷	N/A	25 feet (8 meters)		X		X	X		X		X		X						X	X	X	
Interconnection Cable Maximum Parameters																						
Number of cables per route	6+2 fiber optic cables	6+2 fiber optic cables		X		X	X		X	X	X		X							X	X	
Total route length	0.2 mile (0.4 kilometer)	2.8 miles (4.5 kilometer)	X	X		X	X		X	X	X		X						X	X	X	
Voltage	345 kV	345 kV									X											
Diameter	0.5 foot (150 millimeters)								X	X	X											
Construction corridor width (open cut)	50 feet (15 meters)	100 feet (30 meters) ²⁶		X		X	X		X	X	X		X		X				X	X	X	
Operational corridor width ²⁸	25 feet (8 meters)			X		X	X		X		X		X		X				X	X	X	
Export Cable and Interconnection Cable Installation Methods																						
Export Cable Landfall/Inland Waterway Crossings																						
Trenchless (HDD, direct pipe, jack and bore, or similar)	X	X				X	X	X	X			X	X	X	X			X		X	X	
Open cut trench/jetting (with or without dredging)	X	X				X	X	X	X			X	X	X	X			X		X	X	

Design Parameter	Empire Wind 1	Empire Wind 2	3.4 Air Quality	3.5 Bats	3.6 Benthic Resources	3.7 Birds	3.8 Coastal Habitat and Fauna	3.9 Commercial Fisheries and For-Hire Recreational Fishing	3.10 Cultural Resources	3.11 Demographics, Employment, and Economics	3.12 Environmental Justice	3.13 Finfish, Invertebrates, and Essential Fish Habitat	3.14 Land Use and Coastal Infrastructure	3.15 Marine Mammals	3.16 Navigation and Vessel	3.17 Other Uses (Marine Minerals, Military Use, Aviation)	3.18 Recreation and Tourism	3.19 Sea Turtles	3.20 Scenic and Visual	3.21 Water Quality	3.22 Wetlands
Open cut/jetting (cofferdam)	X	X				X	X	X	X			X	X	X	X			X		X	X
Open cut/jetting (conduit through bulkhead with or without cofferdam)	X	X				X	X	X	X			X	X	X	X			X		X	X
Open cut/jetting (conduit over bulkhead with or without cofferdam)	X	X				X	X	X	X			X	X	X	X			X		X	X
Above-water crossing (cable bridge)	-	X																			
Onshore Export Cable/Interconnection Cable Routes (Upland)																					
Open cut trench	X	X		X		X	X		X				X						X	X	X
HDD	X	X		X		X	X		X				X						X	X	X
Other trenchless (jack and bore)	X	X		X		X	X		X				X						X	X	X
Summary of Onshore Open Cut Trench Parameters																					
Depth of trench	10 feet (3 meters)								X				X								
Width of trench	10 feet (3 meters)	30 feet (9 meters)							X				X						X		
Construction corridor width	50 feet (15 meters)	150 feet (46 meters) ²⁹		X		X	X		X				X						X	X	X
Operational corridor width ³⁰	25 feet (8 meters)			X		X	X		X				X						X	X	X
Summary of HDD Parameters																					
Submarine Export Cable Landfall HDD																					
Onshore (entry) work area footprint	200 feet x 200 feet (61 meters x 61 meters)	246 feet x 246 feet (75 meters x 75 meters)		X		X	X		X				X							X	X
Offshore (exit) work area footprint	150 feet x 150 feet (46 meters x 46 meters)			X	X	X	X	X	X			X	X	X			X	X		X	X
Onshore Export Cable/Interconnection Cable Crossing HDD																					
Onshore work area footprint	200 feet x 200 feet (61 meters x 61 meters) x 2 (entry/exit)	246 feet x 246 feet (75 meters x 75 meters) x 2 (entry/exit)		X		X	X		X				X							X	X
Summary of Other Trenchless Crossing (non-HDD) Parameters																					
Work area footprint	60 feet x 60 feet (18 meters x 18 meters)			X		X	X		X				X						X	X	X
Bore pit footprint	60 feet x 60 feet (18 meters x 18 meters)			X		X	X		X				X							X	X
Receiving pit footprint	40 feet x 40 feet (12 meters x 12 meters)			X		X	X		X				X							X	X
Summary of Direct Pipe Workspace Parameters																					
Submarine Export Cable Landfall Direct Pipe Option																					
Onshore (entry) work area footprint	-	260 feet x 680 feet (79 meters x 207 meters)		X		X	X		X				X							X	X
Offshore (exit) work area footprint	-	100 feet x 100 feet (30 meters x 30 meters)		X	X	X	X	X	X			X	X	X			X	X		X	X

¹ The number of WTGs proposed allows for overplanting. Up to 147 WTG will be installed at any of 176 locations. The remaining two locations will be used for OSS.

² For this parameter, the minimum value represents the maximum PDE value to be used for assessing impacts.

³ Per foundation.

⁴ Per foundation if scour protection is required.

⁵ Per foundation if scour protection is required. Includes protection for J-tubes where interarray cables meet the OSS.

⁶ Accounts for jack-up installation vessels. Seafloor footprint will be the short-term impacts associated with construction and installation activities; operational footprint is the long-term impacts.

⁷ Up to 12 piles per foundation. For piled jackets designed with up to four legs, three piles per leg. For piled jackets designed with six legs, up to two piles per leg or three piles per corner.

⁸ Per foundation if scour protection is required. This footprint will also cover scour protection of the submarine cable protection for J-tubes entering the ISS.

⁹ This scour protection will also cover scour protection of the submarine cable protection for J-tubes entering the OSS.

¹⁰ Accounts for jack-up installation vessels. Seafloor footprint will be short term.

¹¹ Range is dependent on soil type.

¹² Only one foundation is proposed to be installed via pile driving at a given time for the Projects (i.e., there would be no overlap in pile-driving activities between EW 1 and EW 2).

¹³ Height from lowest deck on topside or foundation to highest deck on topside.

¹⁴ Values listed are per OSS. Listed fluids and values are representative; approximate actual values will be incorporated into the Projects' emergency response plan.

¹⁵ The approximate distance along the centerline of the surveyed submarine export cable siting corridor from the edge of the Lease Area to the export cable landfall. Actual length of cables may increase as a result of micrositing and final location of OSS. Final installation would be within the surveyed corridor assessed.

¹⁶ Burial depths to be based on CBRA and site-specific conditions, and may be greater than values listed here.

¹⁷ In locations where the submarine export cable would cross federally maintained areas, in accordance with engagement with USACE and other stakeholders. This depth will be determined based upon the current or future authorized depth or the existing water depths, whichever is greater; therefore, minimum burial could be greater.

¹⁸ Direct seabed disturbance, including tracks from the trenching tool.

¹⁹ The width of the trench is defined here as the widest point of the bottom of the trench established by the clearing of the seabed by the trenching tool and will vary based upon the final installation method selected and soil conditions; the seabed surface trench width could be up to 10 feet (3 meters) in select locations, based upon the final installation method selected.

²⁰ The area in which a submarine export cable installation vessel may anchor in support of installation activities; this 1,250-foot width is on either side of the submarine export cable siting corridor in state waters. Corridor width may increase or decrease where site constraints exist. Impacts from Project-related vessel anchoring are expected to be in up to 269 square feet (25 m²) area, with a maximum penetration depth of 49 feet (15 meters) in up to 1,400 locations.

²¹ For EW 1, the anchor corridor would be in New York and New Jersey state waters only.

²² The area in which the submarine export cables could be installed. Assumes cables to be laid in parallel. Corridor width may increase or decrease where site constraints exist

²³ Distance from centerline for each cable. If a field joint is required, a wider easement may be required at the location of the joint.

²⁴ The widest point of the bottom of the trench established by the clearing of the seabed by the trenching tool. The seabed surface trench width could be up to 10 feet (3 meters) in select locations, based upon the final installation method selected and soil conditions.

²⁵ Represents maximum route length for a single onshore export cable route. For EW 2, up to two routes may be used.

²⁶ Where constrained by existing development, the onshore export cable construction corridor width may be less than 100 feet; the maximum width is included herein, as part of the PDE.

²⁷ Based on onshore cable conduits being installed side by side in a single corridor; however, conduits may also be split or stacked depending on site conditions.

²⁸ Based on onshore cable conduits being installed side by side in a single corridor; however, conduits may also be split or stacked depending on site conditions. As such, this width may vary in certain locations.

²⁹ Where constrained by existing development, the onshore export cable construction corridor width may be less than 150 feet (46 meters); the maximum width is included herein, as part of the PDE.

³⁰ Per cable circuit.

³¹ From mean sea level to highest deck on topside

HAT = highest astronomical tide; MSL = mean sea level; N/A = not applicable; SF₆ = sulfur hexafluoride; UPS = uninterrupted power supply

Appendix F. Planned Activities Scenario

This page intentionally left blank.

TABLE OF CONTENTS

F.1. Planned Activities Scenario	F-1
F.2. Ongoing and Planned Activities	F-1
F.2.1 Offshore Wind Energy Development Activities	F-2
F.2.1.1. Site Characterization Studies	F-2
F.2.1.2. Site Assessment Activities.....	F-2
F.2.1.3. Construction and Operation of Offshore Wind Facilities	F-3
F.2.2 Commercial Fisheries Cumulative Fishery Effects Analysis.....	F-3
F.2.3 Incorporation by Reference of Cumulative Impacts Study and the Analyses Therein	F-7
F.2.4 Undersea Transmission Lines, Gas Pipelines, and Other Submarine Cables	F-7
F.2.5 Tidal Energy Projects.....	F-8
F.2.6 Dredging and Port Improvement Projects	F-8
F.2.7 Marine Minerals Use and Ocean Dredged Material Disposal	F-9
F.2.8 Military Use	F-9
F.2.9 Marine Transportation.....	F-10
F.2.10 National Marine Fisheries Service Activities.....	F-10
F.2.10.1. Directed Take Permits for Scientific Research and Enhancement	F-11
F.2.10.2. Fisheries Use and Management.....	F-11
F.2.11 Global Climate Change.....	F-12
F.2.12 Oil and Gas Activities.....	F-14
F.2.13 Onshore Development Activities.....	F-15
F.3. References Cited	F-18

LIST OF ATTACHMENTS

- Attachment 1 Ongoing and Future Non-Offshore Wind Activity Analysis
- Attachment 2 Maximum-Case Scenario Estimates for Offshore Wind Projects

LIST OF TABLES

Table F-1	Site Characterization Survey Assumptions	F-2
Table F-2	Future Offshore Wind Project Construction Schedule (dates shown as of June 24 2022).....	F-4
Table F-3	Other Fishery Management Plans.....	F-12
Table F-4	Climate Change Plans and Policies	F-12
Table F-5	Resiliency Plans and Policies.....	F-14
Table F-6	Liquid Natural Gas Terminals in the Northeastern United States	F-15
Table F-7	Existing, Approved, and Proposed Onshore Development Activities.....	F-16

This page intentionally left blank.

F.1. Planned Activities Scenario

This appendix describes the other ongoing or planned activities that could occur within the geographic analysis area for each resource and contribute to baseline conditions and trends for resources considered in this EIS. The *Projects* here are the construction, O&M, and conceptual decommissioning of the EW 1 and EW 2 wind energy projects within BOEM’s Renewable Energy Lease Area OCS-A 0512, located on the OCS approximately 14 miles south of Long Island, New York and 19.5 miles east of Long Branch, New Jersey.

The geographic analysis area varies for each resource as described in the individual resource sections of Chapter 3. BOEM anticipates that impacts could occur during Project construction starting in 2023 and throughout a 35-year operational term for EW 1 and EW 2.¹ The geographic analysis area is defined by the anticipated geographic extent of impacts for each resource. For the mobile resources—bats, birds, finfish, and invertebrates; marine mammals; and sea turtles—the species potentially affected are those that occur within the area of impact of the Proposed Action. The geographic analysis area for these mobile resources is the general range of the species. The purpose is to capture the cumulative impacts on each of those resources that would be affected by the Proposed Action as well as the impacts that would still occur under the No Action Alternative.

In this appendix, distances in miles are in statute miles (miles used in the traditional sense) or nm (miles used specifically for marine navigation). This appendix uses statute miles more commonly and refers to them simply as *miles*, whereas nm is referred to by name.

F.2. Ongoing and Planned Activities

This section includes a list and description of ongoing and planned activities that could contribute baseline conditions and trends within the geographic analysis area for each resource topic analyzed in this EIS. Projects or actions that are considered speculative per the definition provided in 43 CFR 46.30² are noted in subsequent tables but excluded from the cumulative impact analysis in Chapter 3.

Ongoing and planned activities described in this section consist of 11 types of actions: (1) other offshore wind energy development activities; (2) undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); (3) tidal energy projects; (4) dredging and port improvement projects; (5) marine minerals use and ocean-dredged material disposal; (6) military use; (7) marine transportation; (8) fisheries use, management, and monitoring surveys; (9) global climate change; (10) oil and gas activities; and (11) onshore development activities.

BOEM analyzed the possible extent of future other offshore wind energy development activities on the Atlantic OCS to determine reasonably foreseeable cumulative effects measured by installed power capacity. Table F2-1 in Attachment 2 presents the current status of projects. The methodology for

¹ Empire’s lease with BOEM (Lease OCS-A 0512) will have an operations term of 25 years that commences on the date of COP approval. Empire would need to request an extension of its operations term from BOEM in order to operate the proposed Projects for 35 years. For the purposes of maximum-case scenario and to ensure NEPA coverage if BOEM grants such an extension, the Draft EIS analyzes a 35-year operations term.

² 43 CFR 46.30 – Reasonably foreseeable future actions include those federal and non-federal activities not yet undertaken, but sufficiently likely to occur, that a responsible official of ordinary prudence would take such activities into account in reaching a decision. The federal and non-federal activities that BOEM must take into account in the analysis of cumulative impacts include, but are not limited to, activities for which there are existing decisions, funding, or proposals identified by BOEM. Reasonably foreseeable future actions do not include those actions that are highly speculative or indefinite.

developing the scenario is the same as for the Vineyard Wind 1 project and details of the scenario development are described in the Vineyard Wind 1 Final EIS (BOEM 2021a).

F.2.1 Offshore Wind Energy Development Activities

F.2.1.1. Site Characterization Studies

A lessee is required to provide the results of site characterization activities with its site assessment plan (SAP) or COP. For the purposes of the cumulative impact analysis, BOEM makes the following assumptions for survey and sampling activities to characterize a maximum-case scenario:

- Site characterization would occur on all existing leases and potential export cable routes.
- Site characterization would likely take place in the first 3 years following execution of a lease, based on the fact that a lessee would likely want to generate data for its COP at the earliest possible opportunity.
- 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, two 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.
- Lessee 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 2016).

Table F-1 describes the typical site characterization surveys, the types of equipment and method used, and which resources the survey information would inform.

Table F-1 Site Characterization Survey Assumptions

Survey Type	Survey Equipment and Method	Resource Surveyed or Information Used to Inform
HRG surveys	Side-scan sonar, sub-bottom profiler, magnetometer, multi-beam echosounder, ultra-short baseline equipment	Shallow hazards, archaeological, bathymetric charting, benthic habitat
Geotechnical/sub-bottom sampling	Vibracores, deep borings, cone penetration tests	Geological, marine archaeology
Biological	Grab sampling, benthic sled, underwater imagery/sediment profile imaging	Benthic habitat
	Aerial digital imaging; visual observation from boat or airplane	Birds, marine mammals, sea turtles
	Ultrasonic detectors installed on survey vessels used for other surveys	Bat
	Visual observation from boat or airplane	Marine fauna (marine mammals and sea turtles)
	Direct sampling of fish and invertebrates	Fish and invertebrates

Source: BOEM 2016.

F.2.1.2. Site Assessment Activities

After SAP approval, a lessee can evaluate the meteorological conditions, such as wind resources, with the approved installation of meteorological towers and buoys. Meteorological buoys have become the preferred meteorological and oceanographic (metocean) data collection platform for developers, and BOEM expects that most future site assessments will use buoys instead of towers (BOEM 2021d). The

installation and operation of meteorological buoys involves substantially less activity and a much smaller footprint than the construction and operation of a meteorological tower. Site assessment activities have been approved or are in the process of being approved for multiple lease areas consisting of one to three meteorological buoys per SAP (Table F2-1 in Attachment 2). Site assessment would likely take place starting within 1 to 2 years of lease execution, because preparation of an SAP (and subsequent BOEM review) takes time. This cumulative analysis considers these site assessment activities.

F.2.1.3. Construction and Operation of Offshore Wind Facilities

Table F2-1 in Attachment 2 lists all offshore wind development activities that BOEM considers reasonably foreseeable by lease areas and projects.

F.2.2 Commercial Fisheries Cumulative Fishery Effects Analysis

Table F-2 depicts future construction of offshore wind projects from Maine to North Carolina that are currently in various stages of planning within BOEM's offshore leases. Projected construction dates for each offshore wind project are listed in Table F2-1 in Attachment 2, and each project will require a NEPA process with an EIS or environmental assessment prior to approval.

Table F-2 summarizes (1) the incremental number of construction locations that are projected to be active in each region during each year between 2021 and 2030; (2) the number of operational turbines in each region at the beginning of each year between 2021 and 2030; and (3) the total number of active construction locations and operational turbines across the Atlantic OCS by year.

BOEM assumes proposed offshore wind projects will include the same or similar components as the proposed Projects: wind turbines, offshore and onshore cable systems, OSS, onshore O&M facilities, and onshore interconnection facilities. BOEM further assumes that other potential offshore wind projects will employ the same or similar construction, O&M, and conceptual decommissioning activities as the proposed Projects. However, future offshore wind projects would be subject to evolving economic, environmental, and regulatory conditions. Lease areas may be split into multiple projects, expanded, or removed, and development within a particular lease area may occur in phases over long periods of time. Research currently being conducted in combination with data gathered regarding physical, biological, socioeconomic, and cultural resources during development of initial offshore wind projects in the United States could affect the design and implementation of future projects, as could advancements in technology. For the analysis of ongoing and planned activities, all proposed projects included in Table F2-1 in Attachment 2 are analyzed in Chapter 3 of this EIS.

Table F-2 Future Offshore Wind Project Construction Schedule (dates shown as of October 24, 2022)

Project/Region	Number of Foundations										
	Before 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 and Beyond
<i>Aqua venus (state waters)</i>	-	-	-	2	-	-	-	-	-	-	-
Total Other State Waters Projects	-	-	-	2	-	-	-	-	-	-	-
Estimated Other State Waters Construction	-	-	-	2	0	0	0	0	0	0	0
Estimated O&M total	-	-	--	0	2	2	2	2	2	2	2
Existing and Ongoing Projects											
<i>Block Island (state waters)</i>	5	-	-	-	-	-	-	-	-	-	-
<i>Vineyard Wind 1 part of OCS-A 0501</i>	-	-	-	63	-	-	-	-	-	-	-
<i>South Fork, OCS-A 0517</i>	-	-	-	13	-	-	-	-	-	-	-
<i>CVOW, OCS-A 0497</i>	2	-	-	-	-	-	-	-	-	-	-
Estimated Existing and Ongoing Project Construction	7	0	0	76	0	0	0	0	0	0	0
Estimated O&M total	0	7	7	7	83	83	83	83	83	83	83
Planned Projects											
Massachusetts/Rhode Island Region											
Sunrise, OCS-A 0487	-	-	-	-	95	-	-	-	-	-	-
Revolution, part of OCS-A 0486	-	-	-	102	-	-	-	-	-	-	-
New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 1 [i.e., Park City Wind])	-	-	-	-	64			-	-	-	-
New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 2 [i.e., Commonwealth Wind])	-	-	-	-	82		-	-	-	-	-
Mayflower OCS-A 0521	-	-	-	-	-	149	-	-	-	-	-
Beacon Wind 1, part of OCS-A 0520	-	-	-	-	79	-	-	-	-	-	-
Beacon Wind 2, part of OCS-A 0520	-	-	-	-	-	78	-	-	-	-	-
Bay State Wind, part of OCS-A 0500	-	-	-	-	-	112					
OCS-A 0500 remainder	-	-	-	-	-	232					
OCS-A 0487 remainder	-	-	-	-	-						
Liberty Wind, part of OCS-A 0522	-	-	-	-	-						

Project/Region	Number of Foundations										
	Before 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 and Beyond
Estimated annual Massachusetts/Rhode Island construction	0	0	0	102	320	571	0	0	0	0	0
Estimated O&M total	0	0	0	0	102	422	993	993	993	993	993
New York/New Jersey Region											
Ocean Wind 1, OCS-A 0498	-	-	-	-	101	-	-	-	-	-	-
Atlantic Shores South, OCS-A 0499	-	-	-	-	-	11	200	-	-	-	-
Ocean Wind 2, part of OCS-A 0532	-	-	-	-	-	-	113	-	-	-	-
Empire Wind 1, part of OCS-A 0512	-	-	-	58	-	-	-	-	-	-	-
Empire Wind 2, part of OCS-A 0512	-	-	-	91	-	-	-	-	-	-	-
Atlantic Shores North, OCS-A 0549	-	-	-	-	-	-	160	-	-	-	-
OW Ocean Winds East LLC, OCS-A 0537	-	-	-	-	-	-	102	-	-	-	-
Attentive Energy LLC, OCS-A 0538	-	-	-	-	-	-	104	-	-	-	-
Bight Wind Holdings, LLC, OCS-A 0539	-	-	-	-	-	-	148	-	-	-	-
Atlantic Shores Offshore Wind Bight, LLC, OCS-A 0541	-	-	-	-	-	-	95	-	-	-	-
Invenergy Wind Offshore LLC, OCS-A 0542	-	-	-	-	-	-	99	-	-	-	-
Vineyard Mid-Atlantic LLC, OCS-A 0544	-	-	-	-	-	-	104	-	-	-	-
Estimated annual New York/New Jersey construction	0	0	0	149	101	11	1,125	0	0	0	0
Estimated O&M total	0	0	0	0	149	250	261	1,386	1,386	1,386	1,386
Delaware/Maryland Region											
Skipjack, OCS-A 0519	-	-	-	-	17	-	-	-	-	-	-
US Wind, OCS-A 0490	-	-	-	-	126	-	-	-	-	-	-
GSOE I, OCS-A 0482	-	-	-	93	-	-	-	-	-	-	-
OCS-A 0519 remainder	-	-	-	-	-	-	-	-	-	-	-
Estimated annual Delaware/Maryland construction	0	0	0	93	143	0	0	0	0	0	0
Estimated O&M total	0	0	0	0	93	236	236	236	236	236	236
Virginia/North Carolina Region											
CVOW-C, OCS-A 0483	-	-	-	208	-	-	-	-	-	-	-

Project/Region	Number of Foundations										
	Before 2021	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030 and Beyond
Kitty Hawk North, OCS-A 0508	-	-	-	-	70						
Kitty Hawk South, OCS-A 0508	-	-	-	-	-	-	-	123			
Estimated annual Virginia/North Carolina construction:	0	0	0	208	70	0	0	123	0	0	0
Estimated O&M total	0	0	0	0	208	278	278	278	401	401	401
Total											
Estimated annual total construction	7	0	0	630	634	582	1,125	123	0	0	0
Estimated O&M total	7	7	7	7	637	1,271	1,853	2,978	3,101	3,101	3,101

CVOW = Coastal Virginia Offshore Wind

F.2.3 Incorporation by Reference of Cumulative Impacts Study and the Analyses Therein

BOEM has completed a study of IPFs on the North Atlantic OCS to consider in an offshore wind development cumulative impacts scenario (BOEM 2019). That study is incorporated in this document by reference. The study identifies cause-and-effect relationships between renewable energy projects and resources potentially affected by such projects. It further classifies those relationships into a manageable number of IPFs through which renewable energy projects could affect resources. It also identifies the types of actions and activities to be considered in a cumulative impact scenario. The study identifies actions and activities that may affect the same physical, biological, economic, or cultural resources as renewable energy projects and states that such actions and activities may have the same IPFs as offshore wind projects.

The BOEM (2019) study identifies the relationships between IPFs associated with specific ongoing and planned activities in the North Atlantic OCS to consider in a NEPA cumulative impacts scenario. These IPFs and their relationships were utilized in the EIS analysis of cumulative impacts, and the application of which IPF applied to which resource was decided by BOEM.

As discussed in the BOEM (2019) study, reasonably foreseeable activities other than offshore wind projects may also affect the same resources as the proposed Projects or other offshore wind projects, possibly via the same IPFs or via IPFs through which offshore wind projects do not contribute. This appendix lists reasonably foreseeable non-offshore wind activities that may contribute to the cumulative impacts of the proposed Projects.

F.2.4 Undersea Transmission Lines, Gas Pipelines, and Other Submarine Cables

There are numerous charted cables within the Lease Area and along the submarine export cable routes. The current status of many of these cables is poorly documented in the public domain, including on NOAA charts. There are currently six NOAA-charted submarine cables that cross through the Lease Area, with an additional three uncharted cables identified within the Lease Area during geophysical survey activities. Through coordination, it is understood that none of the charted cables within the Lease Area are currently in use. In-service cables along the offshore export cable corridor include one bundle of two 345-kV HVAC transmission lines, two 138-kV HVAC transmission cable bundles, Neptune Regional Transmission system, and FLAG Atlantic South telecommunications cable. At least six transmission cables are planned to be installed in the region. The New York Telephone Cable between Fort Hamilton and Fort Wadsworth was identified in the geographic analysis area during a USACE Freedom of Information Act request but was not found during survey campaigns (Empire 2023).

There are no charted pipelines in the Lease Area, and none were identified during geophysical survey activities. In-service pipelines along the submarine export cable route include the Transco Lower New York Bay Lateral gas pipeline, one gas pipeline buried in the northern New York Harbor utility corridor, two gas pipelines and one petroleum product pipeline buried in the southern New York Harbor utility corridor, and the deeply tunneled replacement Brooklyn-Staten Island water siphon. Two retired and partially dismantled Brooklyn-Staten Island water siphons are along the submarine export cable route as well as the planned Transco Raritan Bay Loop gas pipeline (Empire 2023).

The offshore wind projects listed in Table F2-1 in Attachment 2 that have a COP under review are presumed to include at least one cable route.

F.2.5 Tidal Energy Projects

The Roosevelt Island Tidal Energy Project is in the East Channel of the East River, a tidal strait connecting Long Island Sound with the Atlantic Ocean in New York Harbor. In 2005, Verdant Power petitioned the Federal Energy Regulatory Commission (FERC) for permission for the first U.S. commercial license for tidal power. In 2012, FERC issued a 10-year license to install up to 1 MW of power (30 turbines/10 TriFrames) at the Roosevelt Island Tidal Energy Project (FERC 2012; Verdant Power 2018). See the South Fork Wind Farm and South Fork Export Cable Project Final EIS (BOEM 2021b) for descriptions of other tidal projects that are more distant from the Projects in Maine and Massachusetts.

F.2.6 Dredging and Port Improvement Projects

The following dredging projects have been proposed or studied at or near ports that may be used by the Projects in New York and Texas, and are either in operation or are considered reasonably foreseeable:

- USACE has proposed maintenance dredging of the critical shoal areas immediately offshore of the SBMT and the approach to the Gowanus Creek Federal Navigation Channel. Approximately 850,000 cubic yards of material would be removed. This project is anticipated to occur in the summer/fall of 2021 (USACE 2021a).
- Planned activities for Howland Hook include dredging and deepening of the Arthur Kill Channel near the old Goethals Bridge. This channel work is planned for 2022 or 2023 and is associated with two already completed channel maintenance projects in the Arthur Kill Channel (USACE 2021b).
- USACE has proposed maintenance dredging of portions of the Newark Bay, New Jersey Federal navigation channel, including the removal of material from the Port Elizabeth Channel. Maintenance dredging and associated upland placement activities are planned to occur between July 2021 and February 2022 (USACE 2021c).
- USACE is planning or currently conducting numerous navigation projects in and around the Port of Corpus Christi. These include jetty repairs along the Corpus Christi Ship Channel near Port Aransas on Mustang Island; new work dredging within the Corpus Christi Ship Channel along the Lower Bay Reach near Pelican Island and Port Aransas (11.5 million cubic yards); new work dredging within the Corpus Christi Ship Channel along the Upper Bay Reach in Corpus Christi Bay (18 million cubic yards); dike improvements at a spoils containment area adjacent to La Quinta Channel; new work dredging along the Corpus Christi Ship Channel within the Inner Harbor area of Corpus Christi Bay (7 million cubic yards); maintenance dredging within the La Quinta Channel (1 million cubic yards); and maintenance dredging within an approximately 10-mile segment of the Intercoastal Waterway in Corpus Christi Bay (USACE 2022a).
- The Port of Corpus Christi Authority is proposing to deepen portions of the Corpus Christi Ship Channel starting near the southeastern side of Harbor Island, traversing east through the Aransas Pass, and extending into the Gulf of Mexico for an approximate distance of 13.8 miles (USACE 2022b). The project would deepen the ship channel beyond the current authorized channel depths of -54 feet and -56 feet MLLW to maximum depths of -79 feet and -81 feet MLLW to accommodate transit of fully loaded Very Large Crude Carriers through the Corpus Christi Ship Channel. An estimated 42 million cubic yards of new work dredged material would be generated by the channel deepening. Additionally, the proposed project includes:
 - Extending the existing terminus of the authorized channel an additional 29,000 feet into the Gulf of Mexico to reach -80 MLLW;
 - Expanding the existing Inner Basin at Harbor Island as necessary to accommodate Very Large Crude Carrier turning, including construction of a flare transition from the Corpus Christi Ship Channel with Aransas to meet the turning basin expansion;

- Potential placement of the new work dredged material into waters of the United States for beneficial use sites in and around Corpus Christi and Redfish Bays;
- Potential placement of dredged material on San Jose Island for dune restoration;
- Potential placement of dredged material feeder berms for beach to provide restoration along San Jose and Mustang Islands; and
- Transport of new work dredged material to the Corpus Christi New Work Ocean Dredged Material Disposal Site.

F.2.7 Marine Minerals Use and Ocean Dredged Material Disposal

A sand resource area is off the coast of Lido Beach near Jones Inlet. The state sand resource area includes eight smaller sand borrow areas that were recently used for beach renourishment. Within federal waters, the geographic analysis area includes four federal sand resource areas; however, there are no active OCS lease areas for marine minerals within the geographic analysis area (BOEM 2018). The entire extent of the delineated sand borrow area is suitable for renourishment material (Empire 2023). USEPA, Region 2 is responsible for designating and managing ocean disposal sites for materials offshore in the region of the Projects. Section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended (33 USC 1413) authorizes USACE to issue permits for the transportation of dredged material for the purpose of disposal within ocean waters. Co-located with the sand resource area described above is an available dredge disposal site known as the Jones Inlet Dredged Material Disposal Site (Empire 2023 citing Marine Cadastre 2019).

F.2.8 Military Use

The Offshore Narragansett Bay Range Complex primarily consists of surface sea spaces and subsurface space off the coasts of Massachusetts, Rhode Island, and New York. As part of the range complex, the Narragansett Bay Operating Area extends from the shoreline seaward to approximately 180 nm (333 kilometers) from land at its farthest point. The complex is controlled by the Fleet Area Control and Surveillance Facility at Virginia Capes Naval Air Station Oceana. The Navy installations primarily operating in this complex are in New London, Connecticut, and Newport, Rhode Island.

The Narragansett Bay Warning Area is in the western portion of the Offshore Narragansett Bay Range Complex and is designated for operations where limitations may be imposed on aircraft not participating in operations. The Narragansett Bay Warning Area is actively used for U.S. Navy subsurface and surface training and testing activities and to prepare submarines and their crews for formal voyages. Additionally, this Warning Area is used to support special-use airspace, flight testing, surface-to-air gunnery exercises using conventional ordnance, Antisubmarine Warfare exercises, and air-intercept training (Empire 2023 citing Globalsecurity.org 2018).

Three danger zones/restricted areas as defined as a “water area (or areas) used for target practice, bombing, rocket firing or other especially hazardous operations, normally for the armed forces” are in the vicinity of the study area. The danger zones/restricted areas in the area are at the mouth of the New York Harbor, at the Naval Weapons Station Earle in Sandy Hook Bay, and around the Navy Homeport Pier on Staten Island (Empire 2023).

There are two Weapons Training Areas operated by USCG offshore New York and New Jersey within the geographic analysis area. These training areas are used for proficiency training in law enforcement operations (BOEM 2016) and for small caliber weapons training, generally from small vessels that transit during the day to the training area.

F.2.9 Marine Transportation

Marine transportation in the region is diverse and sourced from many ports and private harbors. Commercial vessel traffic in the region includes research, tug/barge, tankers (such as those used for liquid petroleum), cargo, cruise ships, smaller passenger vessels, and commercial fishing vessels. Recreational vessel traffic includes private motor boats and sailboats. A number of federal agencies, state agencies, educational institutions, and environmental non-governmental organizations participate in ongoing research offshore including oceanographic, biological, geophysical, and archaeological surveys. The Lease Area is between the Nantucket/Ambrose TSS along the northern boundary and the Hudson Canyon/Ambrose TSS along the southern boundary of the Lease Area. A third TSS, Barnegat/Ambrose, runs north-south off the coast of New Jersey. Empire's NSRA assumes a conservative growth potential in commercial shipping movements of 10 percent that is applied to the base-case scenario for traffic volumes in the geographic analysis area that includes the Nantucket/Ambrose, Hudson Canyon/Ambrose, and Barnegat/Ambrose TSS (COP Volume 3, Appendix DD, Section 7.5.1; Empire 2023).

USCG chartered a workgroup on May 11, 2011, to gather data, identify existing and future waterway usage, and conduct modeling and analysis of traffic patterns in light of the complex interactions of the various factors that would affect navigational safety along the Atlantic Coast of the United States including potential navigational conflicts with various planned wind energy areas. USCG published the workgroup's Interim Report (77 *Federal Register* 55781; September 11, 2012) and a notification (81 *Federal Register* 13307; March 14, 2016) that announced the availability of the final report issued by the Atlantic Coast PARS workgroup. USCG announced the final report to be complete as published on April 5, 2017 (82 *Federal Register* 16510). The Atlantic Coast PARS Final Report along with the other PARS referenced in Section 3.16 served to gauge and inform the navigational assessment of the Proposed Action and cumulative impacts.

F.2.10 National Marine Fisheries Service Activities

Research and enhancement permits may be issued for marine mammals protected by the MMPA and for threatened and endangered species protected under the ESA. NMFS is anticipated to continue issuing research permits under Section 10(a)(1)(A) of the ESA to allow take of certain ESA-listed species for scientific research. Scientific research permits issued by NMFS currently authorize studies on ESA-listed species in the Atlantic Ocean. Current fisheries management and ecosystem monitoring surveys conducted by or in coordination with NEFSC could overlap with offshore wind lease areas in the New England region and south into the Mid-Atlantic region. Surveys include (1) the NEFSC Bottom Trawl Survey, a more than 50-year multispecies stock assessment tool using a bottom trawl; (2) the NEFSC Sea Scallop/Integrated Habitat Survey, a sea scallop stock assessment and habitat characterization tool, using a bottom dredge and camera tow; (3) the NEFSC Surfclam/Ocean Quahog Survey, a stock assessment tool for both species using a bottom dredge; and (4) the NEFSC Ecosystem Monitoring Program, a more than 40-year shelf ecosystem monitoring program using plankton tows and conductivity, temperature, and depth units. These surveys are anticipated to continue within the region, regardless of offshore wind development.

The regulatory process administered by NMFS, which includes stock assessments for all marine mammals and 5-year reviews for all ESA-listed species, assists in informing decisions on take authorizations and the assessment of project-specific and cumulative impacts that consider ongoing and planned activities in biological opinions. Stock assessments completed regularly under the MMPA include estimates of potential biological removal that stocks of marine mammals can sustainably absorb. MMPA take authorizations require that a proposed action have no more than a negligible impact on species or stocks, and that a proposed action impose the least practicable adverse impact on the species. MMPA authorizations are reinforced by monitoring and reporting requirements so that NMFS is kept informed of deviations from what has been approved. Biological opinions for federal and non-federal

actions are similarly grounded in status reviews and conditioned to avoid jeopardy and to allow continued progress toward recovery. These processes help to ensure that, through compliance with these regulatory requirements, a proposed action would not have a measurable impact on the conservation, recovery, and management of the resource.

F.2.10.1. Directed Take Permits for Scientific Research and Enhancement

NMFS issues permits for research on protected species for scientific purposes. These scientific research permits include the authorization of directed take for activities such as capturing animals and taking measurements and biological samples to study their health, tagging animals to study their distribution and migration, photographing and counting animals to get population estimates, taking animals in poor health to an animal hospital, and filming animals. NMFS also issues permits for enhancement purposes; these permits are issued to enhance the survival or recovery of a species or stock in the wild by taking actions that increase an individual's or population's ability to recover in the wild. Scientific research and enhancement permits have been issued previously for satellite, acoustic, and multi-sensor tagging studies on large and small cetaceans; research on reproduction, mortality, health, and conservation issues for NARWs; and research on population dynamics of harbor and gray seals. Reasonably foreseeable future impacts from scientific research and enhancement permits include physical and behavioral stressors (e.g., restraint and capture, marking, implantable and suction tagging, biological sampling).

F.2.10.2. Fisheries Use and Management

NMFS implements regulations to manage commercial and recreational fisheries in federal waters, including those within which the Projects would be located; the State of New Jersey and the State of New York regulate commercial fisheries in their state waters (within 3 nm of the coastline). The Projects overlap two of NMFS's eight regional councils to manage federal fisheries: MAFMC, which includes New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina; and NEFMC, which includes Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut (NEFMC 2016). The councils manage species with many FMPs that are frequently updated, revised, and amended and coordinate with each other to jointly manage species across jurisdictional boundaries (MAFMC 2019). Many of the fisheries managed by the councils are fished for in state waters or outside of the Mid-Atlantic region, so the council works with the Atlantic States Marine Fisheries Commission (ASMFC). ASMFC is composed of the 15 Atlantic coast states and coordinates the management of marine and anadromous resources found in the states' marine waters. In addition, the states and NMFS, under the framework of ASMFC's *Amendment 3 to the Interstate Fishery Management Plan for American Lobster*, cooperatively manage the American lobster resource and fishery (NOAA 1997).

The FMPs of the councils and ASMFC were established, in part, to manage fisheries to avoid overfishing. They accomplish this through an array of management measures, including annual catch quotas, minimum size limits, and closed areas. These various measures can further reduce (or increase) the size of landings of commercial fisheries in the Northeast and Mid-Atlantic regions.

NMFS also manages highly migratory species, such as tuna and sharks, that can travel long distances and cross domestic boundaries. Table F-3 summarizes other FMPs and actions in the region.

Table F-3 Other Fishery Management Plans

Area	Plan and Projects
ASFMC	ASMFC <i>Five-Year Strategic Plan 2019–2023</i> (ASMFC 2019) ASMFC 2022 Action Plan (ASMFC 2021) <i>Management, Policy and Science Strategies for Adapting Fisheries Management to Changes in Species Abundance and Distribution Resulting from Climate Change</i> (ASMFC 2018)
New York	<i>New York Ocean Action Plan 2017–2027</i> : adaptive management plan (NYSDEC 2017) New York State filed a petition with NOAA, NMFS, and MAFMC to demand that commercial fluke allocations be revised to provide fishers with equitable access to summer flounder. New York is also reviewing other species where there is an unfair allocation, including black sea bass and bluefish, and may pursue similar actions (<i>Federal Register</i> 31945 July 10, 2018).
Long Island Regional Development Council	East Hampton Shellfish Hatchery project to consolidate the hatchery’s municipal hatchery and nursing facilities. Haskell’s seafood facility in East Quogue is proposed become a fully functioning seafood processing plant.
New Jersey	NJDEP Division of Fish and Wildlife Marine Fisheries Management Rule Amendment Proposal with amendments to rules governing crab and lobster management, commercial Atlantic menhaden fishery, marine fisheries, and fishery management in New Jersey was published in the March 1, 2021, <i>New Jersey Register</i> (New Jersey Division of Fish and Wildlife 2021).

F.2.11 Global Climate Change

Section 7.6.1.4 of the *Programmatic EIS for Alternative Energy Development and Production and Alternate Use of Activities on the Outer Continental Shelf* (Minerals Management Service 2007) describes global climate change with respect to assessing renewable energy development. Climate change is predicted to affect Northeast fishery species differently (Hare et al. 2016), and the NMFS biological opinion discusses in detail the potential impacts of global climate change on protected species that occur within the Proposed Action area (NMFS 2013).

The Intergovernmental Panel on Climate Change released a special report in October 2018 that compared risks associated with an increase of global warming of 1.5 °C and an increase of 2 °C. The report found that climate-related risks depend on the rate, peak, and duration of global warming, and that an increase of 2 °C was associated with greater risks associated with climatic changes such as extreme weather and drought; global sea level rise; impacts on terrestrial ecosystems; impacts on marine biodiversity, fisheries, and ecosystems and their functions and services to humans; and impacts on health, livelihoods, food security, water supply, and economic growth (IPCC 2018).

Table F-4 summarizes regional plans and policies that are in place to address climate change, and Table F-5 summarizes resiliency plans.

Table F-4 Climate Change Plans and Policies

Plans and Policies	Summary/Goal
New York	
Order Adopting a Clean Energy Standard (State of New York Public Service Commission 2016)	Requirement that 50% of New York’s electricity come from renewable energy sources by 2030.

Plans and Policies	Summary/Goal
New York State Energy Plan 2015; 2017 Biennial Report to 2015 Plan (NYSERDA 2015, 2017a)	Requires 40% reduction in GHG from 1990 levels, 50% electricity to come from renewable energy resources, and a 600-trillion-British-thermal-unit increase in statewide energy efficiency.
Governor Cuomo State of State Address 2017, 2018, 2021	<p>2017: Set offshore wind energy development goal of 2,400 MW by 2030 (BOEM 2021b citing Governor’s Office 2017a).</p> <p>2018: Procurement of at least 800 MW of offshore wind power between two solicitations in 2018 and 2019; new energy efficiency target for investor-owned utilities to more than double utility energy efficiency progress by 2025; energy storage initiative to achieve 1,500 MW of storage by 2025 and up to 3,000 MW by 2030 (BOEM 2021b citing Governor’s Office 2018b, 2018c).</p> <p>2021: The governor’s 2021 agenda—Reimagine Rebuild Renew—establishes a goal of building out the renewable energy program. The agenda notes the development of two new offshore wind farms more than 20 miles offshore of Long Island, as well as the creation of dedicated offshore port facilities and additional transmission capacity development.</p>
Governor Hochul State of the State Address (2022)	<p>2022: Announced NYSERDA’s third offshore wind procurement to be initiated in 2022; the procurement is expected to result in at least 2 GW of new offshore wind projects.</p> <p>2022: Announced a \$500 million infrastructure investment to develop offshore wind manufacturing and supply chain infrastructure.</p> <p>2022: Announced a legislative proposal to ensure all new building construction reaches zero emissions by 2027, and to develop 2 million electrified or electrification-ready homes by 2030.</p>
New York State Offshore Wind Master Plan (2017) (NYSERDA 2017b)	Grants NYSERDA ability to award 25-year long-term contracts for projects ranging from approximately 200 MW to approximately 800 MW, with an ability to award larger quantities if sufficiently attractive proposals are received. Each proposer is also required to submit at least one proposal of approximately 400 MW. Bids are due in February 2019; awards are expected in spring 2019; and contracts are expected to be executed thereafter.
2020 Offshore Wind Solicitation	<p>As noted above, NYSERDA has provisionally awarded two offshore wind projects, totaling 2,490 MW. EW 2 (1,260 MW) and Beacon Wind (1,230 MW) of Equinor Wind US, LLC will generate enough clean energy to power 1.3 million homes and will be major economic drivers, supporting the following:</p> <ul style="list-style-type: none"> • More than 5,200 direct jobs • Combined economic activity of \$8.9 billion in labor, supplies, development, and manufacturing statewide • \$47 million in workforce development and just access funding
The Climate Leadership and Community Protection Act, enacted on July 18, 2019, signed into law in July 2019, and effective January 1, 2020	The act establishes economy-wide targets to reduce GHG emissions by 40% of 1990 levels by 2030 and 85% of 1990 levels by 2050.

Plans and Policies	Summary/Goal
New Jersey	
New Jersey Energy Master Plan (New Jersey State 2019)	Updated in 2019, the plan sets the framework to implement Executive Order 28 by decarbonizing and modernizing New Jersey’s energy system, expanding the clean energy innovation economy, and accelerating the deployment of renewable energy resources to meet the offshore wind energy generation goal established in Executive Order 92.
Executive Order 28: Measures to Advance New Jersey’s Clean Energy Economy (2018)	Sets target of total conversion of the state’s energy production profile to 100% clean energy sources on or before January 1, 2050.
Executive Order 92: Increase Offshore Wind Goal to 7,500 Megawatts by 2036 (2019)	Establishes a goal of 3,500 MW of offshore wind energy generation by 2030.
Executive Order 100: Protecting Against Climate Threats (PACT); Land Use Regulations and Permitting (2020)	Establishes a GHG monitoring and reporting program, establishes criteria to govern and reduce emissions, and integrates climate change considerations, such as sea level rise, into regulatory and permitting programs.

Table F-5 Resiliency Plans and Policies

Plans and Policies	Summary
New York	
Part 490 of Community Risk and Resiliency Act of 2014	Establishes statewide science-based sea-level rise projections for coastal regions of the state. As of 2019, NYSDEC is in the process of developing a State Flood Risk Management Guidance document for state agencies (NYSDEC n.d.).
NY Rising Community Reconstruction Program (2018)	\$20.4 million in projects on Long Island to help flood-prone communities plan and prepare for extreme weather events as they continue projects to recover from Superstorm Sandy, Hurricane Irene, and Tropical Storm Lee. Three projects were announced for Suffolk County and five for Nassau County (BOEM 2021b citing Governor’s Office 2018c).
New Jersey	
New Jersey Draft Climate Change Resilience Strategy (NJDEP 2021)	This is New Jersey’s first statewide climate resiliency strategy and was released as a draft in April 2021. The <i>Draft Climate Change Resilience Strategy</i> develops a framework for policy, regulatory, and operational changes to support the resilience of New Jersey’s communities, economy, and infrastructure. It includes 125 recommended actions across the following six priority areas: build resilient and healthy communities, strengthen the resilience of New Jersey’s ecosystems, promote coordinated governance, invest in information, increase public understanding, promote climate-informed investments and innovative financing, and coastal resilience plan.

F.2.12 Oil and Gas Activities

The proposed Project area is in the North Atlantic Planning Area of the OCS Oil and Gas Leasing Program (National OCS Program). On September 8, 2020, the White House issued a presidential

memorandum for the Secretary of the Interior on the withdrawal of certain areas of the United States OCS from leasing disposition for 10 years, including the areas currently designated by BOEM as the South Atlantic and Straits of Florida Planning Areas (The White House 2020a). The South Atlantic Planning Area includes the OCS off South Carolina, Georgia, and northern Florida. On September 25, 2020, the White House issued a similar memorandum for the Mid-Atlantic Planning Area that lies south of the northern administrative boundary of North Carolina (The White House 2020b). This withdrawal prevents consideration of these areas for any leasing for purposes of exploration, development, or production during the 10-year period beginning July 1, 2022, and ending June 30, 2032. However, currently, there has been no decision by the Secretary of the Interior regarding future oil and gas leasing in the North Atlantic or remainder of the Mid-Atlantic Planning Areas. Existing leases in the withdrawn areas are not affected.

BOEM issues geological and geophysical permits to obtain data for hydrocarbon exploration and production; locate and monitor marine mineral resources; aid in locating sites for alternative energy structures and pipelines; identify possible manmade, seafloor, or geological hazards; and locate potential archaeological and benthic resources. Geological and geophysical surveys are typically classified into categories by equipment type and survey technique. There are currently no such permits under review for areas offshore New York and New Jersey (BOEM 2021c).

Several liquefied natural gas ports are on the East Coast of the United States. Table F-6 lists existing, approved, and proposed liquified natural gas ports on the East Coast that provide (or may provide in the future) services such as natural gas export, natural gas supply to the interstate pipeline system or local distribution companies, storage of liquified natural gas for periods of peak demand, or production of liquified natural gas for fuel and industrial use. In addition, there are ten existing liquid natural gas export or import facilities and 18 liquid natural gas facilities that are approved but have not been constructed across the Gulf Coast states of Texas, Louisiana, and Mississippi (FERC 2022a, 2022b).

Table F-6 Liquid Natural Gas Terminals in the Eastern United States

Terminal Name	Type	Company	Jurisdiction	Status
Everett, MA	Import terminal	GDF SUEZ—DOMAC	FERC	Existing
Offshore Boston, MA	Import terminal	Neptune LNG	MARAD/USCG	Existing
Offshore Boston, MA	Import terminal, authorized to re-export delivered LNG	Excelerate Energy—Northeast Gateway	MARAD/USCG	Existing
Cove Point, MD (Chesapeake Bay)	Import terminal	Dominion—Cove Point LNG	FERC	Existing
Elba Island, GA (Savannah River)	Import terminal	El Paso—Southern LNG	FERC	Existing
Elba Island, GA (Savannah River)	Export terminal	Southern LNG Company	FERC	Existing
Jacksonville, FL	Export terminal	Eagle LNG Partners	FERC	Proposed

Source: FERC 2022a, 2022b.

DOMAC = Distrigas of Massachusetts; FL = Florida; GA = Georgia; LNG = liquified natural gas; MA = Massachusetts; MARAD = U.S. Department of Transportation Maritime Administration; MD = Maryland

F.2.13 Onshore Development Activities

Onshore development activities that may contribute to cumulative impacts include visible infrastructure such as onshore wind turbines and cell towers, port development, and other energy projects such as transmission and pipeline projects. Coastal development projects permitted through regional planning

commissions, counties, and towns may also contribute to cumulative impacts. These may include residential, commercial, and industrial developments spurred by population growth in the region (Table F-7).

Table F-7 Existing, Approved, and Proposed Onshore Development Activities

Type	Description
Local planning documents	<p>City of New York <i>2021–2025 Consolidated Plan</i> (NYC Planning 2021) <i>Nassau County Master Plan</i> (Nassau County Planning Department 2010) <i>Creating Resilience: A Planning Initiative, City of Long Beach Comprehensive Plan</i> (City of Long Beach 2018) <i>Staten Island Comprehensive Economic Development Strategy 2020</i> (Staten Island Economic Development Corporation 2020) <i>Plan CC Comprehensive Plan</i> (City of Corpus Christi 2016) <i>Aransas Pass 2018 Comprehensive Plan</i> (Aransas Pass 2018)</p>
Oceanside POI	<p>Long Island Power Authority is proposing to build a new substation (Hampton Road Substation) on the EW 2 Onshore Substation A parcel to improve the existing power grid and support the interconnection of EW 2. The Hampton Road Substation would serve to step down the voltage from 345 kV to 138 kV and would include the POI to interconnect EW 2 into the existing electric grid. The Hampton Road Substation would house both 345-kV and 138-kV substation facilities, including a new 345-kV gas-insulated switchgear breaker array, two new 345-/138-kV step-down transformers, and a 138-kV gas-insulated switchgear breaker array. Improvements would also include four underground 138-kV loop-in/loop-out lines that would connect from the Hampton Road Substation to Long Island Power Authority’s existing transmission lines under Lawson Boulevard in Oceanside within an approximately 0.1-mile (0.2-kilometer)-long cable corridor. If final design determines that the loop-in/loop-out lines would be oil-filled rather than solid dielectric, an oil pump station would also be part of the planned facilities (Empire 2023).</p>
Onshore wind projects	<p>According to the U.S. Geological Survey, there are two onshore wind projects within the 40-mile viewshed of the Projects. The Bayonne Wind Energy Project consists of one 1.5-MW turbine with a tip height of 103.6 meters and a rotor diameter of 77 meters (Hoen et al. 2021). Additionally, there is one unnamed onshore wind project in Sunset Park, Brooklyn that consists of one turbine. The specifications of that turbine are unknown.</p>
Communications towers	<p>There are numerous communication towers in communities within the viewshed of the Projects. For example, there are 17 towers within a 3-mile radius of Long Beach, New York; 38 communication towers within a 3-mile radius of Oceanside, New York; and 362 communication towers within a 3-mile radius of Gowanus (Brooklyn), New York (AntennaSearch.com 2023).</p>

Type	Description
Development projects	<p>As part of New York State’s \$100 billion infrastructure project, \$5.6 billion will go to transform the Long Island Railroad to improve system connectivity. Within Suffolk County, the following stations will receive funds for upgrades: Brentwood, Deer Park, East Hampton, Northport, Ronkonkoma, Stony Brook, Port Jefferson, and Wyandanch. The East Hampton historic Long Island Railroad station will undergo upgrades and modernizations (Metropolitan Transit Authority 2017; BOEM 2021b citing Governor’s Office 2017b). Additional plans for transit-oriented design and highway improvements are planned in Suffolk County in state and county planning documents.</p> <p>The Fire Island Inlet to Montauk Point Project is a \$1.2 billion project by USACE, NYSDEC, and Long Island, New York municipalities to engage in inlet management; beach, dune, and berm construction; breach response plans; raising and retrofitting 4,400 homes; road-raising; groin modifications; and coastal process features. Within Suffolk County, portions of the Towns of Babylon, Islip, Brookhaven, Southampton, and East Hampton; 12 incorporated villages along Long Island’s south shore (mainland); Fire Island National Seashore; and the Poospatuck and Shinnecock Indian Reservations will be involved in this project (USACE 2018).</p>
Port studies/ upgrades	<p>Ports in New York may require upgrades to support the offshore wind industry developing in the northeastern United States. Upgrades may include onshore developments or underwater improvements (such as dredging).</p> <p>In December 2017, NYSERDA issued an offshore wind master plan that assessed 54 distinct waterfront sites along the New York Harbor and Hudson River and 11 distinct areas with multiple small sites along the Long Island coast. Twelve waterfront areas and five distinct areas were singled out for “potential to be used or developed into facilities capable of supporting OSW projects” (Table 26, NYSERDA 2017b). Nearly all identified sites would require some level of infrastructure upgrade (from minimal to significant) depending on offshore wind activities intended for the site. Particular sites of interest include Red Hook-Brooklyn, SBMT, and the Port of Coeymans (NYSERDA 2017b). For additional information regarding specific proposed improvements to these ports, see Capital Region Economic Development Council 2018, American Association of Port Authorities 2016, Rulison 2018, and NYCEDC 2018.</p> <p>New York State proposed port improvements include the governor’s 2021 agenda “Reimagine Rebuild Renew,” which includes upgrades to create five dedicated port facilities for offshore wind, including the following:</p> <ul style="list-style-type: none"> • The nation’s first offshore wind tower manufacturing facility, to be built at the Port of Albany • An offshore wind turbine staging facility and O&M hub to be established at SBMT • Increasing the use of the Port of Coeymans for cutting-edge turbine foundation manufacturing • Buttressing ongoing O&M out of Port Jefferson and Port of Montauk Harbor in Long Island <p>Corpus Christi Polymers, LLC is planning to finish construction of a partially completed chemical manufacturing plant on Port of Corpus Christi property on the north side of the Inner Harbor area of Corpus Christi Bay. The \$1.1 billion plant would produce between 1.1 million and 1.3 million metric tons of purified terephthalic acid and polyethylene terephthalate and would be the largest of its kind in the world. Completion of the project is expected to be in 2023 (Market Report Company 2022).</p> <p>Several new saltwater desalination plants are being proposed in the Corpus Christi area. The City of Corpus Christi is pursuing development of a saltwater desalination plant with a capacity of up to 30 mgd on property on the Inner Harbor Ship Channel</p>

Type	Description
	<p>and a 20- to 40-mgd saltwater desalination plant on a site near the La Quinta Ship Channel. The Port of Corpus Christi is pursuing development of a 30-mgd saltwater desalination plant on a site near the La Quinta Ship Channel and 50-mgd saltwater desalination plant on Harbor Island adjacent to the Corpus Christi Ship Channel (Virtual Builders Exchange 2022).</p> <p>The Port of Corpus Christi is partnering with Bluewater Texas Terminal to build two single-point mooring buoys 21 nm from the mouth of the Corpus Christi Ship Channel to serve as new offshore oil terminals. The offshore terminals will be used to load Very Large Crude Carriers at production rates of up to 80,000 barrels per hour with throughput capacities of 16 Very Large Crude Carriers per month. Crude oil from Permian and Eagle Ford shale plays will feed the export port via pipelines connected to the Harvest Midway Terminal, a planned multi-use crude oil storage terminal near Taft, Texas (Corpus Christi Business News 2020).</p>

mgd = million gallons per day

F.3. References Cited

American Association of Port Authorities. 2016. *Port-Related Projects Awarded \$61.8 Million in TIGER VIII Infrastructure Grants*. Available: <https://www.aapa-ports.org/advocating/PRDetail.aspx?ItemNumber=21393>. Accessed: December 20, 2018.

AntennaSearch.com. 2023. Tower and Antenna Database. Available: www.antennasearch.com.

Atlantic States Marine Fisheries Commission (ASMFC). 2018. *Management, Policy and Science Strategies for Adapting Fisheries Management to Changes in Species Abundance and Distribution Resulting from Climate Change*. February. Available: http://www.asmfc.org/files/pub/ClimateChangeWorkGroupGuidanceDocument_Feb2018.pdf. Accessed: January 7, 2019.

Atlantic States Marine Fisheries Commission (ASMFC). 2019. *ASMFC Five-Year Strategic Plan 2019–2023*. Available: http://www.asmfc.org/files/pub/2019-2023StrategicPlan_Final.pdf. Accessed: March 2022.

Atlantic States Marine Fisheries Commission (ASMFC). 2021. *Atlantic States Marine Fisheries Commission 2022 Action Plan*. Available: <http://www.asmfc.org/files/pub/2022ActionPlan.pdf>. Accessed: March 2022.

Aransas Pass. 2018. *Aransas Pass 2018 Comprehensive Plan*.

Bureau of Ocean Energy Management (BOEM). 2016. *Revised Environmental Assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New York*. OCS EIS/EA BOEM 2016-070. October 2016.

Bureau of Ocean Energy Management (BOEM). 2018. *Marine Minerals: Requests and Active Leases*. Last updated August 27, 2018. Available: <https://www.boem.gov/Requests-and-Active-Leases/>. Accessed: December 6, 2021.

Bureau of Ocean Energy Management (BOEM). 2019. *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Continental Shelf*. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Sterling, VA. OCS Study 2019-036.

- Bureau of Ocean Energy Management (BOEM). 2021a. *Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement*. OCS EIS/EA, BOEM 2021-0012. March.
- Bureau of Ocean Energy Management (BOEM). 2021b. *South Fork Wind Farm and South Fork Export Cable Project Final Environmental Impact Statement*. OCS EIS/EA, BOEM 2020-057. August.
- Bureau of Ocean Energy Management (BOEM). 2021b. Citing Governor's Office. 2017a. *2017 State of the State*.
- Bureau of Ocean Energy Management (BOEM). 2021b. Citing Governor's Office. 2017b. Governor Cuomo Announces Historic \$5.6 Billion Transformation of the Long Island Rail Road. July 19, 2017.
- Bureau of Ocean Energy Management (BOEM). 2021b. Citing Governor's Office. 2018b. Governor Cuomo Announces Dramatic Increase in Energy Efficiency and Energy Storage Targets to Combat Climate Change. December 13.
- Bureau of Ocean Energy Management (BOEM). 2021b. Citing Governor's Office. 2018c. *2018 State of the State*.
- Bureau of Ocean Energy Management (BOEM). 2021c. Submitted Atlantic OCS Region Permit Requests. Available: <https://www.boem.gov/submitted-atlantic-ocs-region-permit-requests>. Accessed: July 16, 2021.
- Bureau of Ocean Energy Management (BOEM). 2021d. *Commercial and Research Wind Lease and Grant Issuance and Associated Site Assessment Activities on the Atlantic Outer Continental Shelf of the New York Bight*. OCS EIS/EA BOEM 2021-073. December.
- Capital Region Economic Development Council. 2018. *Capital Region Creates 2018 Progress Report*. Available: <http://www.regionalcouncils.ny.gov/sites/default/files/2018-10/CapitalRegion2018ProgressReport.pdf>. Accessed: December 18, 2018.
- City of Corpus Christi. 2016. *Plan CC Comprehensive Plan*. September.
- City of Long Beach. 2018. *Creating Resilience: A Planning Initiative, City of Long Beach Comprehensive Plan*. Available: https://www.longbeachny.gov/vertical/sites/%7BC3C1054A-3D3A-41B3-8896-814D00B86D2A%7D/uploads/Draft_Comp_Plan_012318_rev.pdf. Accessed: September 29, 2021.
- Corpus Christi Business News 2020. Port Corpus Christi approves deepwater terminal. December 18. Available: <https://www.ccbiznews.com/news/port-corpus-christi-approoves-deepwater-terminal>. Accessed: January 19, 2022.
- Empire Offshore Wind, LLC (Empire). 2023. *Empire Offshore Wind: Empire Wind Project (EW1 and EW2), Construction and Operations Plan*. Available: <https://www.boem.gov/renewable-energy/empire-wind-construction-and-operations-plan>.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Globalsecurity.org. 2018. "Narragansett Bay Complex." Available: <https://www.globalsecurity.org/military/facility/moa-narra.htm>.
- Empire Offshore Wind, LLC (Empire). 2023. Citing Marine Cadastre. 2019. "Ocean Disposal Sites." Available: <https://marinecadastre.gov/nationalviewer/>. Accessed: December 6, 2021.

- Federal Energy Regulatory Commission (FERC). 2012. Order Issuing Project Pilot License. Verdant Power, LLC. Project Number 12611-005. Available: <https://www.ferc.gov/media/news-releases/2012/2012-1/01-23-12-order.pdf?csrt=4969462846396361735>. Accessed: October 30, 2018.
- Federal Energy Regulatory Commission (FERC). 2022a. North American LNG Export Terminals – Existing, Approved, Not Yet Built, and Proposed, and North American LNG Export Terminals. Available: <https://cms.ferc.gov/media/north-american-lng-export-terminals-existing-approved-not-yet-built-and-proposed-8>. Last updated August 30, 2022. Accessed: September 2022.
- Federal Energy Regulatory Commission (FERC). 2022b. North American LNG Import Terminals – Existing, Approved, Not Yet Built, and Proposed, and North American LNG Import Terminals, Existing, Approved, Not Yet Built, and Proposed. Available: <https://cms.ferc.gov/media/north-american-lng-import-terminals-existing-approved-not-yet-built-and-proposed-8>. Last Updated August 30, 2022. Accessed: September 2022.
- Hare, J. A., W. E. Morrison, M. W. Nelson, M. M. Stachura, E. J. Teeters, and R. B. Griffis. 2016. A Vulnerability Assessment of Fish and Invertebrates to Climate Change on the Northeast U.S. Continental Shelf. *PLOS ONE* 11(2): e0146756. DOI:10.1371/journal.pone.0146756.
- Hoen, B. D., J. E. Diffendorfer, J. T. Rand, L. A. Kramer, C. P. Garrity, and H. E. Hunt. 2021. United States Wind Turbine Database V4.0 (April 9, 2021): U.S. Geological Survey, American Clean Power Association, and Lawrence Berkeley National Laboratory data release. Available: <https://doi.org/10.5066/F7TX3DN0>.
- Intergovernmental Panel on Climate Change (IPCC). 2018. *IPCC Special Report on Impacts of Global Warming of 1.5 Degrees Celsius Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty: Summary for Policymakers*. Available: http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf. Accessed: November 5, 2018.
- Market Report Company. 2022. News of polymer market. Available: http://www.mrcplast.com/news-news_open-368137.html. Accessed: January 18, 2022.
- Metropolitan Transit Authority. 2017. “Governor Cuomo Proposes \$120 Million to Enhance 16 LIRR Stations and Improve System Connectivity with MacArthur Airport and Brookhaven National Laboratory.” January 10. Available: <http://www.mta.info/news/2017/01/10/governor-cuomo-proposes-120-million-enhance-16-lirr-stations-and-improve-system>. Accessed: December 19, 2018.
- Mid-Atlantic Fishery Management Council (MAFMC). 2019. “About the Council.” Available: <http://www.mafmc.org/about/>. Accessed: January 8, 2019.
- Minerals Management Service. 2007. *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf*. Available: <https://www.boem.gov/Guide-To-EIS/>. Accessed: January 1, 2019.
- Nassau County Planning Department. 2010. *2010 Nassau County Master Plan*. Available: <https://www.nassaucountyny.gov/2872/Master-Plan>. Accessed: September 29, 2021.

- National Marine Fisheries Service (NMFS). 2013. *Endangered Species Act Section 7 Consultation Biological Opinion for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf in Massachusetts, Rhode Island, New York and New Jersey Wind Energy Areas*. NER-2012-9211.
- National Oceanic and Atmospheric Administration (NOAA). 1997. *Amendment 3 to the Interstate Fishery Management Plan for American Lobster*. Available: <http://www.asmfc.org/uploads/file/lobsterAmendment3.pdf>. Accessed: February 28, 2019.
- New England Fishery Management Council (NEFMC). 2016. *Omnibus Essential Fish Habitat Amendment 2, Volume 6: Cumulative Effects, Compliance with Applicable Law and References*. Available: https://s3.amazonaws.com/nefmc.org/OA2-FEIS_Vol_6_FINAL_170303.pdf. Accessed: October 30, 2018.
- New Jersey Department of Environmental Protection (NJDEP). 2021. *Draft Climate Change Resilience Strategy*. Available: <https://www.nj.gov/dep/climatechange/resilience-strategy.html>. Accessed: July 21, 2021.
- New Jersey Division of Fish and Wildlife. 2021. *Marine Fisheries Management Rule Amendment Proposal with Amendments to Rules governing Crab and Lobster Management, Commercial Atlantic Menhaden Fishery, Marine Fisheries, and Fishery Management in New Jersey*. Published March 1, 2021, NJ Register. Available: https://www.nj.gov/dep/fgw/news/2021/marine_rules_proposed.htm. Accessed: July 22, 2021.
- New Jersey State. 2019. *Energy Master Plan Pathway to 2050*. Available: https://nj.gov/emp/docs/pdf/2020_NJBPU_EMP.pdf. Accessed: July 20, 2021.
- New York City Economic Development Corporation (NYCEDC). 2018. *New York Works: NYCDC Announces Transformation of South Brooklyn Maritime Shipping Hub, Creating over 250 Jobs in the Near-Term*. May 8, 2018. Available: <https://www.nycedc.com/press-release/new-york-works-nycdc-announces-transformation-south-brooklyn-maritime-shipping-hub>. Accessed: December 19, 2018.
- New York City (NYC) Planning. 2021. *Consolidated Plan, 2021-2025*. Available: <https://www1.nyc.gov/assets/planning/download/pdf/about/consolidated-plan/2021-2025-con-plan.pdf>. Accessed: September 29, 2021.
- New York State Department of Environmental Conservation (NYSDEC). No date. *Community Risk and Resiliency Act (CRRRA)*. Available: <https://www.dec.ny.gov/energy/102559.html>. Accessed: January 17, 2019.
- New York State Department of Environmental Conservation (NYSDEC). 2017. *New York Ocean Action Plan 2017–2027*. Available: https://www.dec.ny.gov/docs/fish_marine_pdf/nyoceanactionplan.pdf. Accessed: January 13, 2019.
- New York State Energy Research and Development Authority (NYSERDA). 2015. *Clean Energy Plan*. Available: <https://energyplan.ny.gov/-/media/nysenergyplan/2015-state-energy-plan.pdf>. Accessed: January 5, 2019.
- New York State Energy Research and Development Authority (NYSERDA). 2017a. *Biennial Report to the 2015 State Energy Plan*. Available: <https://energyplan.ny.gov/-/media/nysenergyplan/2017-BiennialReport-printer-friendly.pdf>. Accessed: February 1, 2019.

- New York State Energy Research and Development Authority (NYSERDA). 2017b. *New York State Offshore Wind Master Plan*. NYSERDA Report 17-25b. Available: <https://www.nyserda.ny.gov/All-Programs/Programs/Offshore-Wind/Offshore-Wind-in-New-York-State-Overview/NYS-Offshore-Wind-Master-Plan>. Accessed: December 20, 2018.
- Rulison, L. 2018. Port of Albany Plans Giant Warehouse in Bethlehem. *Times Union*. Published August 24, 2018. Available: <https://www.timesunion.com/business/article/Port-of-Albany-plans-giant-warehouse-in-Bethlehem-13180505.php>. Accessed: December 20, 2018.
- State of New York Public Service Commission. 2016. Order Adopting a Clean Energy Standard. 8/1/2016. Available: <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7b44C5D5B8-14C3-4F32-8399-F5487D6D8FE8%7d>. Accessed: January 29, 2019.
- Staten Island Economic Development Corporation. 2020. *Staten Island Comprehensive Economic Development Strategy 2020*. Available: <https://static1.squarespace.com/static/5b7455833917eea0cc03d384/t/5eb04a4abc84607ce3f2da41/1588611670485/SIEDC+CEDS+Report+Final+Draft+04.28.2020-compressed.pdf>. Accessed: September 29, 2021.
- U.S. Army Corps of Engineers (USACE). 2018. Fire Island Inlet to Montauk Point (FIMP) Project. Available: <https://www.nan.usace.army.mil/Missions/Civil-Works/Projects-in-New-York/Fire-Island-to-Montauk-Point-Reformulation-Study/>. Accessed: December 2018.
- U.S. Army Corps of Engineers (USACE). 2021a. *Public Notice: Bay Ridge and Red Hook Channels, New York. Federal Navigation Project Maintenance Dredging*. March 11. Available: https://www.nan.usace.army.mil/Portals/37/docs/regulatory/publicnotices/Operation%20and%20Maintenance/2021/BRRH21%20Public%20Notice_Final.pdf.
- U.S. Army Corps of Engineers (USACE). 2021b. Fact Sheet: Arthur Kill Channel, Howland Hook Marine Terminal, New York and New Jersey (41 Ft Project). March 29. Available: <https://www.nan.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/487404/fact-sheet-arthur-kill-channel-howland-hook-marine-terminal-ny-nj-41-ft-project/>.
- U.S. Army Corps of Engineers (USACE). 2021c. *Newark Bay, New Jersey Federal Navigation Project Maintenance Dredging*. Public Notice No. Newark Bay, NJ FY21. May.
- U.S. Army Corps of Engineers (USACE). 2022a. USACE Galveston District Operations Dashboard. <https://experience.arcgis.com/experience/d4ba5e6561334e259297f0a50bc47127>. Accessed: January 18, 2022.
- U.S. Army Corps of Engineers (USACE). 2022b. Port of Corpus Christi Authority Channel Deepening Project Fact Sheet. June 2020. <https://pccaaisproject.com/fact-sheet/>. Accessed: January 19, 2022.
- The White House. 2020a. Memorandum on the Withdrawal of Certain Areas of the United States Outer Continental Shelf from Leasing Disposition. Available: <https://www.whitehouse.gov/presidential-actions/memorandum-withdrawal-certain-areas-united-states-outer-continental-shelf-leasing-disposition/>. Accessed: September 25, 2020.
- The White House. 2020b. Presidential Determination on the Withdrawal of Certain Areas of the United States Outer Continental Shelf from Leasing Disposition. Available: <https://www.whitehouse.gov/presidential-actions/presidential-determination-withdrawal-certain-areas-united-states-outer-continental-shelf-leasing-disposition/>. Accessed: October 8, 2020.

Verdant Power. 2018. Roosevelt Island Tidal Energy Project – FERC No. P-12611. Available: <https://www.verdantpower.com/rite>. Accessed: December 21, 2018.

Virtual Builders Exchange. 2021. Corpus Christi: As Inner Harbor Desalination Plant Proceeds, Harbor Island Desalination Plant in Doubt. February 25. Available: <https://www.virtualbx.com/construction-preview/corpus-christi-as-inner-harbor-desalination-plant-proceeds-harbor-island-desalination-plant-in-doubt/>. Accessed: January 19, 2022.

This page intentionally left blank.

ATTACHMENT 1
ONGOING AND FUTURE NON-OFFSHORE WIND ACTIVITY ANALYSIS

This page intentionally left blank.

LIST OF TABLES

Table F1-1	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Air Quality	F-29
Table F1-2	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Bats	F-31
Table F1-3	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Benthic Resources	F-33
Table F1-4	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Birds	F-38
Table F1-5	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Terrestrial and Coastal Fauna.....	F-43
Table F1-6	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Coastal Habitats	F-44
Table F1-7	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Commercial Fisheries and For-Hire Recreational Fishing	F-48
Table F1-8	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Cultural Resources.....	F-54
Table F1-9	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Demographics, Employment, and Economics	F-59
Table F1-10	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Environmental Justice	F-62
Table F1-11	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Finfish, Invertebrates, and Essential Fish Habitat.....	F-65
Table F1-12	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Land Use and Coastal Infrastructure	F-73
Table F1-13	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Marine Mammals.....	F-74
Table F1-14	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Navigation and Vessel Traffic	F-84
Table F1-15	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Military and National Security Uses	F-86
Table F1-16	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Aviation and Air Traffic.....	F-87
Table F1-17	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Cables and Pipelines	F-88
Table F1-18	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Radar Systems	F-88
Table F1-19	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Scientific Research and Surveys	F-89
Table F1-20	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Recreation and Tourism.....	F-89
Table F1-21	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Sea Turtles	F-92
Table F1-22	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Scenic and Visual Resources	F-101

Table F1-23	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Water Quality.....	F-103
Table F1-24	Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Wetlands	F-106

BOEM developed the following tables based on its 2019 study *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf* (BOEM 2019), which evaluates potential impacts associated with ongoing and future non-offshore wind activities.

Table F1-1 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Air Quality

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	Accidental releases of air toxics HAPs are due to potential chemical spills. Ongoing releases occur in low frequencies. These may lead to short-term periods of toxic pollutant emissions through surface evaporation. According to the U.S. Department of Energy, 31,000 barrels of petroleum are spilled into U.S. waters from vessels and pipelines in a typical year. Approximately 40.5 million barrels of oil were lost as a result of tanker incidents from 1970 to 2009, according to International Tanker Owners Pollution Federation Limited, which collects data on oil spills from tankers and other sources. From 1990 to 1999, the average annual input to the coastal Northeast was 220,000 barrels of petroleum and offshore it was up to less than 70,000 barrels.	Accidental releases of air toxics or HAPs will be due to potential chemical spills. See Table F1-23 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 35 years would increase the risk of accidental releases. These may lead to short-term periods of toxic pollutant emissions through evaporation. Air quality impacts will be short-term and limited to the local area at and around the accidental release location.
Air emissions: Construction and decommissioning	Air emissions originate from combustion engines and electric power generated by burning fuel. These activities are regulated under the CAA to meet set standards. Air quality has generally improved over the last 35 years; however, some areas in the Northeast have experienced a decline in air quality over the last 2 years. Some areas of the Atlantic coast remain in nonattainment for ozone, with the source of this pollution from power generation. Many of these states have made commitments toward cleaner energy goals to improve this, and offshore wind is part of these goals. Primary processes and activities that can affect the air quality impacts are expansions and modifications to existing fossil fuel power plants, onshore and offshore	The largest air quality impacts over the next 35 years will occur during the construction phase of any one project; however, projects will be required to comply with the CAA. During the limited construction and decommissioning phases, emissions may occur that are above <i>de minimis</i> thresholds and will require offsets and mitigation. Primary emission sources will be increased commercial vehicular traffic, air traffic, public vehicular traffic, and combustion emissions from construction equipment and fugitive emissions from construction-generated dust. As projects come online, power generation emissions overall will decline and the industry as a whole will have a net benefit on air quality.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Air emissions: O&M	activities involving renewable energy facilities, and various construction activities.	Activities associated with O&M of onshore wind projects will have a proportionally very small contribution to emissions compared to the construction and decommissioning activities over the next 35 years. Emissions will largely be due to commercial vehicular traffic and operation of emergency diesel generators. Such activity will result in short-term, intermittent, and widely dispersed emissions and small air quality impacts.
Air emissions: Power generation emissions reductions		Many Atlantic states have committed to clean energy goals, with offshore wind being a large part of that. Other reductions include transitioning to onshore wind and solar. The No Action Alternative without implementation of other future offshore wind projects would likely result in increased air quality impacts regionally due to the need to construct and operate new energy generation facilities to meet future power demands. These facilities may consist of new natural-gas-fired power plants, coal-fired, oil-fired, or clean-coal-fired plants. These types of facilities would likely have larger and continuous emissions and result in greater regional scale impacts on air quality.
Climate change	The construction, operation, and decommissioning of offshore wind projects would produce GHG emissions (nearly all CO ₂) that can contribute to climate change; however, these contributions would be minuscule compared to aggregate global emissions. CO ₂ is relatively stable in the atmosphere and generally mixed uniformly throughout the troposphere and stratosphere. Hence the impact of GHG emissions does not depend upon the source location. Increasing energy production from offshore wind projects will likely decrease GHGs emissions by replacing energy from fossil fuels.	Development of future onshore wind projects will produce a small overall increase in GHG emissions over the next 35 years. However, these contributions would be very small compared to the aggregate global emissions. The impact on climate change from these activities would be very small. As more projects come online, some reduction in GHG emissions from modifications of existing fossil fuel facilities to reduce power generation. Overall, it is anticipated that there would be no cumulative impact on global warming as a result of onshore wind project activities.

HAP = hazardous air pollutant; hazmat = hazardous materials

Table F1-2 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Bats

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded and would result in high-intensity, low-exposure level, long-term, but localized intermittent risk to bats in nearshore waters. Direct impacts are not expected to occur as recent research has shown that bats may be less sensitive to TTS than other terrestrial mammals (Simmons et al. 2016). Indirect impacts (i.e., displacement from potentially suitable habitats) could occur as a result of construction activities, which could generate noise sufficient to cause avoidance behavior (Schaub et al. 2008). Construction activity would be temporary and highly localized.	Similar to ongoing activities, noise associated with pile driving activities would be limited to nearshore waters, and these high-intensity, but low-exposure risks would not be expected to result in direct impacts. Some indirect impacts (i.e., displacement from potentially suitable foraging habitats) could occur as a result of construction activities, which could generate noise sufficient to cause avoidance behavior (Schaub et al. 2008). Construction activity would be temporary and highly localized, and no population-level effects would be expected.
Noise: Construction	Onshore construction occurs regularly for generic infrastructure projects in the bats geographic analysis area. There is a potential for displacement caused by equipment if construction occurs at night (Schaub et al. 2008). Any displacement would only be temporary. No individual or population level impacts would be expected. Some bats roosting in the vicinity of construction activities may be disturbed during construction but would be expected to move to a different roost farther from construction noise. This would not be expected to result in any impacts as frequent roost switching is a common component of a bat's life history (Hann et al. 2017; Whitaker 1998).	Onshore construction is expected to continue at current trends. Some behavioral responses and avoidance of construction areas may occur (Schaub et al. 2008). However, no injury or mortality would be expected.
Presence of structures: Migration disturbances	There may be few structures scattered throughout the offshore bats geographic analysis area, such as navigation and weather buoys and light towers. Migrating bats can easily fly around or over these sparsely distributed structures, and no migration disturbance would be expected. Bat use of offshore areas is very limited and generally restricted to spring and fall migration. Very few bats would be expected to encounter structures on the OCS and no population-level effects would be expected.	The infrequent installation of future new structures in the marine environment of the next 35 years is expected to continue. As described under Ongoing Activities, these structures would not be expected to cause disturbance to migrating tree bats in the marine environment.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Turbine strikes	There may be few structures in the offshore bats geographic analysis area, such as navigation and weather buoys, turbines, and light towers. Migrating tree bats can easily fly around or over these sparsely distributed structures, and no strikes would be expected.	The infrequent installation of future new structures in the marine environment of the next 35 years is expected to continue. As described under Ongoing Activities, these structures would not be expected to result in increased collision risk to migrating tree bats in the marine environment.
Land disturbance: onshore construction	Onshore construction activities are expected to continue at current trends. Potential direct effects on individuals may occur if construction activities include tree removal when bats are potentially present. Injury or mortality may occur if trees being removed are occupied by bats at the time of removal. While there is some potential for indirect impacts associated with habitat loss, no individual or population-level effects would be expected.	Future non-offshore wind development would continue to occur at the current rate. This development has the potential to result in habitat loss and could result in injury or mortality of individuals.
Climate change: Warming and sea level rise, storm severity/frequency	Storms during breeding and roosting season can reduce productivity and increase mortality. Intensity of this impact is speculative.	No future activities were identified within the bats geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, increased disease frequency	Disease can weaken, lower reproductive output, and/or kill individuals. Some tropical diseases will move northward. Extent and intensity of this impact is highly speculative.	No future activities were identified within the bats geographic analysis area other than ongoing activities.

Table F1-3 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Benthic Resources

Associated IPFs: Sub-IFPs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table F1-23 for a discussion of ongoing accidental releases. Accidental releases of hazmat occur periodically, mostly consisting of fuels, lubricating oils, and other petroleum compounds. Because most of these materials tend to float in seawater, they rarely contact benthic resources. The chemicals with potential to sink or dissolve rapidly often dilute to non-toxic levels before they affect benthic resources. The corresponding impacts on benthic resources are rarely noticeable.	Gradually increasing vessel traffic over the next 35 years would increase the risk of accidental releases. See previous cell and Table F1-23 on water quality for details.
Accidental releases: Invasive species	Invasive species are periodically released accidentally during ongoing activities, including the discharge of ballast water and bilge water from marine vessels. The impacts on benthic resources (e.g., competitive disadvantage, smothering) depend on many factors, but can be noticeable, widespread, and permanent.	No future activities were identified within the geographic analysis area other than ongoing activities.
Accidental releases: Trash and debris	Ongoing releases of trash and debris occurs from onshore sources, fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying. However, there does not appear to be evidence that ongoing releases have detectable impacts on benthic resources.	No future activities were identified within the geographic analysis area other than ongoing activities.
Anchoring	Regular vessel anchoring related to ongoing military, survey, commercial, and recreational activities continue to cause temporary to permanent impacts in the immediate area where anchors and chains meet the seafloor. These impacts include increased turbidity levels and the potential for direct contact to cause injury and mortality of benthic resources, as well as physical damage to their habitats. All impacts are localized; turbidity is temporary; injury and mortality are recovered in the short term; and physical damage can be permanent if it occurs in eelgrass beds or hard bottom.	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
EMFs	<p>EMFs continuously emanate from existing telecommunication and electrical power transmission cables. New cables generating EMFs are infrequently installed in the geographic analysis area. Some benthic species can detect EMFs, although EMFs do not appear to present a barrier to movement.</p> <p>The extent of impacts (behavioral changes) is likely less than 50 feet (15.2 meters) from the cable and the intensity of impacts on benthic resources is likely undetectable.</p>	<p>No future activities were identified within the geographic analysis area other than ongoing activities.</p>
New cable emplacement/maintenance	<p>Cable maintenance activities infrequently disturb benthic resources and cause temporary increases in suspended sediment; these disturbances would be local and limited to the emplacement corridor. New cables are infrequently added near shore. Cable emplacement/maintenance activities injure and kill benthic resources, and result in temporary to long-term habitat alterations. The intensity of impacts depends on the time (season) and place (habitat type) where the activities occur. (See also the IPFs of Seabed profile alterations and Sediment deposition and burial.)</p>	<p>There are three planned submarine cables in the geographic analysis area including two transmission cables and one telecommunications cable. Impacts of planned cable emplacement would be the same as described for ongoing activities.</p>
Noise: Onshore/offshore construction	<p>See Table F1-11 on finfish, invertebrates, and EFH. Detectable impacts of construction noise on benthic resources rarely, if ever, overlap from multiple sources.</p>	<p>See Table F1-11 on finfish, invertebrates, and EFH. Detectable impacts of construction noise on benthic resources would rarely, if ever, overlap from multiple sources.</p>
Noise: G&G	<p>See Table F1-11 on finfish, invertebrates, and EFH. Detectable impacts of G&G noise on benthic resources rarely, if ever, overlap from multiple sources.</p>	<p>See Table F1-11 on finfish, invertebrates, and EFH. Detectable impacts of G&G noise on benthic resources would rarely, if ever, overlap from multiple sources.</p>
Noise: O&M	<p>See Table F1-11 on finfish, invertebrates, and EFH.</p>	<p>See Table F1-11 on finfish, invertebrates, and EFH.</p>
Noise: Pile driving	<p>Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can cause injury and/or mortality to benthic resources in a small area around each pile and can cause short-term stress and behavioral changes to individuals over a greater area. The extent depends on pile size, hammer energy, and local acoustic conditions.</p>	<p>No future activities were identified within the geographic analysis area other than ongoing activities.</p>

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: Cable laying/ trenching	Infrequent trenching activities for pipeline and cable laying, as well as other cable burial methods, emit noise. These disturbances are local, temporary, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	New or expanded submarine cables and pipelines are likely to occur in the geographic analysis area. These disturbances would be infrequent over the next 35 years, local, temporary, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.
Port utilization: Expansion	See Table F1-11 on finfish, invertebrates, and EFH.	See Table F1-11 on finfish, invertebrates, and EFH.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear are periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. The lost gear, moved by currents, can disturb, injure, or kill benthic resources, creating small, short-term, localized impacts.	Future new cables would present additional risk of gear loss, resulting in small, short-term, localized impacts (disturbance, injury).
Presence of structures: Hydrodynamic disturbance	See Table F1-11 on finfish, invertebrates, and EFH.	See Table F1-11 on finfish, invertebrates, and EFH.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables continuously create uncommon relief in a mostly sandy seascape. Structure-oriented fishes are attracted to these locations. Increased predation upon benthic resources by structure-oriented fishes can adversely affect populations and communities of benthic resources. These impacts are local and permanent.	New cables installed in the geographic analysis area over the next 35 years would likely require hard protection atop portions of the route (see the “new cable emplacement/maintenance” row in this table). Any new towers, buoy, or piers would also create uncommon relief in a mostly flat, sandy seascape. Structure-oriented fishes could be attracted to these locations. Increased predation upon benthic resources by structure-oriented fishes could adversely affect populations and communities of benthic resources. These impacts are expected to be local and to be permanent as long as the structures remain.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Habitat conversion	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables continuously provide uncommon hard-bottom habitat. A large portion is homogeneous sandy seascape but there is some other hard and/or complex habitat. Benthic species dependent on hard-bottom habitat can benefit on a constant basis, although the new habitat can also be colonized by invasive species (e.g., certain tunicate species). Structures are periodically added, resulting in the conversion of existing soft-bottom and hard-bottom habitat to the new hard-structure habitat.	See above for quantification and timing. Any new towers, buoy, piers, or cable protection structures would create uncommon relief in a mostly sandy seascape. Benthic species dependent on hard-bottom habitat could benefit, although the new habitat could also be colonized by invasive species (e.g., certain tunicate species). Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010).
Presence of structures: Cable infrastructure	The presence of cable infrastructure, especially hard protection atop cables, causes impacts through entanglement/gear loss/damage, fish aggregation, and habitat conversion.	See other sub-IPFs within Presence of structures.
Discharges	The gradually increasing amount of vessel traffic is increasing the cumulative permitted discharges from vessels. Many discharges are required to comply with permitting standards established to ensure potential impacts on the environment are minimized or mitigated. However, there does not appear to be evidence that the volumes and extents have any impact on benthic resources.	There is the potential for new ocean dumping/dredge disposal sites in the Northeast. Impacts (disturbance, reduction in fitness) of infrequent ocean disposal to benthic resources are short-term because spoils are typically recolonized naturally. In addition, USEPA has established dredge spoil criteria and it regulates the disposal permits issued by USACE; these discharges are required to comply with permitting standards established to ensure potential impacts on the environment are minimized or mitigated.
Regulated fishing effort	Ongoing commercial and recreational regulations for finfish and shellfish implemented and enforced by states, towns, and/or NOAA, depending on jurisdiction, affect benthic resources by modifying the nature, distribution and intensity of fishing-related impacts, including those that disturb the seafloor (trawling, dredge fishing).	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Seabed profile alterations	Ongoing sediment dredging for navigation purposes results in localized short-term impacts (habitat alteration, injury, and mortality) on benthic resources through this IPF. Dredging typically occurs only in sandy or silty habitats, which are abundant in the geographic analysis area and are quick to recover from disturbance. Therefore, such impacts, while locally intense, have little impact on benthic resources in the geographic analysis area.	No future activities were identified within the geographic analysis area other than ongoing activities.
Sediment deposition and burial	Ongoing sediment dredging for navigation purposes results in fine sediment deposition. Ongoing cable maintenance activities also infrequently disturb bottom sediments; these disturbances are local, limited to the emplacement corridor. Sediment deposition could have adverse impacts on some benthic resources, especially eggs and larvae, including smothering and loss of fitness. Impacts may vary based on season/time of year. Where dredged materials are disposed, benthic resources are smothered. However, such areas are typically recolonized naturally in the short term. Most sediment dredging projects have time-of-year restrictions to minimize impacts on benthic resources. Most benthic resources in the geographic analysis area are adapted to the turbidity and periodic sediment deposition that occur naturally in the geographic analysis area.	USACE and/or private ports may undertake dredging projects periodically. Where dredged materials are disposed, benthic resources are buried. However, such areas are typically recolonized naturally in the short term. Most benthic resources in the geographic analysis area are adapted to the turbidity and periodic sediment deposition that occur naturally in the geographic analysis area.
Climate change: Ocean acidification	Ongoing CO ₂ emissions causing ocean acidification may contribute to reduced growth or the decline of benthic invertebrates that have calcareous shells, as well as reefs and other habitats formed by shells.	No future activities were identified within the geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat, ecology, and migration patterns	Climate change, influenced in part by ongoing GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters, influencing the distributions of benthic species and altering ecological relationships, likely causing permanent changes of unknown intensity gradually over the next 35 years.	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Climate change: Warming and sea level rise, disease frequency	Climate change, influenced in part by ongoing GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters, influencing the frequencies of various diseases of benthic species, and likely causing permanent changes of unknown intensity over the next 35 years.	No future activities were identified within the geographic analysis area other than ongoing activities.

Table F1-4 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Birds

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table F1-23 for a quantitative analysis of these risks. Ongoing releases are frequent/chronic. Ingestion of hydrocarbons can lead to morbidity and mortality due to decreased hematological function, dehydration, drowning, hypothermia, starvation, and weight loss (Briggs et al. 1997; Haney et al. 2017; Paruk et al. 2016). Additionally, even small exposures that result in feather oiling can lead to sublethal effects that include changes in flight efficiencies and result in increased energy expenditure during daily and seasonal activities including chick provisioning, commuting, courtship, foraging, long-distance migration, predator evasion, and territory defense (Maggini et al. 2017). These impacts rarely result in population-level impacts.	See Table F1-23 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 35 years would increase the potential risk of accidental releases and associated impacts, including mortality, decreased fitness, and health effects on individuals. Impacts are unlikely to affect populations.
Accidental releases: Trash and debris	Trash and debris are accidentally discharged through onshore sources; fisheries use; dredged material ocean disposal; marine minerals extraction; marine transportation, navigation, and traffic; survey activities; and cables, lines, and pipeline laying on an ongoing basis. In a study from 2010, students at sea collected more than 520,000 bits of plastic debris per square mile. In addition, many fragments come from consumer products blown out of landfills or tossed out as litter (Law et al. 2010). Birds may accidentally ingest trash mistaken for prey. Mortality is typically a result of blockages caused by both hard and soft plastic debris (Roman et al. 2019).	As population and vessel traffic increase gradually over the next 35 years, accidental release of trash and debris may increase. This may result in increased injury or mortality of individuals. However, there does not appear to be evidence that the volumes and extents would have any impact on bird populations.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Light: Vessels	Ocean vessels have an array of lights including navigational lights, deck lights, and interior lights. Such lights can attract some birds. The impact is localized and temporary. This attraction would not be expected to result in an increased risk of collision with vessels. Population-level impacts would not be expected.	Gradually increasing vessel traffic over the next 35 years would increase the potential for bird and vessel interactions. While birds may be attracted to vessel lights, this attraction would not be expected to result in increased risk of collision with vessels. No population-level impacts would be expected.
Light: Structures	Buoys, towers, and onshore structures with lights can attract birds. Onshore structures like houses and ports emit a great deal more light than offshore buoys and towers. This attraction has the potential to result in an increased risk of collision with lighted structures (Hüppop et al. 2006). Light from structures is widespread and permanent near the coast, but minimal offshore.	Light from onshore structures is expected to gradually increase in proportion with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/maintenance	Cable emplacement and maintenance activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances will be temporary and generally limited to the emplacement corridor. Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances will be temporary and limited to the emplacement corridor. Suspended sediment could impair the vision of diving birds that are foraging in the water column (Cook and Burton 2010). However, given the localized nature of the potential impacts, individuals would be expected to successfully forage in nearby areas not affected by increased sedimentation and no biologically significant impacts on individuals or populations would be expected.	Future new cables, would occasionally disturb the seafloor and cause temporary increases in suspended sediment, resulting in localized, short-term impacts. Impacts would be temporary and localized, with no biologically significant impacts on individuals or populations.
Noise: Aircraft	Aircraft routinely travel in the geographic analysis area for birds. With the possible exception of rescue operations and survey aircraft, no ongoing aircraft flights would occur at altitudes that would elicit a response from birds. If flights are at a sufficiently low altitude, birds may flush, resulting in non-biologically significant increased energy expenditure. Disturbance, if any, would be localized and temporary and impacts would be expected to dissipate once the aircraft has left the area.	Aircraft noise is likely to continue to increase as commercial air traffic increases; however, very few flights would be expected to be at a sufficiently low altitude to elicit a response from birds. If flights are at a sufficiently low altitude, birds may flush, resulting in non-biologically significant increased energy expenditure. Disturbance, if any, would be localized and temporary and impacts would be expected to dissipate once the aircraft has left the area.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: G&G	Infrequent site characterization surveys and scientific surveys produce high-intensity impulsive noise around sites of investigation. These activities could result in diving birds leaving the local area. Non-diving birds would be unaffected. Any displacement would only be temporary during non-migratory periods, but impacts could be greater if displacement were to occur in preferred feeding areas during seasonal migration periods.	Same as ongoing activities, with the addition of possible future oil and gas surveys.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water could result in intermittent, temporary, localized impacts on diving birds due to displacement from foraging areas if birds are present in the vicinity of pile-driving activity. The extent of these impacts depends on pile size, hammer energy, and local acoustic conditions. No biologically significant impacts on individuals or populations would be expected.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Noise: Onshore construction	Onshore construction is routinely used in generic infrastructure projects. Equipment could potentially cause displacement. Any displacement would only be temporary and no individual fitness or population-level impacts would be expected.	Onshore construction will continue at current trends. Some behavior responses could range from escape behavior to mild annoyance, but no individual injury or mortality would be expected.
Noise: Vessels	Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Sub-surface noise from vessels could disturb diving birds foraging for prey below the surface. The consequence to birds would be similar to noise from G&G but likely less because noise levels are lower.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Presence of structures: Entanglement, gear loss, gear damage	Each year, 2,551 seabirds die annually from interactions with U.S. commercial fisheries on the Atlantic (Sigourney et al. 2019). Even more die due to abandoned commercial fishing gear (nets). In addition, recreational fishing gear (hooks and lines) is periodically lost on existing buoys, pilings, hard protection, and other structures and has the potential to entangle birds.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various hard protections atop cables create uncommon relief in a mostly flat seascape. Structure-oriented fishes are attracted to these objects. These impacts are local and can be short-term to permanent. These fish aggregations can provide localized, short-term to permanent, beneficial impacts on some bird species because it could increase prey species availability.	New cables, installed incrementally in the geographic analysis area for birds over the next 20 to 35 years, would likely require hard protection atop portions of the cables (see New cable emplacement/maintenance row). Any new towers, buoys, or piers would also create uncommon relief in a mostly flat seascape. Structure-oriented fishes could be attracted to these locations. Abundance of certain fishes may increase. These impacts are expected to be local and may be short-term to permanent. These fish aggregations can provide localized, short-term to permanent beneficial impacts on some bird species due to increased prey species availability.
Presence of structures: Migration disturbances	A few structures may be scattered about the offshore geographic analysis area for birds, such as navigation and weather buoys and light towers. Migrating birds can easily fly around or over these sparsely distributed structures.	The infrequent installation of future new structures in the marine or onshore environment over the next 35 years would not be expected to result in migration disturbances.
Presence of structures: Turbine strikes, displacement, and attraction	A few structures may be in the offshore geographic analysis area for birds, such as navigation and weather buoys, turbines, and light towers. Given the limited number of structures currently in the geographic analysis area, individual- and population-level impacts due to displacement from current foraging habitat would not be expected. Stationary structures in the offshore environment would not be expected to pose a collision risk to birds. Some birds like cormorants and gulls may be attracted to these structures and opportunistically roost on these structures.	The installation of future new structures in the marine or onshore environment over the next 35 years would not be expected to result in an increase in collision risk or to result in displacement. Some potential for attraction and opportunistic roosting exists, but would be expected to be limited given the anticipated number of structures.
Traffic: Aircraft	General aviation accounts for approximately two bird strikes per 100,000 flights (Dolbeer et al. 2019). Additionally, aircraft are used for scientific and academic surveys in marine environments.	Bird fatalities associated with general aviation would be expected to increase with the current trend in commercial air travel. Aircraft will continue to be used to conduct scientific research studies as well as wildlife monitoring and pre-construction surveys. These flights would be well below the 100,000 flights and no bird strikes would be expected to occur.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Land disturbance: Onshore construction	Onshore construction activity will continue at current trends. There is some potential for indirect impacts associated with habitat loss and fragmentation.	Future non-offshore wind development would continue to occur at the current rate. This development has the potential to result in habitat loss but would not be expected to result in injury or mortality of individuals.
Climate change: Warming and sea level rise, storm severity/frequency	Increased storm frequency and severity during the breeding season can reduce productivity of bird nesting colonies and kill adults, eggs, and chicks.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Ocean acidification	Increasing ocean acidification may affect prey species upon which some birds feed and could lead to shifts in prey distribution and abundance. Intensity of impacts on birds is speculative.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters over the next 35 years, influencing the distribution of bird prey resources.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Warming and sea level rise, altered migration patterns	Birds rely on cues from the weather to start migration. Wind direction and speed influence the amount of energy used during migration. For nocturnal migrants, wind assistance is projected to increase across eastern portions of the continent (0.32 m/s; 9.6%) during spring migration by 2091, and wind assistance is projected to decrease within eastern portions of the continent (0.17 m/s; 6.6%) during autumn migration (La Sorte et al. 2018).	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Warming and sea level rise, protective measures (barriers, seawalls)	The proliferation of coastline protections have the potential to result in long-term, high-consequence, impacts on bird nesting habitat.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.
Climate change: Warming and sea level rise, increased disease frequency	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters over the next 35 years, influencing the frequencies and distributions of various diseases of birds.	No future activities were identified within the geographic analysis area for birds other than ongoing activities.

hazmat = hazardous materials

Table F1-5 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Terrestrial and Coastal Fauna

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Land disturbance: Erosion and sedimentation	Periodic ground-disturbing activities contribute to elevated levels of erosion and sedimentation, but usually not to a degree that affects terrestrial and coastal fauna, assuming that industry standard BMPs are implemented.	No future activities were identified within the geographic analysis area other than ongoing activities.
Land disturbance: Onshore construction	Periodic clearing of shrubs and tree saplings along existing utility ROWs causes disturbance and temporary displacement of mobile species and may cause direct injury or mortality of less-mobile species, resulting in short-term impacts that are less than noticeable. Continual development of residential, commercial, industrial, solar, transmission, gas pipeline, onshore wind turbine, and cell tower projects also causes disturbance, displacement, and potential injury and/or mortality of fauna, resulting in small temporary impacts.	No future activities were identified within the geographic analysis area other than ongoing activities.
Land disturbance: Onshore, land use changes	Periodically, undeveloped parcels are cleared and developed for human uses, permanently changing the condition of those parcels as habitat for terrestrial fauna. Continual development of residential, commercial, industrial, solar, transmission, gas pipeline, onshore wind turbine, transportation infrastructure, sewer infrastructure, and cell tower projects could permanently convert various areas.	No future activities were identified within the geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	Climate change, influenced in part by GHG emissions, is altering the seasonal timing and patterns of species distributions and ecological relationships, likely causing permanent changes of unknown intensity gradually over the next 35 years.	No future activities were identified within the geographic analysis area other than ongoing activities.

ROW = right-of-way

Table F1-6 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Coastal Habitats

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table F1-23 for a discussion of ongoing accidental releases. Accidental releases of fuel/fluids/hazmat have the potential to cause habitat contamination and harm to the species that build biogenic coastal habitats (e.g., eelgrass, oysters, mussels, slipper limpets, salt marsh cordgrass) from releases and/or cleanup activities. Only a portion of the ongoing releases contact coastal habitats in the geographic analysis area. Impacts are small, localized, and temporary.	See Table F1-23 for a discussion of accidental releases.
Accidental releases: Trash and debris	Ongoing releases of trash and debris occur from onshore sources, fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying. As population and vessel traffic increase, accidental releases of trash and debris may increase. Such materials may be obvious when they come to rest on shorelines; however, there does not appear to be evidence that the volumes and extents would have any detectable impact on coastal habitats.	No future activities were identified within the geographic analysis area for coastal habitats other than ongoing activities.
Anchoring	Vessel anchoring related to ongoing military, survey, commercial, and recreational activities will continue to cause temporary to permanent impacts in the immediate area where anchors and chains meet the seafloor. These impacts include increased turbidity levels and potential for direct contact to cause physical damage to coastal habitats. All impacts are localized; turbidity is short-term and temporary; physical damage can be permanent if it occurs in eelgrass beds or hard bottom.	No future activities were identified within the geographic analysis area for coastal habitats other than ongoing activities.
EMF	EMFs continuously emanate from existing telecommunication and electrical power transmission cables. New cables generating EMFs are infrequently installed in the analysis area. The extent of impacts is likely less than 50 feet from the cable, and the intensity of impacts on coastal habitats is likely undetectable.	No future activities were identified within the geographic analysis area for coastal habitats other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Light: Vessels	Navigation lights and deck lights on vessels would be a source of ongoing light. The extent of impacts is limited to the immediate vicinity of the lights, and the intensity of impacts on coastal habitats is likely undetectable.	Light is expected to continue to increase gradually with increasing vessel traffic over the next 35 years. The extent of impacts would likely be limited to the immediate vicinity of the lights, and the intensity of impacts on coastal habitats would likely be undetectable.
Light: Structures	Ongoing lights from navigational aids and other structures onshore and nearshore. The extent of impacts is likely limited to the immediate vicinity of the lights, and the intensity of impacts on coastal habitats is likely undetectable.	No future activities were identified within the geographic analysis area for coastal habitats other than ongoing activities.
New cable emplacement/ maintenance	Ongoing cable maintenance activities infrequently disturb bottom sediments; these disturbances are local and limited to the emplacement corridor (see the Sediment deposition and burial IPF).	There are three planned submarine cables in the geographic analysis area including two transmission cables and one telecommunications cable. Impacts of planned cable emplacement would be the same as described for ongoing activities.
Noise: Onshore/ offshore construction	Ongoing noise from construction occurs frequently near shores of populated areas in New England and the Mid-Atlantic, but infrequently offshore. Noise from construction near shore is expected to gradually increase over the next 35 years in line with human population growth along the coast of the geographic analysis area. The intensity and extent of noise from construction is difficult to generalize, but impacts are local and temporary.	No future activities were identified within the analysis area other than ongoing activities.
Noise: G&G	Site characterization surveys and scientific surveys are ongoing. The intensity and extent of the resulting impacts are difficult to generalize but are local and temporary.	Site characterization surveys, scientific surveys, and exploratory oil and gas surveys are anticipated to occur infrequently over the next 35 years. Site characterization surveys typically use sub-bottom profiler technologies that generate less-intense sound waves similar to common deep-water echosounders. The intensity and extent of the resulting impacts are difficult to generalize but are likely local and temporary.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can reach coastal habitats. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the analysis area other than ongoing activities.
Noise: Cable laying/ trenching	Rare but ongoing trenching for pipeline and cable laying activities emits noise; cable burial via jet embedment also causes similar noise impacts. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise on coastal habitats are discountable compared to the impacts of the physical disturbance and sediment suspension.	New or expanded submarine cables and pipelines may occur in the geographic analysis area infrequently over the next 35 years. These disturbances would be temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise on coastal habitats are discountable compared to the impacts of the physical disturbance and sediment suspension.
Presence of structures: Habitat conversion	Various structures, including pilings, piers, towers, riprap, buoys, and various means of hard protection, are periodically added to the seascape, creating uncommon relief in a mostly flat seascape and converting previously existing habitat (whether hard-bottom or soft-bottom) to a type of hard habitat, although it differs from the typical hard-bottom habitat in the analysis area, namely, coarse substrates in a sand matrix. The new habitat may or may not function similarly to hard-bottom habitat typical in the region (Kerckhof et al. 2019; HDR 2019). Soft bottom is the dominant habitat type on the OCS, and structures do not meaningfully reduce the amount of soft-bottom habitat available (Guida et al. 2017; Greene et al. 2010). Structures can also create an artificial reef effect, attracting a different community of organisms.	Any new cable or pipeline installed in the geographic analysis area would likely require hard protection atop portions of the route (see cells to the left). Such protection is anticipated to increase incrementally over the next 35 years. Where cables would be buried deeply enough that protection would not be used, presence of the cable would have no impact on coastal habitats.
Presence of structures: Transmission cable infrastructure	Various means of hard protection atop existing cables can create uncommon hard-bottom habitat. Where cables are buried deeply enough that protection is not used, presence of the cable has no impact on coastal habitats.	See above.
Land disturbance: Erosion and sedimentation	Ongoing development of onshore properties, especially shoreline parcels, periodically causes short-term erosion and sedimentation of coastal habitats.	No future activities were identified within the geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Land disturbance: Onshore construction	Ongoing development of onshore properties, especially shoreline parcels, periodically causes short-term to permanent degradation of onshore coastal habitats.	No future activities were identified within the geographic analysis area other than ongoing activities.
Land disturbance: Onshore, land use changes	Ongoing development of onshore properties, especially shoreline parcels, periodically causes the conversion of onshore coastal habitats to developed space.	No future activities were identified within the geographic analysis area other than ongoing activities.
Seabed profile alterations	Ongoing sediment dredging for navigation purposes results in localized, short-term impacts on coastal habitats through this IPF. Dredging typically occurs only in sandy or silty habitats, which are abundant in the analysis area and are quick to recover from disturbance. Therefore, such impacts, while locally intense, have little effect on the general character of coastal habitats.	No future activities were identified within the geographic analysis area other than ongoing activities.
Sediment deposition and burial	Ongoing sediment dredging for navigation purposes results in fine sediment deposition within coastal habitats. Ongoing cable maintenance activities also infrequently disturb bottom sediments; these disturbances are local, limited to the emplacement corridor. No dredged material disposal sites were identified within the geographic analysis area.	No future activities were identified within the geographic analysis area other than ongoing activities.
Climate change: Ocean acidification	Ongoing CO ₂ emissions causing ocean acidification may contribute to reduced growth or the decline of reefs and other habitats formed by shells.	No future activities were identified within the geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	Climate change, influenced in part by ongoing GHG emissions, is expected to continue to contribute to a widespread loss of shoreline habitat from rising seas and erosion. In submerged habitats, warming is altering ecological relationships and the distributions of ecosystem engineer species, likely causing permanent changes of unknown intensity gradually over the next 3 years.	No future activities were identified within the geographic analysis area other than ongoing activities.

hazmat = hazardous materials

Table F1-7 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Commercial Fisheries and For-Hire Recreational Fishing

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Anchoring	Impacts from anchoring occur due to ongoing military, survey, commercial, and recreational activities. The short-term, localized impact on this resource is the presence of a navigational hazard (anchored vessel) to fishing vessels.	Impacts from anchoring may occur on a semi-regular basis over the next 35 years due to offshore military operations, survey activities, commercial vessel traffic, and/or recreational vessel traffic. Anchoring could pose a temporary (hours to days), localized (within a few hundred meters of anchored vessel) navigational hazard to fishing vessels.
New cable emplacement/maintenance	New cable emplacement and infrequent cable maintenance activities disturb the seafloor, increase suspended sediment, and cause temporary displacement of fishing vessels. These disturbances would be local and limited to the emplacement corridor.	Future new cables and cable maintenance would occasionally disturb the seafloor and cause temporary displacement in fishing vessels and increases in suspended sediment resulting in local, short-term impacts. If the cable routes enter the geographic analysis area for this resource, short-term disruption of fishing activities would be expected.
Noise: Construction, trenching, operations and maintenance	<p>Noise from construction occurs frequently in coastal habitats in populated areas in New England and the Mid-Atlantic, but infrequently offshore. The intensity and extent of noise from construction is difficult to generalize, but impacts are local and temporary. Infrequent offshore trenching could occur in connection with cable installation. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Low levels of elevated noise from operational WTGs likely have low to no impacts on fish and no impacts at a fishery level.</p> <p>Noise is also created by O&M of marine minerals extraction, which has small, local impacts on fish, but likely no impacts at a fishery level.</p>	Noise from construction near shore is expected to gradually increase in line with human population growth along the coast of the geographic analysis area for this resource. Noise from dredging and sand and gravel mining could occur. New or expanded marine minerals extraction may increase noise during their O&M over the next 35 years. Impacts from construction, operations, and maintenance would likely be small and local on fish, and not seen at a fishery level. Periodic trenching would be needed for repair or new installation of underground infrastructure. These disturbances would be temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise on commercial fish species are typically less prominent than the impacts of the physical disturbance and sediment suspension. Therefore, fishery-level impacts are unlikely.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: G&G	Ongoing site characterization surveys and scientific surveys produce noise around sites of investigation. These activities can disturb fish and invertebrates in the immediate vicinity of the investigation and can cause temporary behavioral changes. The extent depends on equipment used, noise levels, and local acoustic conditions.	Site characterization surveys, scientific surveys, and exploratory oil and gas surveys are anticipated to occur infrequently over the next 35 years. Seismic surveys used in oil and gas exploration create high-intensity impulsive noise to penetrate deep into the seabed, potentially resulting in injury or mortality to finfish and invertebrates in a small area around each sound source and short-term stress and behavioral changes to individuals over a greater area. Site characterization surveys typically use sub-bottom profiler technologies that generate less-intense sound waves more similar to common deep-water echosounders. The intensity and extent of the resulting impacts are difficult to generalize but are likely local and temporary.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when ports or marinas, piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can cause injury and/or mortality to finfish and invertebrates in a small area around each pile and can cause short-term stress and behavioral changes to individuals over a greater area, leading to temporary local impacts on commercial fisheries and for-hire recreational fishing. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the analysis area other than ongoing activities.
Noise: Vessels	Vessel noise is anticipated to continue at levels similar to current levels. While vessel noise may have some impact on behavior, it is likely limited to brief startle and temporary stress responses. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels.	Planned new barge route and dredging disposal sites would generate vessel noise when implemented.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance, including dredging. Port utilization is expected to increase over the next 35 years.	Ports would need to perform maintenance and upgrades to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size. Port utilization is expected to increase over the next 35 years, with increased activity during construction. The ability of ports to receive the increase in vessel traffic may require port modifications, such as channel deepening, leading to local impacts on fish populations. Port expansions could also increase vessel traffic and competition for dockside services, which could affect fishing vessels.
Presence of structures: Navigation hazard and allisions	Structures within and near the cumulative lease areas that pose potential navigation hazards include offshore wind turbines, buoys, and shoreline developments such as docks and ports. An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. Two types of allisions occur: drift and powered. A drift allision generally occurs when a vessel is powered down due to operator choice or power failure. A powered allision generally occurs when an operator fails to adequately control their vessel movements or is distracted.	No known reasonably foreseeable structures are proposed to be located in the geographic analysis area that could affect commercial fisheries. Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. The lost gear, moved by currents, can disturb habitats and potentially harm individuals, creating small, localized, short-term impacts on fish, but likely no impacts at a fishery level.	No future activities were identified within the analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Habitat conversion and fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly sandy seascape. A large portion is homogeneous sandy seascape but there is some other hard and/or complex habitat. Structures are periodically added, resulting in the conversion of existing soft-bottom and hard-bottom habitat to the new hard-structure habitat. Structure-oriented fishes are attracted to these locations. These impacts are local and can be short-term to permanent. Fish aggregation may be considered adverse, beneficial, or neither. Commercial and for-hire recreational fishing can occur near these structures. For-hire recreational fishing is more popular, as commercial mobile fishing gear risk snagging on the structures.	New cables, installed incrementally in the analysis area over the next 20 to 35 years, would likely require hard protection atop portions of the route (see New cable emplacement/maintenance IPF above). Any new towers, buoys, or piers would also create uncommon relief in a mostly flat seascape. Structure-oriented species could be attracted to these locations. Structure-oriented species would benefit (Claisse et al. 2014; Smith et al. 2016). This may lead to more and larger structure-oriented fish communities and larger predators opportunistically feeding on the communities, as well as increased private and for-hire recreational fishing opportunities. Soft bottom is the dominant habitat type in the region, and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010). These impacts are expected to be local and may be long term.
Presence of structures: Migration disturbances	Human structures in the marine environment, e.g., shipwrecks, artificial reefs, buoys, and oil platforms, can attract finfish and invertebrates that approach the structures during their migrations. This could slow species migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement than structure (Secor et al. 2018). There is no evidence to suggest that structures pose a barrier to migratory animals.	The infrequent installation of future new structures in the marine environment over the next 35 years may attract finfish and invertebrates that approach the structures during their migrations. This could tend to slow migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement (Secor et al. 2018). Migratory animals would likely be able to proceed from structures unimpeded. Therefore, fishery-level impacts are not anticipated.
Presence of structures: Space use conflicts	Current structures do not result in space use conflicts.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Presence of structures: Cable infrastructure	The existing offshore cable infrastructure supports the economy by transmitting electric power and communications between mainland and islands. Shoreline developments are ongoing and include docks, ports, and other commercial, industrial, and residential structures.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Traffic: Vessels and vessel collisions	<p>No substantial changes are anticipated to the vessel traffic volumes. The geographic analysis area would continue to have numerous ports and the extensive marine traffic related to shipping, fishing, and recreation would continue to be important to the region's economy. The region's substantial marine traffic may result in occasional collisions. Vessels need to navigate around structures to avoid collisions. When multiple vessels need to navigate around a structure, then navigation is more complex, as the vessels need to avoid both the structure and each other. The risk for collisions is ongoing but infrequent.</p>	<p>New vessel traffic in the geographic analysis area would consistently be generated by proposed barge routes and dredging demolition sites. Marine commerce and related industries would continue to be important to the regional economy.</p>
Climate change	<p>Impacts to commercial fisheries and for-hire recreational fishing are expected to result from climate change events such as increased magnitude or frequency of storms, shoreline changes, ocean acidification, and water temperature changes. Risks to fisheries associated with these events include habitat/distribution shifts, disease incidence, and risk of invasive species. If these risk factors result in a decrease in catch and/or an increase in fishing costs (e.g., transiting time), the profitability of businesses engaged in commercial fisheries and for-hire recreational fishing would be adversely affected. While climate change is predicted to have adverse impacts on the distribution and/or productivity of some stocks targeted by commercial fisheries and for-hire recreational fishing, other stocks may be beneficially affected.</p> <p>The economies of communities reliant on marine species that are vulnerable to the effects of climate change could be adversely affected. If the distribution of important stocks changes, it could affect where commercial and for-hire recreational fisheries are located. Furthermore, coastal communities with fishing businesses that have infrastructure near the shore could be adversely affected by sea level rise.</p>	<p>No future activities were identified within the geographic analysis area for this resource other than ongoing activities.</p>

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Regulated fishing effort	Commercial and recreational regulations for finfish and shellfish implemented and enforced by NMFS and coastal states, affect how the commercial and for-hire recreational fisheries operate. Commercial and recreational for-hire fisheries are managed by FMPs, which are established to manage fisheries to avoid overfishing through catch quotas, special management areas, and closed area regulations. These can reduce or increase the size of available landings to commercial and for-hire recreational fisheries. For example, ongoing fishing restrictions designed to rebuild depleted stocks in the Northeast Multispecies (large-mesh) fishery will continue to reduce landings in that fishery.	Reasonably foreseeable fishery management actions include measures to reduce the risk of interactions between fishing gear and the NARW by 60% (McCreary and Brooks 2019). This will likely have a have a major adverse impact on fishing effort in the lobster and Jonah crab fisheries in the geographic analysis area for this resource. As discussed in Karp et al. (2019), changing climate and ocean conditions and the resultant effects on species distributions and productivity can have significant effects on management decisions, such as allocation, spatiotemporal closures, stock status determinations, and catch limits. See No Action alternative for additional fishery management actions that will affect commercial fisheries and for-hire recreational fishing.

Table F1-8 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Cultural Resources

Associated IPF: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table F1-23 for water quality for a quantitative analysis of these risks. Accidental releases of fuel/fluids/hazmat occur during vessel use for recreational, fisheries, marine transportation, or military purposes, and other ongoing activities. Both released fluids and cleanup activities that require the removal of contaminated soils and/or seafloor sediments can cause impacts on cultural resources because resources are affected during by the released chemicals as well as the ensuing cleanup activities.	Gradually increasing vessel traffic over the next 35 years would increase the risk of accidental releases within the geographic analysis area for cultural resources, increasing the frequency of small releases. Although the majority of anticipated accidental releases would be small, resulting in small-scale impacts on cultural resources, a single, large-scale accidental release such as an oil spill, could have significant impacts on marine and coastal cultural resources. A large-scale release would require extensive cleanup activities to remove contaminated materials resulting in damage to or the complete removal of terrestrial and marine cultural resources. In addition, the accidentally released materials in deep water settings could settle on seafloor cultural resources such as wreck sites, accelerating their decomposition and/or covering them and making them inaccessible/unrecognizable to researchers, resulting in a significant loss of historic information. As a result, although considered unlikely, a large-scale accidental release and associated cleanup could result in permanent, geographically extensive, and large-scale impacts on cultural resources.

Associated IPF: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Trash and debris	Accidental releases of trash and debris occur during vessel use for recreational, fisheries, marine transportation, or military purposes and other ongoing activities. While the released trash and debris can directly affect cultural resources, the majority of impacts associated with accidental releases occur during cleanup activities, especially if soil or sediment removed during cleanup affect known and undiscovered archaeological resources. In addition, the presence of large amounts of trash on shorelines or the ocean surface can impact the cultural value of TCPs for stakeholders. State and federal laws prohibiting large releases of trash would limit the size of any individual release and ongoing local, state, and federal efforts to clean up trash on beaches and waterways would continue to mitigate the effects of small-scale accidental releases of trash.	Future activities with the potential to result in accidental releases include construction and operations of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications). Accidental releases would continue at current rates along the northeast Atlantic coast.
Anchoring	The use of vessel anchoring and gear (i.e., wire ropes, cables, chain, sweep on the seafloor) that disturbs the seafloor, such as bottom trawls and anchors, by military, recreational, industrial, and commercial vessels can impact cultural resources by physically damaging maritime archaeological resources such as shipwrecks and debris fields.	Future activities with the potential to result in anchoring/gear utilization include construction and operations of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); military use; marine transportation; fisheries use and management; and oil and gas activities. These activities are likely to continue to occur at current rates along the entire coast of the eastern United States.
Gear utilization: Dredging	Activities associated with dredge operations and activities could damage marine archaeological resources. Ongoing activities identified by BOEM with the potential to result in dredging impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; and oil and gas activities.	Dredging activities would gradually increase through time as new offshore infrastructure is built, such as gas pipelines and electrical lines, and as ports and harbors are expanded or maintained.

Associated IPF: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Light: Vessels	Light associated with military, commercial, or construction vessel traffic can temporarily affect coastal historic structures and TCP resources when the addition of intrusive, modern lighting changes the physical environment (“setting”) of cultural resources. The impacts of construction and operations lighting would be limited to cultural resources on the shoreline for which a nighttime sky is a contributing element to historic integrity. This excludes resources that are closed at night, such as historic buildings, lighthouses, and battlefields, and resources that generate their own nighttime light, such as historic districts. Offshore construction activities that require increased vessel traffic, construction vessels stationed offshore, and construction area lighting for prolonged periods can cause more sustained and significant visual impacts on coastal historic structure and TCP resources.	Future activities with the potential to result in vessel lighting impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; and oil and gas activities. Light pollution from vessel traffic would continue at the current intensity along the northeast coast, with a slight increase due to population increase and development over time.
Light: Structures	The construction of new structures that introduce new light sources into the setting of historic architectural properties or TCPs can result in impacts, particularly if the historic and/or cultural significance of the resource is associated with uninterrupted nighttime skies or periods of darkness. Any tall structure (commercial building, radio antenna, large satellite dishes, etc.) requiring nighttime hazard lighting to prevent aircraft collision can cause these types of impacts.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
Port utilization: Expansion	Major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Expansion of port facilities can introduce large, modern port infrastructure into the viewsheds of nearby historic properties, affecting their setting and historic significance.	Future activities with the potential to result in port expansion impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; and oil and gas activities. Port expansion would continue at current levels, which reflect efforts to capture business associated with the offshore wind industry (irrespective of specific projects).

Associated IPF: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures	The only existing offshore structures within the viewshed of the geographic analysis area are minor features such as buoys.	Non-offshore wind structures that could be viewed would be limited to meteorological towers. Marine activity would also occur within the marine viewshed of the geographic analysis area.
New cable emplacement/maintenance	Infrequent cable maintenance activities disturb the seafloor and could cause impacts on submerged archaeological resources. These disturbances would be local and limited to emplacement corridors.	Future activities with the potential to result in seafloor disturbances similar to offshore impacts include construction and operation of undersea transmission lines, gas pipelines, and other submarine cables (e.g., telecommunications); tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; and oil and gas activities. Such activities could cause impacts on submerged archaeological resources including shipwrecks and formerly subaerially exposed pre-contact Native American archaeological sites.
Land disturbance: Onshore construction	Onshore construction activities can impact archaeological resources by damaging and/or removing resources.	Future activities that could result in terrestrial land disturbance impacts include onshore residential, commercial, industrial, and military development activities in central Cape Cod, particularly those proximate to OECRs and interconnection facilities. Onshore construction would continue at current rates.
Climate change: Warming and sea level rise, storm severity/frequency	Sea level rise and increased storm severity and frequency would result in impacts on archaeological, architectural, and TCP resources. Increased storm frequency and severity would also result in damage to and/or destruction of architectural properties. Sea level rise would increase erosion-related impacts on archaeological and architectural resources, while sea level rise would inundate archaeological, architectural, and TCP resources.	Sea level rise and storm severity/frequency would increase due to the effects of climate change.
Climate change: Warming and sea level rise, altered habitat/ecology	Altered habitat/ecology related to warming seas and sea level rise would impact the ability of Native Americans and other communities to use maritime TCPs for traditional fishing, shell fishing, and fowling activities.	The rate of change to habitats/ecology would increase as a result of climate change.

Associated IPF: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Climate change: Warming and sea level rise, altered migration patterns	Altered migration patterns related to warming seas and sea level rise would impact the ability of Native Americans and other communities to use maritime TCPs for traditional fishing, shell fishing, and fowling activities.	The rate of change to migratory animal patterns would increase as a result of climate change.
Climate change: Warming and sea level rise, property/ infrastructure damage	Sea level rise and increased storm severity and frequency would result in impacts on archaeological, architectural, and TCP resources. Increased storm frequency and severity would result in damage to and/or destruction of architectural properties. Sea level rise would increase erosion-related impacts on archaeological and architectural resources while sea level rise would inundate archaeological, architectural, and TCP resources.	The rate of property and infrastructure damage would increase as a result of climate change.
Climate change: Warming and sea level rise, protective measures (barriers, sea walls)	The installation of protective measures such as barriers and sea walls would impact archaeological resources during associated ground-disturbing activities. Construction of these modern protective structures would alter the viewsheds from historic properties and/or TCPs, resulting in impacts on the historic and/or cultural significance of resources.	The installation of coastal protective measures would increase as a result of climate change.
Climate change: Warming and sea level rise, storm severity/frequency, sediment erosion, deposition	Sea level rise and increased storm severity and frequency would result in impacts on archaeological, architectural, and TCP resources. Increased storm frequency and severity would result in damage to and/or destruction of architectural properties. Sea level rise would increase erosion related impacts on archaeological and architectural resources while sea level rise would inundate archaeological, architectural, and TCP resources.	Sea level rise and storm severity/frequency would increase due to the effects of climate change.

hazmat = hazardous materials; OECR = onshore export cable route

Table F1-9 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Demographics, Employment, and Economics

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Energy generation/ security	In 2019, New Jersey energy production totaled 328 trillion Btu, of which 13.8 trillion Btu was from renewable sources, including geothermal, hydroelectric, wind, solar, and biomass (U.S. Energy Information Administration 2020).	Ongoing development of onshore solar and wind energy would provide diversified, small-scale energy generation. State and regional energy markets would require additional peaker plants and energy storage to meet the electricity needs when utility scale renewables are not producing.
Light: Structures	Offshore buoys and towers emit low-intensity light, while onshore structures, including houses and ports, emit substantially more light on an ongoing basis.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
Light: Vessels	Ocean vessels have an array of lights including navigational lights and deck lights.	Anticipated modest growth in vessel traffic would result in some growth in the nighttime traffic of vessels with lighting.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances would be local and limited to emplacement corridors. In the geographic analysis area for demographics, employment, and economics there are six existing power cables.	Future new cables would disturb the seafloor and cause temporary increases in suspended sediment resulting in infrequent, localized, short-term impacts over the next 35 years.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. These disturbances are temporary, local, and extend only a short distance beyond the work area.	No future activities were identified within the geographic analysis area for demographics, employment, and economics other than ongoing activities.
Noise: Cable laying/ trenching	Infrequent trenching for pipeline and cable laying activities emit noise. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	Periodic trenching would be needed over the next 35 years for repair or new installation of underground infrastructure.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: Vessels	Vessel noise occurs offshore and more frequently near ports and docks. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Vessel noise is anticipated to continue at or near current levels.	Planned new barge route and dredging disposal sites would generate vessel noise when implemented. The number and location of such routes are uncertain.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The New Jersey Wind Port is being developed and the Port of Paulsboro is being upgraded specifically to support the construction of offshore wind energy facilities.	Ports would need to perform maintenance and upgrade facilities over the next 35 years to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Port utilization: Maintenance/ dredging	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. As ports expand, maintenance dredging of shipping channels is expected to increase.	Ports would need to perform maintenance and upgrades over the next 35 years to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Presence of structures: Allisions	An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. The likelihood of allisions is expected to continue at or near current levels.	Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. Such loss and damage are direct costs for gear owners and are expected to continue at or near current levels.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented fishes are attracted to these locations, which may be known as FADs. Recreational and commercial fishing can occur near the FADs, although recreational fishing is more popular, because commercial mobile fishing gear is more likely to snag on FADs.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Habitat conversion	Structures, including foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented species thus benefit on a constant basis.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid collisions, especially in nearshore areas. This navigation becomes more complex when multiple vessels must navigate around a structure, because vessels need to avoid both the structure and each other.	Vessel traffic, overall, is not expected to meaningfully increase over the next 35 years. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space use conflicts	Current structures do not result in space use conflicts.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Viewshed	No existing offshore structures are within the viewshed of the offshore wind lease areas except buoys.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Transmission cable infrastructure	The existing offshore cable infrastructure supports the economy by transmitting electric power and communications between mainland and islands. Additional communication cables run between the U.S. East Coast and European countries along the eastern Atlantic.	No known proposed structures not associated with offshore wind development are reasonably foreseeable.
Traffic: Vessels	Ports and marine traffic related to shipping, fishing, and recreation are important to the region's economy. No substantial changes are anticipated to existing vessel traffic volumes.	New vessel traffic near the geographic analysis area would be generated by proposed barge routes and dredging demolition sites over the next 35 years. Marine commerce and related industries would continue to be important to the geographic analysis area economy.
Traffic: Vessel collisions	The region's substantial marine traffic may result in occasional vessel collisions, which would result in costs to the vessels involved. The likelihood of collisions is expected to continue at or near current rates.	No substantial changes anticipated.
Land disturbance: Onshore construction	Onshore development activities support local population growth, employment, and economies. Disturbances can cause temporary, localized traffic delays and restricted access to adjacent properties. The rate of onshore land disturbance is expected to continue at or near current rates.	Onshore development projects would be ongoing in accordance with local government land use plans and regulations.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Climate change	Climate models predict climate change if current trends continue. Climate change has adverse implications for demographics and economic health of coastal communities, due in part to the costs of resultant damage to property and infrastructure, fisheries and other natural resources, increased disease frequency, and sedimentation, among other factors.	Onshore projects that reduce air emissions could contribute to the effort to limit climate change. Onshore solar and wind energy projects, although producing less energy than potential offshore wind developments, would also provide incremental reductions.
Regulated fishing effort	Commercial and recreational regulations for finfish and shellfish implemented and enforced by NMFS and coastal states affect how commercial and for-hire recreational fisheries operate. Commercial and recreational for-hire fisheries are managed by FMPs, which are established to manage fisheries to avoid overfishing through catch quotas, special management areas, and closed area regulations. These can reduce or increase the size of available landings to commercial and for-hire recreational fisheries.	Reasonably foreseeable fishery management actions include measures to reduce the risk of interactions between fishing gear and the NARW by 60% (McCreary and Brooks 2019). This will likely have a significant impact on fishing effort in the lobster and Jonah crab fisheries in the geographic analysis area for this resource. See No Action alternative for additional fishery management actions that will affect commercial fisheries and for-hire recreational fishing.

Btu = British thermal unit; FAD = fish aggregating device

Table F1-10 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Environmental Justice

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Air emissions: Construction/ decommissioning	Ongoing population growth and new development within the analysis area is likely to increase traffic with resulting increase in emissions from motor vehicles. Some new industrial development may result in emissions-producing uses. At the same time, many industrial waterfront areas near environmental justice communities are losing industrial uses and converting to more commercial or residential uses.	New development may include emissions-producing industry and new development that would increase emissions from motor vehicles. Some historically industrial waterfront locations will continue to lose industrial uses, with no new industrial development to replace it. Cities such as New Bedford are promoting start-up space and commercial uses to re-use industrial space.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Air emissions: Operations and maintenance	Ongoing population growth and new development within the analysis area is likely to increase traffic with resulting increase in emissions from motor vehicles. Some new industrial development may result in emissions-producing uses. At the same time, many industrial waterfront areas near environmental justice communities are losing industrial uses and converting to more commercial or residential uses.	New development may include emissions-producing industry and new development that would increase emissions from motor vehicles. Some historically industrial waterfront locations will continue to lose industrial uses, with no new industrial development to replace it. Cities such as New Bedford are promoting start-up space and commercial uses to re-use industrial space.
Light: Structures	Offshore buoys and towers emit low-intensity light, while onshore structures, including houses and ports, emit substantially more light on an ongoing basis.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/ maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances would be local and limited to emplacement corridors.	Future new cables would disturb the seafloor and cause temporary increases in suspended sediment, resulting in infrequent, localized, short-term impacts over the next 35 years.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. These disturbances are temporary, local, and extend only a short distance beyond the work area.	No future activities were identified within the analysis area other than ongoing activities.
Noise: Trenching	Infrequent trenching for pipeline and cable laying activities emits noise. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of trenching noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	Periodic trenching would be needed over the next 35 years for repair or new installation of underground infrastructure.
Noise: Vessels	Vessel noise occurs offshore and more frequently near ports and docks. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels.	Vessel noise is anticipated to continue at or near current levels.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The New Jersey Wind Port is being developed and the Port of Paulsboro is being upgraded specifically to support the construction of offshore wind energy facilities.	Ports would need to perform maintenance and upgrade facilities to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Presence of structures: Entanglement, gear loss/damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. Such loss and damage are direct costs for gear owners and are expected to continue at or near current levels.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid collisions, especially in nearshore areas. This navigation becomes more complex when multiple vessels must navigate around a structure, because vessels need to avoid both the structure, and each other.	Vessel traffic is generally not expected to meaningfully increase over the next 35 years. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space use conflicts	Current structures do not result in space use conflicts.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Viewshed	There are no existing offshore structures within the viewshed of the offshore wind lease areas except buoys.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: cable infrastructure	Existing submarine cables cross cumulative lease areas.	Existing cable O&M activities would continue within the analysis area.
Traffic: Vessels	Ports and marine traffic related to shipping, fishing and recreation are important to the region's economy. No substantial changes are anticipated to existing vessel traffic volumes.	Vessel traffic is not expected to meaningfully increase over the next 35 years. Marine commerce and related industries would continue to be important to area employment.
Land disturbance: Erosion and sedimentation	Potential erosion and sedimentation from development and construction is controlled by local and state development regulations.	New development activities would be subject to erosion and sedimentation regulations.
Land disturbance: Onshore construction	Onshore development supports local population growth, employment, and economics.	Onshore development would continue in accordance with local government land use plans and regulations.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Land disturbance: Onshore, land use changes	Onshore development would result in changes in land use in accordance with local government land use plans and regulations.	Development of onshore solar and wind energy would provide diversified, small-scale energy generation.
Climate change	Climate models predict climate change if current trends continue. Climate change has adverse implications for demographics and the economic health of coastal communities, due in part to the costs of resultant damage to property and infrastructure, fisheries, and other natural resources; increased disease frequency; and sedimentation, among other factors.	Onshore projects that reduce air emissions could contribute to the effort to limit climate change. Onshore solar and wind energy projects, although producing less energy than potential offshore wind developments, would also provide incremental reductions.
Regulated fishing effort	Commercial and recreational regulations for finfish and shellfish implemented and enforced by NMFS and coastal states affect how commercial and for-hire recreational fisheries operate. Commercial and recreational for-hire fisheries are managed by FMPs, which are established to manage fisheries to avoid overfishing through catch quotas, special management areas, and closed area regulations. These can reduce or increase the size of available landings to commercial and for-hire recreational fisheries.	Reasonably foreseeable fishery management actions include measures to reduce the risk of interactions between fishing gear and the NARW by 60% (McCreary and Brooks 2019). This will likely have a significant impact on the fishing effort in the lobster and Jonah crab fisheries in the geographic analysis area for this resource. See No Action alternative for additional fishery management actions that will affect commercial fisheries and for-hire recreational fishing.

Table F1-11 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Finfish, Invertebrates, and Essential Fish Habitat

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table F1-23 for a quantitative analysis of these risks. Ongoing releases are frequent/chronic. Impacts, including mortality, decreased fitness, and contamination of habitat, are localized and temporary, and rarely affect populations.	See Table F1-23 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 35 years would increase the risk of accidental releases. Impacts are unlikely to affect populations.
Accidental releases: Invasive species	Invasive species are periodically released accidentally during ongoing activities, including the discharge of ballast water and bilge water from marine vessels. The impacts on finfish, invertebrates, and EFH depend on many factors, but can be widespread and permanent.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Anchoring	Vessel anchoring related to ongoing military use, and survey, commercial, and recreational activities continue to cause temporary to permanent impacts in the immediate area where anchors and chains meet the seafloor. Impacts on finfish, invertebrates, and EFH are greatest for sensitive EFH (e.g., eelgrass, hard bottom) and sessile or slow-moving species (e.g., corals, sponges, and sedentary shellfish).	Impacts from anchoring may occur on a semi-regular basis over the next 35 years due to offshore military operations, survey activities, commercial vessel traffic, and/or recreational vessel traffic. These impacts would include increased turbidity levels and potential for direct contact causing mortality of benthic species and, possibly, degradation of sensitive habitats. All impacts would be localized; turbidity would be temporary; impacts from direct contact would be recovered in the short term. Degradation of sensitive habitats such as certain types of hard bottom (e.g., boulder piles), if it occurs, could be long term.
EMF	EMF emanates continuously from installed telecommunication and electrical power transmission cables. Biologically significant impacts on finfish, invertebrates, and EFH have not been documented for AC cables (CSA Ocean Sciences, Inc. and Exponent 2019; Thomsen et al. 2015), but behavioral impacts have been documented for benthic species (skates and lobster) near operating DC cables (Hutchison et al. 2018). The impacts are localized and affect the animals only while they are within the EMF. There is no evidence to indicate that EMF from undersea AC power cables negatively affects commercially and recreationally important fish species (CSA Ocean Sciences, Inc. and Exponent 2019).	During operation, future new cables would produce EMF. Submarine power cables in the geographic analysis area are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF to low levels. Although the EMF would exist as long as a cable was in operation, impacts, on finfish, invertebrates, and EFH would likely be difficult to detect.
Light: Vessels	Marine vessels have an array of lights including navigational lights and deck lights. There is little downward-focused lighting, and therefore only a small fraction of the emitted light enters the water. Light can attract finfish and invertebrates, potentially affecting distributions in a highly localized area. Light may also disrupt natural cycles, e.g., spawning, possibly leading to short-term impacts.	Vessels would continue to be a light source within the analysis area.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Light: Structures	Offshore buoys and towers emit light, and onshore structures, including buildings and ports, emit a great deal more on an ongoing basis. Light can attract finfish and invertebrates, potentially affecting distributions in a highly localized area. Light may also disrupt natural cycles, e.g., spawning, possibly leading to short-term impacts. Light from structures is widespread and permanent near the coast, but minimal offshore.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances are local, limited to the cable corridor. New cables are infrequently added near shore. Cable emplacement/maintenance activities disturb, displace, and injure finfish and invertebrates and result in temporary to long-term habitat alterations. The intensity of impacts depends on the time (season) and place (habitat type) where the activities occur. (See also the IPF of Sediment deposition and burial.)	Future new cables would occasionally disturb the seafloor and cause temporary increases in suspended sediment, resulting in local short-term impacts. If the cable routes enter the geographic analysis area for this resource, short-term disturbance would be expected. The intensity of impacts would depend on the time (season) and place (habitat type) where the activities would occur.
Noise: Aircraft	Noise from aircraft reaches the sea surface on a regular basis. However, there is not likely to be any impact of aircraft noise on finfish, invertebrates, and EFH, as very little of the aircraft noise propagates through the water.	Aircraft noise is likely to continue to increase as commercial air traffic increases. However, there is not likely to be any impact of aircraft noise on finfish, invertebrates, and EFH.
Noise: Onshore/offshore construction	Noise from construction occurs frequently in near shores of populated areas in New England and the Mid-Atlantic but infrequently offshore. The intensity and extent of noise from construction is difficult to generalize, but impacts are local and temporary. See also sub-IPF for Noise: Pile driving.	Noise from construction near shores is expected to gradually increase in line with human population growth along the coast of the geographic analysis area for this resource.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: G&G	Ongoing site characterization surveys and scientific surveys produce noise around sites of investigation. These activities can disturb finfish and invertebrates in the immediate vicinity of the investigation and can cause temporary behavioral changes. The extent depends on equipment used, noise levels, and local acoustic conditions.	Site characterization surveys, scientific surveys, and exploratory oil and gas surveys are anticipated to occur infrequently over the next 35 years. Seismic surveys used in oil and gas exploration create high-intensity impulsive noise to penetrate deep into the seabed, potentially resulting in injury or mortality to finfish and invertebrates in a small area around each sound source and short-term stress and behavioral changes to individuals over a greater area. Site characterization surveys typically use sub-bottom profiler technologies that generate less-intense sound waves more similar to common deep-water echosounders. The intensity and extent of the resulting impacts are difficult to generalize but are likely local and temporary.
Noise: O&M	Some finfish and invertebrates may be able to hear the continuous underwater noise of operational WTGs. As measured at the Block Island Wind Farm, this low frequency noise barely exceeds ambient levels at 164 feet (50 meters) from the WTG base. Based on the results of Thomsen et al. (Thomsen et al. 2015), SPLs would be expected to be at or below ambient levels at relatively short distances (approximately 164 feet [50 meters]) from WTG foundations. These low levels of elevated noise likely have little to no impact. Noise is also created by O&M of marine minerals extraction and commercial fisheries, each of which has small local impacts.	New or expanded marine minerals extraction and commercial fisheries may intermittently increase noise during their O&M over the next 35 years. Impacts would likely be small and local.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can cause injury and/or mortality to finfish and invertebrates in a small area around each pile and can cause short-term stress and behavioral changes to individuals over a greater area. Eggs, embryos, and larvae of finfish and invertebrates could also experience developmental abnormalities or mortality resulting from this noise, although thresholds of exposure are not known (Weilgart 2018; Hawkins and Popper 2017). Potentially injurious noise could also be considered as rendering EFH temporarily unavailable or unsuitable for the duration of the noise. The extent depends on pile size, hammer energy, and local acoustic conditions.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Noise: Cable laying/ trenching	Infrequent trenching activities for pipeline and cable laying, as well as other cable burial methods, emit noise. These disturbances are temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.	New or expanded submarine cables and pipelines are likely to occur in the geographic analysis area for this resource. These disturbances would be infrequent over the next 35 years, temporary, local, and extend only a short distance beyond the emplacement corridor. Impacts of this noise are typically less prominent than the impacts of the physical disturbance and sediment suspension.
Noise: Vessels	While ongoing vessel noise may have some effect on behavior, it is likely limited to brief startle and temporary stress responses. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels.	See cell to the left.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance, including dredging. Port utilization is expected to increase over the next 35 years.	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. Certain types of vessel traffic have increased recently (e.g., ferry use and cruise industry) and may continue to increase in the foreseeable future. In addition, the general trend along the coast from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase may require port modifications, leading to local impacts. Future channel deepening activities will likely be undertaken. Existing ports have already affected finfish, invertebrates, and EFH, and future port projects would implement BMPs to minimize impacts. Although the degree of impacts on EFH would likely be undetectable outside the immediate vicinity of the ports, adverse impacts on EFH for certain species and/or life stages may lead to impacts on finfish and invertebrates beyond the vicinity of the port.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures. The lost gear, moved by currents, can disturb habitats and potentially harm individuals, creating small, localized, short-term impacts.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Presence of structures: Hydrodynamic disturbance	Manmade structures, especially tall vertical structures such as foundations for towers of various purposes, continuously alter local water flow at a fine scale. Water flow typically returns to background levels within a relatively short distance from the structure. Therefore, impacts on finfish, invertebrates, and EFH are typically undetectable. Indirect impacts of structures influencing primary productivity and higher trophic levels are possible but are not well understood. New structures are periodically added.	Tall vertical structures can increase seabed scour and sediment suspension. Impacts would likely be highly localized and difficult to detect. Indirect impacts of structures influencing primary productivity and higher trophic levels are possible but are not well understood.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly sandy seascape. Structure-oriented fishes are attracted to these locations. These impacts are local and often permanent. Fish aggregation may be considered adverse, beneficial, or neutral.	New cables, installed incrementally in the geographic analysis area for this resource over the next 20 to 35 years, would likely require hard protection atop portions of the route (see the New cable emplacement/maintenance IPF). Any new towers, buoys, or piers would also create uncommon relief in a mostly sandy seascape. Structure-oriented fishes could be attracted to these locations. Abundance of certain fishes may increase. These impacts are local and may be permanent.
Presence of structures: Habitat conversion	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly sandy seascape. A large portion is homogeneous sandy seascape but there is some other hard and/or complex habitat. Structure-oriented species thus benefit on a constant basis; however, the diversity may decline over time as early colonizers are replaced by successional communities dominated by blue mussels and anemones (Degraer et al. 2019 [Chapter 7]). Structures are periodically added, resulting in the conversion of existing soft-bottom and hard-bottom habitat to the new hard-structure habitat.	New cable, installed incrementally in the analysis area over the next 20 to 35 years, would likely require hard protection atop portions of the route (see New cable emplacement/maintenance). Any new towers, buoys, or piers would also create uncommon relief in a mostly sandy seascape. Structure-oriented species would benefit (Claisse et al. 2014; Smith et al. 2016); however, the diversity may decline over time as early colonizers are replaced by successional communities dominated by blue mussels and anemones (Degraer et al. 2019 [Chapter 7]). Soft bottom is the dominant habitat type from Cape Hatteras to the Gulf of Maine (over 60 million acres), and species that rely on this habitat would not likely experience population-level impacts (Guida et al. 2017; Greene et al. 2010).
Presence of structures: Migration disturbances	Human structures in the marine environment, e.g., shipwrecks, artificial reefs, and oil platforms, can attract finfish and invertebrates that approach the structures during their migrations. This could slow migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement than structure is (Moser and Shepherd 2009; Fabrizio et al. 2014; Secor et al. 2018). There is no evidence to suggest that structures pose a barrier to migratory animals.	The infrequent installation of future new structures in the marine environment over the next 35 years may attract finfish and invertebrates that approach the structures during their migrations. This could tend to slow migrations. However, temperature is expected to be a bigger driver of habitat occupation and species movement (Moser and Shepherd 2009; Fabrizio et al. 2014; Secor et al. 2018). Migratory animals would likely be able to proceed from structures unimpeded.
Presence of structures: Cable infrastructure	See other sub-IPFs within the Presence of structures IPF. See Table F1-6 on Coastal Habitats.	See other sub-IPFs within the Presence of structures IPF. See Table F1-6 on Coastal Habitats.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Regulated fishing effort	Regulated fishing effort results in the removal of a substantial amount of the annually produced biomass of commercially regulated finfish and invertebrates and can also influence bycatch of non-regulated species. Ongoing commercial and recreational regulations for finfish and shellfish implemented and enforced by states, municipalities, and/or NOAA, depending on jurisdiction, affect finfish, invertebrates, and EFH by modifying the nature, distribution and intensity of fishing-related impacts, including those that disturb the seafloor (trawling, dredge fishing).	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Seabed profile alterations	Ongoing sediment dredging for navigation purposes results in localized short-term impacts (habitat alteration, change in complexity) on finfish, invertebrates, and EFH through this IPF. Dredging is most likely in sand wave areas where typical jet plowing is insufficient to meet target cable burial depth. Sand waves that are dredged would likely be redeposited in like-sediment areas. Any particular sand wave may not recover to the same height and width as pre-disturbance; however, the habitat function would largely recover post-disturbance. Therefore, seabed profile alterations, while locally intense, have little impact on finfish, invertebrates, and EFH on a regional (Cape Hatteras to Gulf of Maine) scale.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Sediment deposition and burial	Ongoing sediment dredging for navigation purposes results in fine sediment deposition. Ongoing cable maintenance activities also infrequently disturb bottom sediments; these disturbances are local, limited to the emplacement corridor. Sediment deposition could have negative impacts on eggs and larvae, particularly demersal eggs such as longfin squid, which are known to have high rates of egg mortality if egg masses are exposed to abrasion or burial. Impacts may vary based on season/time of year.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Climate change: Ocean acidification	Continuous CO ₂ emissions causing ocean acidification may contribute to reduced growth or the decline of invertebrates that have calcareous shells over the course of the next 35 years.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Climate change: Warming and sea level rise, altered habitat, ecology, and migration patterns	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters over the next 35 years, influencing the distributions of finfish, invertebrates, and EFH. This sub-IPF has been shown to affect the distribution of fish in the northeast United States, with several species shifting their centers of biomass either northward or to deeper waters (Hare et al. 2016).	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.
Climate change: Warming and sea level rise, disease frequency	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters over the next 35 years, influencing the frequencies of various diseases of finfish and invertebrates.	No future activities were identified within the geographic analysis area for this resource other than ongoing activities.

AC = alternating current; DC = direct current; hazmat = hazardous materials

Table F1-12 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Land Use and Coastal Infrastructure

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	Various ongoing onshore and coastal construction projects include the use of vehicles and equipment that contain fuel, fluids, and hazardous materials that could be released.	Ongoing onshore construction projects involve vehicles and equipment that use fuel, fluids, or hazardous materials could result in an accidental release. Intensity and extent would vary, depending on the size, location, and materials involved in the release.
Light: Structures	Various ongoing onshore and coastal construction projects have nighttime activities, as well as existing structures, facilities, and vehicles that would use nighttime lighting.	Ongoing onshore construction projects involving nighttime activity could generate nighttime lighting. Intensity and extent would vary, depending on the location, type, direction, and duration of nighttime lighting.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The New Jersey Wind Port is being developed and the Port of Paulsboro is being upgraded specifically to support the construction of offshore wind energy facilities.	Ports would need to perform maintenance and upgrade facilities to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep draft vessels as they continue to increase in size.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Viewshed	The only existing offshore structures within the offshore viewshed are minor features such as buoys.	Non-offshore wind structures that could be viewed in conjunction with the offshore components would be limited to met towers. Marine activity would also occur within the marine viewshed.
Presence of structures: Cable infrastructure	Onshore buried cables would only occur where permitted by local land use authorities, which would avoid long-term land use conflicts.	No known proposed structures are reasonably foreseeable and proposed to be located in the geographic analysis area for land use and coastal infrastructure.
Land disturbance: Onshore construction	Onshore construction supports local population growth, employment, and economics.	Onshore development would continue in accordance with local government land use plans and regulations.
Land disturbance: Onshore, land use changes	New development or redevelopment would result in changes in land use in accordance with local government land use plans and regulations.	Ongoing and future development and redevelopment is anticipated to reinforce existing land use patterns, based on local government planning documents.

hazmat = hazardous materials; met = meteorological

Table F1-13 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Marine Mammals

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table F1-23 for a quantitative analysis of these risks. Ongoing releases are frequent/chronic. Marine mammal exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality or sublethal effects on the individual fitness, including adrenal effects, hematological effects, liver effects lung disease, poor body condition, skin lesions, and several other health affects attributed to oil exposure (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008; Smith et al. 2017; Sullivan et al. 2019; Takeshita et al. 2017). Additionally, accidental releases may result in impacts on marine mammals due to effects on prey species (Table F1-11).	See Table F1-23 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 35 years would increase the risk of accidental releases. Marine mammal exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality or sublethal effects on the individual fitness, including adrenal effects, hematological effects, liver effects lung disease, poor body condition, skin lesions, and several other health affects attributed to oil exposure (Kellar et al. 2017; Mazet et al. 2001; Mohr et al. 2008; Smith et al. 2017; Sullivan et al. 2019; Takeshita et al. 2017). Additionally, accidental releases may result in impacts on marine mammals due to effects on prey species (Table F1-11).

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Trash and debris	<p>Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying, and debris carried in river outflows or windblown from onshore. Accidental releases of trash and debris are expected to be low quantity, local, and low-impact events. Worldwide 62 of 123 (50.4%) marine mammal species have been documented ingesting marine litter (Werner et al. 2016). Stranding data indicate potential debris induced mortality rates of 0 to 22%. Mortality has been documented in cases of debris interactions, as well as blockage of the digestive track, disease, injury, and malnutrition (Baulch and Perry 2014). However, it is difficult to link physiological effects to individuals to population level impacts (Browne et al. 2015).</p>	<p>As population and vessel traffic increase gradually over the next 35 years, accidental release of trash and debris may increase. Trash and debris may continue to be accidentally released through fisheries use and other offshore and onshore activities. There may also be a long-term risk from exposure to plastics and other debris in the ocean. Worldwide 62 of 123 (50.4%) of marine mammal species have been documented ingesting marine litter (Werner et al. 2016). Mortality has been documented in cases of debris interactions, as well as blockage of the digestive track, disease, injury, and malnutrition (Baulch and Perry 2014).</p>
EMF	<p>EMFs emanate constantly from installed telecommunication and electrical power transmission cables. Marine mammals appear to have a detection threshold for magnetic intensity gradients (i.e., changes in magnetic field levels with distance) of 0.1% of the earth's magnetic field or about 0.05 μT (Kirschvink 1990) and are thus likely to be very sensitive to minor changes in magnetic fields (Walker et al. 2003). There is a potential for animals to react to local variations of the geomagnetic field caused by power cable EMFs. Depending on the magnitude and persistence of the confounding magnetic field, such an effect could cause a trivial temporary change in swim direction or a longer detour during the animal's migration (Gill et al. 2005). Such an effect on marine mammals is more likely to occur with direct current cables than with AC cables (Normandeau et al. 2011). However, there are numerous transmission cables installed across the seafloor and no impacts on marine mammals have been demonstrated from this source of EMF.</p>	<p>During operation, future new cables would produce EMF. Submarine power cables in the marine mammal geographic analysis area are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF to low levels. EMF of any two sources would not overlap. Although the EMF would exist as long as a cable was in operation, impacts, if any, would likely be difficult to detect, if they occur at all. Marine mammals have the potential to react to submarine cable EMF; however, no effects from the numerous submarine cables have been observed. Furthermore, this IPF would be limited to extremely small portions of the areas used by migrating marine mammals. As such, exposure to this IPF would be low, and as a result impacts on marine mammals would not be expected.</p>

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
New cable emplacement/maintenance	<p>Cable maintenance activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances will be local and generally limited to the emplacement corridor. Data are not available regarding marine mammal avoidance of localized turbidity plumes; however, Todd et al. (2015) suggest that since some marine mammals often live in turbid waters and some species of mysticetes and sirenians employ feeding methods that create sediment plumes, some species of marine mammals have a tolerance for increased turbidity. Similarly, McConnell et al. (1999) documented movements and foraging of grey seals in the North Sea. One tracked individual was blind in both eyes, but otherwise healthy. Despite being blind, observed movements were typical of the other study individuals, indicating that visual cues are not essential for grey seal foraging and movement (McConnell et al. 1999). If elevated turbidity caused any behavioral responses such as avoiding the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any impacts would be temporary and short term. Turbidity associated with increased sedimentation may result in temporary, short-term impacts on marine mammal prey species (Table F1-11).</p>	<p>The impact on water quality from accidental sediment suspension during cable emplacement is temporary and short term. If elevated turbidity caused any behavioral responses such as avoidance of the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any negative impacts would be temporary and short term. Turbidity associated with increased sedimentation may result in temporary, short-term impacts on some marine mammal prey species (Table F1-11).</p>

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: Aircraft	<p>Aircraft routinely travel in the marine mammal geographic analysis area. With the possible exception of rescue operations, no ongoing aircraft flights would occur at altitudes that would elicit a response from marine mammals. If flights are at a sufficiently low altitude, marine mammals may respond with behavioral changes, including short surface durations, abrupt dives, and percussive behaviors (i.e., breaching and tail slapping) (Patenaude et al. 2002). These brief responses would be expected to dissipate once the aircraft has left the area. Similarly, aircraft have the potential to disturb hauled-out seals if aircraft overflights occur within 2,000 feet (610 meters) of a haul out area (Efroymsen et al. 2000). However, this disturbance would be temporary, short-term, and result in minimal energy expenditure. These brief responses would be expected to dissipate once the aircraft has left the area.</p>	<p>Future low altitude aircraft activities such as survey activities and navy training operations could result short-term responses of marine mammals to aircraft noise. If flights are at a sufficiently low altitude, marine mammals may respond with a behavior changes, including short surface durations, abrupt dives, and percussive behaviors (i.e., breaching and tail slapping) (Patenaude et al. 2002). These brief responses would be expected to dissipate once the aircraft has left the area.</p>
Noise: G&G	<p>Infrequent site characterization surveys and scientific surveys produce high-intensity impulsive noise around sites of investigation. These activities have the potential to result in high intensity, high consequence impacts, including auditory injuries, stress, disturbance, and behavioral responses, if present within the ensonified area (NOAA 2018). Survey protocols and underwater noise mitigation procedures are typically implemented to decrease the potential for any marine mammal to be within the area where sound levels are above relevant harassment thresholds associated with an operating sound source to reduce the potential for behavioral responses and injury (PTS/TTS) close to the sound source. The magnitude of effects, if any, is intrinsically related to many factors, including acoustic signal characteristics, behavioral state (e.g., migrating), biological condition, distance from the source, duration and level of the sound exposure, as well as environmental and physical conditions that affect acoustic propagation (NOAA 2018).</p>	<p>Same as ongoing activities, with the addition of possible future oil and gas exploration surveys.</p>

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: Turbines	Marine mammals would be able to hear the continuous underwater noise of operational WTGs. As measured at the Block Island Wind Facility, this low frequency noise barely exceeds ambient levels at 164 feet (50 meters) from the WTG base. Based on the results of Thomsen et al. (2015) and Kraus et al. (2016), SPLs would be expected to be at or below ambient levels at relatively short distances from the WTG foundations.	This sub-IPF does not apply to future non-offshore wind development.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can result in high-intensity, low-exposure level, long-term, but localized intermittent risk to marine mammals. Impacts would be localized in nearshore waters. Pile driving activities may negatively affect marine mammals during foraging, orientation, migration, predator detection, social interactions, or other activities (Southall et al. 2007). Noise exposure associated with pile-driving activities can interfere with these functions and have the potential to cause a range of responses, including insignificant behavioral changes, avoidance of the ensonified area, PTS, harassment, and ear injury, depending on the intensity and duration of the exposure. BOEM assumes that all ongoing and potential future activities will be conducted in accordance with a project-specific IHA to minimize impacts on marine mammals.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Noise: Cable laying/ trenching	Noise from cable laying could periodically occur in the analysis area.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: Vessels	<p>Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, scientific and academic research vessels, as well as other construction vessels. The frequency range for vessel noise falls within marine mammals' known range of hearing and would be audible. Noise from vessels presents a long-term and widespread impact on marine mammals across in most oceanic regions. While vessel noise may have some effect on marine mammal behavior, it would be expected to be limited to brief startle and temporary stress response. Results from studies on acoustic impacts from vessel noise on odontocetes indicate that small vessels at a speed of 5 knots in shallow coastal water can reduce the communication range for bottlenose dolphins within 164 feet (50 meters) of the vessel by 26% (Jensen et al. 2009). Pilot whales in a quieter, deep-water habitat could experience a 50% reduction in communication range from a similar size boat and speed (Jensen et al. 2009). Since lower frequencies propagate farther away from the sound source compared to higher frequencies, LFCs are at a greater risk of experiencing Level B Harassment produced by vessel traffic.</p>	<p>Any offshore projects that require the use of ocean vessels could potentially result in long term but infrequent impacts on marine mammals, including temporary startle responses, masking of biologically relevant sounds, physiological stress, and behavioral changes. However, BOEM expects that these brief responses of individuals to passing vessels would be unlikely given the patchy distribution of marine mammals and no stock or population level effects would be expected.</p>

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Port utilization: Expansion	<p>The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Port expansion activities are localized to nearshore habitats, and are expected to result in temporary, short-term impacts, if any, on marine mammals. Vessel noise may affect marine mammals, but response would be expected to be temporary and short-term (see Vessels: Noise sub-IPF above). The impacts on water quality from sediment suspension during port expansion activities is temporary, short-term, and would be similar to those described under the New cable emplacement/maintenance IPF above.</p>	<p>Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. In addition, the general trend along the coastal region from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase in larger ships will require port modifications. Future channel deepening activities are being undertaken to accommodate deeper draft vessels for the Panama Canal Locks. The additional traffic and larger vessels could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. The increased sediment suspension could be long-term depending on the vessel traffic increase. Certain types of vessel traffic have increased recently (e.g. ferry use and cruise industry) and may continue to increase in the foreseeable future. Additional impacts associated with the increased risk of vessel strike could also occur (see the Traffic: Vessel collisions sub-IPF below).</p>
Presence of structures: Entanglement or ingestion of lost fishing gear	<p>There are more than 130 artificial reefs in the Mid-Atlantic region. This sub-IPF may result in long-term, high intensity impacts, but with low exposure due to localized and geographic spacing of artificial reefs, long-term. Currently bridge foundations and the Block Island Wind Facility may be considered artificial reefs and may have higher levels of recreational fishing, which increases the chances of marine mammals encountering lost fishing gear, resulting in possible ingestions, entanglement, injury, or death of individuals (Moore and van der Hoop 2012), if present nearshore where these structures are located. There are very few, if any, areas within the OCS geographic analysis area for marine mammals that would serve to concentrate recreational fishing and increase the likelihood that marine mammals would encounter lost fishing gear.</p>	<p>No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.</p>

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Habitat conversion and prey aggregation	There are more than 130 artificial reefs in the Mid-Atlantic region. Hard-bottom (scour control and rock mattresses) and vertical structures (bridge foundations and Block Inland Wind Facility WTGs) in a soft-bottom habitat can create artificial reefs, thus inducing the “reef” effect (Taormina et al. 2018; NMFS 2015). The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans (Taormina et al. 2018), providing a potential increase in available forage items and shelter for seals and small odontocetes compared to the surrounding soft-bottoms.	The presence of structures associated with non-offshore wind development in near shore coastal waters have the potential to provide habitat for seals and small odontocetes as well as preferred prey species. This “reef effect” has the potential to result in long term, low-intensity benefits. Bridge foundations will continue to provide foraging opportunities for seals and small odontocetes with measurable benefits to some individuals. Hard-bottom (scour control and rock mattresses used to bury the offshore export cables) and vertical structures (i.e., WTG and OSS foundations) in a soft-bottom habitat can create artificial reefs, thus inducing the “reef effect” (Taormina et al. 2018; Causon and Gill 2018). The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans (Taormina et al. 2018), providing a potential increase in available forage items and shelter for marine mammals compared to the surrounding soft-bottoms.
Presence of structures: Avoidance/ displacement	No ongoing activities in the marine mammal geographic analysis area beyond offshore wind facilities are measurably contributing to this sub-IPF. There may be some impacts resulting from the existing Block Island Wind Facility, but given that there are only 5 WTGs, no measurable impacts are occurring.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Behavioral disruption - breeding and migration	No ongoing activities in the marine mammal geographic analysis area beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Displacement into higher risk areas (Vessels and Fishing)	No ongoing activities in the marine mammal geographic analysis area beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Traffic: Vessel collisions	Current activities that are contributing to this sub-IPF include port traffic levels, fairways, TSS, commercial vessel traffic, recreational and fishing activity, and scientific and academic vessel traffic. Vessel strike is relatively common with cetaceans (Kraus et al. 2005) and one of the primary causes of death to NARWs with as many as 75% of known anthropogenic mortalities of NARWs likely resulting from collisions with large ships along the U.S. and Canadian eastern seaboard (Kite-Powell et al. 2007). Marine mammals are more vulnerable to vessel strike when they are within the draft of the vessel and when they are beneath the surface and not detectable by visual observers. Some conditions that make marine mammals less detectable include weather conditions with poor visibility (e.g., fog, rain, and wave height) or nighttime operations. Vessels operating at speeds exceeding 10 knots have been associated with the highest risk for vessel strikes of NARWs (Vanderlaan and Taggart 2007). Reported vessel collisions with whales show that serious injury rarely occurs at speeds below 10 knots (Laist et al. 2001). Data show that the probability of a vessel strike increases with the velocity of a vessel (Pace and Silber 2005; Vanderlaan and Taggart 2007).	Vessel traffic associated with non-offshore wind development has the potential to result in an increased collision risk. While these impacts would be high consequence, the patchy distribution of marine mammals makes stock or population-level effects unlikely (Navy 2018).
Climate change: Warming and sea level rise, storm severity/frequency	Increased storm frequency could result in increased energetic costs for marine mammals and reduced fitness, particularly for juveniles, calves and pups.	No future activities were identified within the geographic analysis area for marine mammals other than ongoing activities.
Climate change: Ocean acidification	This sub-IPF has the potential to lead to long-term, high-consequence impacts on marine ecosystems by contributing to reduced growth or the decline of invertebrates that have calcareous shells.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	This sub-IPF has the potential to lead to long-term, high-consequence impacts on marine mammals as a result of changes in distribution, reduced breeding, and/or foraging habitat availability, and disruptions in migration.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Climate change: Warming and sea level rise, altered migration patterns	This sub-IPF has the potential to lead to long-term, high-consequence impacts on marine mammal habitat use and migratory patterns. For example, the NARW appears to be migrating differently and feeding in different areas in response to changes in prey densities related to climate change (Record et al. 2019; MacLeod 2009; Nunny and Simmonds 2019).	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, increased disease frequency	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters, influencing the frequencies of various diseases of marine mammals, such as Phocine distemper. Climate change is clearly influencing infectious disease dynamics in the marine environment; however, no studies have shown a definitive causal relationship between any components of climate change and increases in infectious disease among marine mammals. This is due in large part to a lack of sufficient data and to the likely indirect nature of climate change's impact on these diseases. Climate change could potentially affect the incidence or prevalence of infection, the frequency or magnitude of epizootics, and/or the severity or presence of clinical disease in infected individuals. There are a number of potential proposed mechanisms by which this might occur (see summary in Burge et al. 2014 Climate Change Influences on Marine Infectious Diseases: Implications for Management and Society).	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.
Climate change: Warming and sea level rise, storm severity/frequency, sediment erosion, deposition	Increased storm frequency could result in increased energetic costs for marine mammals, reduced fitness, particularly for juveniles, calves and pups. Erosion could impact seal haul outs reducing their habitat availability, especially as things like sea walls are added, blocking seals access to shore.	No future activities were identified within the marine mammal geographic analysis area other than ongoing activities.

μT = microtesla; AC = alternating current; hazmat = hazardous materials

Table F1-14 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Navigation and Vessel Traffic

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Anchoring	Larger commercial vessels (specifically tankers) sometimes anchor outside of major ports to transfer their cargo to smaller vessels for transport into port, an operation known as lightering. These anchors have deeper ground penetration and are under higher stresses. Smaller vessels (commercial fishing or recreational vessels) would anchor for fishing and other recreational activities. These activities cause temporary to short-term impacts on navigation in the immediate anchorage area. All vessels may anchor in an emergency scenario (such as power loss) if they lose power to prevent them from drifting and creating navigational hazards for other vessels or drifting into structures.	Lightering and anchoring operations are expected to continue at or near current levels, with the expectation of moderate increase commensurate with any increase in tankers visiting ports. Deep-draft visits to major port visits are expected to increase as well, increasing the potential for an emergency need to anchor, creating navigational hazards for other vessels. Recreational activity and commercial fishing activity would likely stay largely the same related to this IPF.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Impacts from these activities would be short term and could include congestion in ports, delays, and changes in port usage by some fishing or recreational vessel operators.	Ports would need to perform maintenance and perform upgrades to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size. Impacts would be short term and could include congestion in ports, delays, and changes in port usage by some fishing or recreational vessel operators.
Presence of structures: Allisions	An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. There are two types of allisions that occur: drift and powered. A drift allision generally occurs when a vessel is powered down due to operator choice or power failure. A powered allision generally occurs when an operator fails to adequately control their vessel movements or is distracted.	Absent other information, and because total vessel transits in the area have remained relatively stable since 2010, BOEM does not anticipate vessel traffic to greatly increase over the next 35 years. Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Fish aggregation	Items in the water, such as ghost fishing gear, buoys, and energy platform foundations can create an artificial reef effect, aggregating fish. Recreational and commercial fishing can occur near the artificial reefs. Recreational fishing is more popular than commercial near artificial reefs as commercial mobile fishing gear can risk snagging on the artificial reef structure.	Fishing near artificial reefs is not expected to change meaningfully over the next 35 years.
Presence of structures: Habitat conversion	Equipment in the ocean can create a substrate for mollusks to attach to, and fish eggs to settle near. This can create a reef-like habitat and benefit structure-oriented species on a constant basis.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Migration disturbances	Noise-producing activities, such as pile driving and vessel traffic, may interfere and adversely affect marine mammals during foraging, orientation, migration, response to predators, social interactions, or other activities. Marine mammals may also be sensitive to changes in magnetic field levels. The presence of structures and operational noise could cause mammals to avoid areas.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid collisions. When multiple vessels need to navigate around a structure, then navigation is made more complex, as the vessels need to avoid both the structure and each other.	Absent other information, and because total vessel transits in the area have remained relatively stable since 2010, BOEM does not anticipate vessel traffic to greatly increase over the next 35 years. Even with increased port visits by deep-draft vessels, this is still a relatively small adjustment when considering the whole of New England vessel traffic. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space use conflicts	Currently, the offshore area is occupied by marine trade, stationary and mobile fishing, and survey activities.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Cable infrastructure	See IPF for Anchoring.	See IPF for Anchoring.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
New cable emplacement/maintenance	Within the geographic analysis area for navigation and vessel traffic, existing cables may require access for maintenance activities. Infrequent cable maintenance activities may cause temporary increases in vessel traffic and navigational complexity.	Future new cables would cause temporary increases in vessel traffic during installation or maintenance, resulting in infrequent, localized, short-term impacts over the next 35 years. Care would need to be taken by vessels that are crossing the cable routes during these activities.
Traffic: Aircraft	USCG SAR helicopters are the main aircraft that may be flying at low enough heights to risk interaction with WTGs. USCG SAR aircraft need to fly low enough that they can spot objects in the water.	SAR operations could be expected to increase with any increase in vessel traffic. However, as vessel traffic volume is not expected to increase appreciably, neither should SAR operations. Final EIS Section 3.16 provides a discussion of navigation impacts on fishing vessel traffic.
Traffic: Vessels	See the sub-IPF for Presence of structures: Navigation hazard.	See the sub-IPF for Presence of structures: Navigation hazard.
Traffic: Vessels, collisions	See the sub-IPF for Presence of structures: Navigation hazard.	See the sub-IPF for Presence of structures: Navigation hazard.

Table F1-15 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Military and National Security Uses

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Allisions	Existing stationary facilities that present allision risks include buoys that are used to mark inlet approaches, channels, and shoals (NOAA 2021), dock facilities, meteorological buoys associated with offshore wind lease areas, and other offshore or shoreline-based structures.	No additional non-offshore wind stationary structures were identified within the geographic analysis area. Stationary structures such as private or commercial docks may be added close to the shoreline.
Presence of structures: Fish aggregation	No existing stationary structures that would act as FADs were identified within the geographic analysis area.	No future non-offshore wind additional stationary structures that would act as FADs were identified within the geographic analysis area.
Presence of structures: Navigation hazard	Existing stationary facilities within the geographic analysis area that present navigational hazards include buoys that are used to mark inlet approaches, channels, and shoals (NOAA 2021), dock facilities, meteorological buoys associated with offshore wind lease areas, and other offshore or shoreline-based structures.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore, development activities are anticipated to continue with additional proposed communications towers and onshore commercial, industrial, and residential developments.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Space use conflicts	Existing stationary facilities within the geographic analysis area that could present a space use conflict include onshore wind turbines, communication towers, and other onshore commercial, industrial, and residential structures.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore, development activities are anticipated to continue with additional proposed communications towers and onshore commercial, industrial, and residential developments.
Presence of structures: Cable infrastructure	Existing submarine cables cross cumulative lease areas.	Submarine cables would remain in current locations with infrequent maintenance continuing along those cable routes for the foreseeable future.
Traffic: Vessels	Current vessel traffic in the region is described in Final EIS Section 3.16. Vessel activities associated with offshore wind in the cumulative lease areas is currently limited to site assessment surveys.	Continued vessel traffic in the region, as described in Final EIS Section 3.16.
Traffic: Vessels, collisions	Current vessel traffic in the region is described in Final EIS Section 3.16. Vessel activities associated with offshore wind in the cumulative lease areas is currently limited to site assessment surveys.	Continued vessel traffic in the region is described in Final EIS Section 3.16.

FAD = fish aggregating device

Table F1-16 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Aviation and Air Traffic

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Towers	Existing aboveground stationary facilities within the geographic analysis area that present aviation hazards include onshore wind turbines, communication towers, dock facilities, and other onshore structures exceeding 200 feet in height.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore development activities are anticipated to continue with additional proposed communications towers.
Presence of structures: Space use conflicts	Existing aboveground stationary facilities within the geographic analysis area that could cause space use conflicts for aircraft include onshore wind turbines, communication towers, and other onshore structures exceeding 200 feet in height.	No future non-offshore wind stationary structures were identified within the offshore analysis area. Onshore, development activities are anticipated to continue with additional proposed communications towers.

Table F1-17 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Cables and Pipelines

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Allisions and navigation hazards	Structures within and near the geographic analysis area that pose potential allision hazards include buoys that are used to mark inlet approaches, channels, and shoals, meteorological buoys associated with offshore wind lease areas, and shoreline developments such as docks, ports, and other commercial, industrial, and residential structures.	Reasonably foreseeable non-offshore wind structures that could affect submarine cables have not been identified in the geographic analysis area.
Presence of structures: Space use conflicts	Existing submarine cables cross cumulative lease areas and create potential space use conflicts with marine mineral and sand borrow areas.	Reasonably foreseeable non-offshore wind structures that could create space use conflicts with submarine cables have not been identified in the geographic analysis area.
Presence of structures: Cable infrastructure	Existing submarine cables cross cumulative lease areas.	Reasonably foreseeable non-offshore wind structures have not been identified in the geographic analysis area.

Table F1-18 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Radar Systems

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Towers	Wind developments in the direct line of sight with, or extremely close to, radar systems can cause clutter and interference.	Reasonably foreseeable non-offshore wind structures proposed for construction in the lease areas that could affect radar systems have not been identified.

Table F1-19 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Other Uses: Scientific Research and Surveys

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Navigation hazards	Stationary structures are limited in the open ocean environment of the geographic analysis area, and include met buoys associated with site assessment activities, the five Block Island Wind Farm WTGs, and the two CVOW WTGs.	Reasonably foreseeable non-offshore wind activities would not implement stationary structures within the open ocean environment that would pose navigational hazards and raise the risk of allisions for survey vessels and collisions for survey aircraft.

CVOW = Coastal Virginia Offshore Wind; met = meteorological

Table F1-20 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Recreation and Tourism

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Anchoring	Anchoring occurs due to ongoing military, survey, commercial, and recreational activities.	Impacts from anchoring would continue, and may increase due to offshore military operations, survey activities, commercial vessel traffic, and/or recreational vessel traffic. Modest growth in vessel traffic could increase the temporary, localized impacts of navigational hazards, increased turbidity levels, and potential for direct contact causing mortality of benthic resources.
Light: Vessels	Ocean vessels have an array of lights including navigational lights and deck lights.	Anticipated modest growth in vessel traffic would result in some growth in the nighttime traffic of vessels with lighting.
Light: Structures	Offshore buoys and towers emit low-intensity light. Onshore structures, including houses and ports, emit substantially more light on an ongoing basis.	Light from onshore structures is expected to gradually increase in line with human population growth along the coast. This increase is expected to be widespread and permanent near the coast, but minimal offshore.
New cable emplacement/maintenance	Infrequent cable maintenance activities disturb the seafloor and cause temporary increases in suspended sediment; these disturbances would be local and limited to emplacement corridors.	Cable maintenance or replacement of existing cables in the geographic analysis area would occur infrequently and would generate short-term disturbances.
Noise: Pile driving	Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. These disturbances are temporary, local, and extend only a short distance beyond the work area.	No future activities were identified within the recreation and tourism geographic analysis area other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: Cable laying/ trenching	Offshore trenching occurs periodically in connection with cable installation or sand and gravel mining.	No future activities were identified within the recreation and tourism geographic analysis area other than ongoing activities.
Noise: Vessels	Vessel noise occurs offshore and more frequently near ports and docks. Ongoing activities that contribute to this sub-IPF include commercial shipping, recreational and fishing vessels, and scientific and academic research vessels. Vessel noise is anticipated to continue at or near current levels.	Planned new barge routes and dredging disposal sites would generate vessel noise when implemented. The number and location of such routes are uncertain.
Port utilization: Expansion	The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance.	Ports would need to perform maintenance and upgrade facilities over the next 35 years to ensure that they can still receive the projected future volume of vessels visiting their ports, and to be able to host larger deep-draft vessels as they continue to increase in size.
Port utilization: Maintenance/ dredging	Periodic maintenance is necessary for harbors within the analysis area.	Ongoing maintenance and dredging of harbors within the geographic analysis area will continue as needed. No specific projects are known.
Presence of structures: Allisions	An allision occurs when a moving vessel strikes a stationary object. The stationary object can be a buoy, a port feature, or another anchored vessel. The likelihood of allisions is expected to continue at or near current levels.	Vessel allisions with non-offshore wind stationary objects should not increase meaningfully without a substantial increase in vessel congestion.
Presence of structures: Entanglement, gear loss, gear damage	Commercial and recreational fishing gear is periodically lost due to entanglement with existing buoys, pilings, hard protection, and other structures.	No future activities were identified within the recreation and tourism geographic analysis area other than ongoing activities.
Presence of structures: Fish aggregation	Structures, including tower foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented fishes are attracted to these locations. Recreational and commercial fishing can occur near these aggregation locations, although recreational fishing is more popular, because commercial mobile fishing gear is more likely to snag on structures.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Habitat conversion	Structures, including foundations, scour protection around foundations, and various means of hard protection atop cables create uncommon relief in a mostly flat seascape. Structure-oriented species thus benefit on a constant basis.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Navigation hazard	Vessels need to navigate around structures to avoid allisions, especially in nearshore areas. This navigation becomes more complex when multiple vessels must navigate around a structure, because vessels need to avoid both the structure and each other.	Vessel traffic, overall, is not expected to meaningfully increase over the next 35 years. The presence of navigation hazards is expected to continue at or near current levels.
Presence of structures: Space use conflicts	Current structures do not result in space use conflicts.	Reasonably foreseeable activities (non-offshore wind) would not result in additional offshore structures.
Presence of structures: Viewshed	The only existing offshore structures within the viewshed of the Projects are minor features such as buoys.	Non-offshore wind structures that could be viewed in conjunction with the offshore components of the Projects would be limited to meteorological towers. Marine activity would also occur within the marine viewshed.
Traffic: Vessels	Geographic analysis area ports and marine traffic related to shipping, fishing, and recreation are important to the region's economy. No substantial changes are anticipated to existing vessel traffic volumes.	New vessel traffic near the geographic analysis area would be generated by proposed barge routes and dredging demolition sites over the next 35 years. Marine commerce and related industries would continue to be important to the geographic analysis area economy.
Traffic: Vessel collisions	The region's substantial marine traffic may result in occasional vessel collisions, which would result in costs to the vessels involved. The likelihood of collisions is expected to continue at or near current rates.	An increased risk of collisions is not anticipated from future activities.

Table F1-21 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Sea Turtles

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	See Table F1-23 for a quantitative analysis of these risks. Ongoing releases are frequent and chronic. Sea turtle exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality (Shigenaka et al. 2010) or sublethal effects on individual fitness, including adrenal effects, dehydration, hematological effects, increased disease incidence, liver effects, poor body condition, skin effects, skeletomuscular effects, and several other health effects that can be attributed to oil exposure (Camacho et al. 2013; Bembenek-Bailey et al. 2019; Mitchelmore et al. 2017; Shigenaka et al. 2010; Vargo et al. 1986). Additionally, accidental releases may result in impacts on sea turtles due to effects on prey species (Table F1-11).	See Table F1-23 for a quantitative analysis of these risks. Gradually increasing vessel traffic over the next 35 years would increase the risk of accidental releases. Sea turtle exposure to aquatic contaminants and inhalation of fumes from oil spills can result in mortality (Shigenaka et al. 2010; Wallace et al. 2010) or sublethal effects on individual fitness, including adrenal effects, dehydration, hematological effects, increased disease incidence, liver effects, poor body condition, skin effects, skeletomuscular effects, and several other health effects that can be attributed to oil exposure (Camacho et al. 2013; Bembenek-Bailey et al. 2019; Mitchelmore et al. 2017; Shigenaka et al. 2010; Vargo et al. 1986). Additionally, accidental releases may result in impacts on sea turtles due to effects on prey species (Table F1-11).

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
<p>Accidental releases: Trash and debris</p>	<p>Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities, cables, lines, and pipeline laying, as well as debris carried in river outflows or windblown from onshore. Accidental releases of trash and debris are expected to be low quantity, local, and low-impact events. Direct ingestion of plastic fragments is well documented and has been observed in all species of sea turtles (Bugoni et al. 2001; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). In addition to plastic debris, ingestion of tar, paper, Styrofoam™, wood, reed, feathers, hooks, lines, and net fragments have also been documented (Thomás et al. 2002). Ingestion can also occur when individuals mistake debris for potential prey items (Gregory 2009; Hoarau et al. 2014; Thomás et al. 2002). Potential ingestion of marine debris varies among species and life history stages due to differing feeding strategies (Nelms et al. 2016). Ingestion of plastics and other marine debris can result in both lethal and sublethal impacts on sea turtles, with sublethal effects more difficult to detect (Gall and Thompson 2015; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). Long-term sublethal effects may include dietary dilution, chemical contamination, depressed immune system function, poor body condition, as well as reduced growth rates, fecundity, and reproductive success. However, these effects are cryptic and clear causal links are difficult to identify (Nelms et al. 2016).</p>	<p>Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities and cables, lines and pipeline laying, and debris carried in river outflows or windblown from onshore. Accidental releases of trash and debris are expected to be low quantity, local, and low-impact events. Direct and indirect ingestion of plastic fragments and other marine debris is well documented and has been observed in all species of sea turtles (Bugoni et al. 2001; Gregory 2009; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014; Thomás et al. 2002). Ingestion can result in both lethal and sublethal impacts on sea turtles, with sublethal effects more difficult to detect (Gall and Thompson 2015; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). However, these effects are cryptic and clear causal links are difficult to identify (Nelms et al. 2016).</p>

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
EMF	<p>EMFs emanate constantly from installed telecommunication and electrical power transmission cables. Sea turtles appear to have a detection threshold of magnetosensitivity and behavioral responses to field intensities ranging from 0.0047 to 4000 μT for loggerhead turtles, and 29.3 to 200 μT for green turtles, with other species likely similar due to anatomical, behavioral, and life history similarities (Normandeau et al. 2011). Juvenile or adult sea turtles foraging on benthic organisms may be able to detect magnetic fields while they are foraging on the bottom near the cables and up to potentially 82 feet (25 meters) in the water column above the cable. Juvenile and adult sea turtles may detect the EMF over relatively small areas near cables (e.g., when resting on the bottom or foraging on benthic organisms near cables or concrete mattresses). There are no data on impacts on sea turtles from EMFs generated by underwater cables, although anthropogenic magnetic fields can influence migratory deviations (Luschi et al. 2007; Snoek et al. 2016). However, any potential impacts from AC cables on turtle navigation or orientation would likely be undetectable under natural conditions, and thus would be insignificant (Normandeau et al. 2011).</p>	<p>During operations, future new cables would produce EMF. Submarine power cables in the geographic analysis area for sea turtles are assumed to be installed with appropriate shielding and burial depth to reduce potential EMF to low levels. (Section 5.2.7 of BOEM's 2007 Final Programmatic EIS for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf.) EMF of any two sources would not overlap. Although the EMF would exist as long as a cable was in operation, impacts, if any, would likely be difficult to detect, if they occur at all. Furthermore, this IPF would be limited to extremely small portions of the areas used by resident or migrating sea turtles. As such, exposure to this IPF would be low, and as a result, impacts on sea turtles would not be expected.</p>
Light: Vessels	<p>Ocean vessels such as ongoing commercial vessel traffic, recreational and fishing activity, scientific and academic research traffic have an array of lights including navigational, deck lights, and interior lights. Such lights have some limited potential to attract sea turtles, although the impacts, if any, are expected to be localized and temporary.</p>	<p>Construction, operations, and decommissioning vessels associated with non-offshore wind activities produce temporary and localized light sources that could result in the attraction or avoidance behavior of sea turtles. These short-term impacts are expected to be of low intensity and occur infrequently.</p>

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Light: Structures	Artificial lighting on nesting beaches or in nearshore habitats has the potential to result in disorientation to nesting females and hatchling turtles. Artificial lighting on the OCS does not appear to have the same potential for effects. Decades of oil and gas platform operation in the Gulf of Mexico, that can have considerably more lighting than offshore WTGs, has not resulted in any known impacts on sea turtles (BOEM 2019).	Non-offshore wind activities would not be expected to appreciably contribute to this sub-IPF. As such, no impact on sea turtles would be expected.
New cable emplacement/maintenance	Cable maintenance activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances will be local and generally limited to the emplacement corridor. Data are not available regarding effects of suspended sediments on adult and juvenile sea turtles, although elevated suspended sediments may cause individuals to alter normal movements and behaviors. However, these changes are expected to be too small to be detected (NOAA 2020). Sea turtles would be expected to swim away from the sediment plume. Elevated turbidity is most likely to affect sea turtles if a plume causes a barrier to normal behaviors, but no impacts would be expected due to swimming through the plume (NOAA 2020). Turbidity associated with increased sedimentation may result in short-term, temporary impacts on sea turtle prey species (Table F1-11).	The impact on water quality from accidental sediment suspension during cable emplacement is short-term and temporary. If elevated turbidity caused any behavioral responses such as avoidance of the turbidity zone or changes in foraging behavior, such behaviors would be temporary, and any impacts would be short-term and temporary. Turbidity associated with increased sedimentation may result in short-term, temporary impacts on some sea turtle prey species (Table F1-11).
Noise: Aircraft	Aircraft routinely travel in the geographic analysis area for sea turtles. With the possible exception of rescue operations, no ongoing aircraft flights would occur at altitudes that would elicit a response from sea turtles. If flights are at a sufficiently low altitude, sea turtles may respond with a startle response (diving or swimming away), altered submergence patterns, and a temporary stress response (NSF and USGS 2011; Samuel et al. 2005). These brief responses would be expected to dissipate once the aircraft has left the area.	Future low-altitude aircraft activities such as survey activities and navy training operations could result in short-term responses of sea turtles to aircraft noise. If flights are at a sufficiently low altitude, sea turtles may respond with a startle response (diving or swimming away), altered submergence patterns, and a temporary stress response (NSF and USGS 2011; Samuel et al. 2005). These brief responses would be expected to dissipate once the aircraft has left the area.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: G&G	<p>Infrequent site characterization surveys and scientific surveys produce high-intensity impulsive noise around sites of investigation. These activities have the potential to result in some impacts including potential auditory injuries, short-term disturbance, behavioral responses, and short-term displacement of feeding or migrating sea turtles, if present within the ensonified area (NSF and USGS 2011). The potential for PTS and TTS is considered possible in proximity to G&G surveys utilizing air guns, but impacts are unlikely as turtles would be expected to avoid such exposure and survey vessels would pass quickly (NSF and USGS 2011). No significant impacts would be expected at the population level.</p>	<p>Same as ongoing activities, with the addition of possible future oil and gas exploration surveys.</p>
Noise: Turbines	<p>Available evidence suggests that typical underwater noise levels from operating WTGs would be below current cumulative injury and behavioral effect thresholds for sea turtles. Operating turbines were determined to produce underwater noise on the order of 110 to 125 dB_{RMS}, occasionally reaching as high as 128 dB_{RMS}, in the 10-Hz to 8-kilohertz range (Tougaard et al. 2020). As measured at the Block Island Wind Facility, low frequency operational noise barely exceeds ambient levels at 164 feet (50 meters) from the WTG base (Miller and Potty 2017). Operational noise impacts would be expected to be negligible.</p>	<p>This sub-IPF does not apply to future non-offshore wind development.</p>

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Noise: Pile driving	<p>Noise from pile driving occurs periodically in nearshore areas when piers, bridges, pilings, and seawalls are installed or upgraded. Noise transmitted through water and/or through the seabed can result in high intensity, low exposure levels, and long-term, but localized intermittent risk to sea turtles. Impacts, potentially including behavioral responses, masking, TTS, and PTS, would be localized in nearshore waters. Data regarding threshold levels for impacts on sea turtles from sound exposure during pile driving are very limited, and no regulatory threshold criteria have been established for sea turtles. Based on current literature, the following thresholds are used to assess impacts on turtles:</p> <p>Potential mortal injury: 210 dB cumulative SPL or greater than 207 dB peak SPL (Popper et al. 2014)</p> <p>Potential mortal injury: 204 dB_{SEL}, 232 dB_{PEAK} (PTS), 189 dB_{SEL}, 226 dB_{PEAK} (TTS) (Navy 2017)</p> <p>Behavioral harassment: 175 dB referenced to 1 µPa RMS (Navy 2017)</p>	<p>No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.</p>
Noise: Vessels	<p>The frequency range for vessel noise (10 to 1000 Hz; MMS 2007) overlaps with sea turtles' known hearing range (less than 1,000 Hz with maximum sensitivity between 200 to 700 Hz; Bartol 1994) and would therefore be audible. However, Hazel et al. (2007) suggests that sea turtles' ability to detect approaching vessels is primarily vision-dependent, not acoustic. Sea turtles may respond to vessel approach and/or noise with a startle response (diving or swimming away) and a temporary stress response (NSF and USGS 2011). Samuel et al. (2005) indicated that vessel noise could have an effect on sea turtle behavior, especially their submergence patterns.</p>	<p>Any offshore projects that require the use of ocean vessels could potentially result in long-term but infrequent impacts on sea turtles, including temporary startle responses, masking of biologically relevant sounds, physiological stress, and behavioral changes, especially their submergence patterns (NSF and USGS 2011; Samuel et al. 2005). However, BOEM expects that these brief responses of individuals to passing vessels would be unlikely given the patchy distribution of sea turtles and no stock or population level effects would be expected.</p>

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Port utilization: Expansion	<p>The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. Port expansion activities are localized to nearshore habitats, and are expected to result in short-term, temporary impacts, if any, on sea turtles. Vessel noise may affect sea turtles, but response would be expected to be short-term and temporary (see the Vessels: Noise sub-IPF above). The impact on water quality from sediment suspension during port expansion activities is short-term, temporary, and would be similar to those described under the New cable emplacement/maintenance IPF above.</p>	<p>Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. In addition, the general trend along the coastal region from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase in larger ships will require port modifications. Future channel deepening activities are being undertaken to accommodate deeper-draft vessels for the Panama Canal Locks. The additional traffic and larger vessels could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. The increased sediment suspension could be long-term depending on the vessel traffic increase. Certain types of vessel traffic have increased recently (e.g., ferry use and cruise industry) and may continue to increase in the foreseeable future. Additional impacts associated with the increased risk of vessel strikes could also occur (see the Traffic: Vessel collisions sub-IPF below).</p>
Presence of structures: Entanglement or ingestion of lost fishing gear	<p>The Mid-Atlantic region has more than 130 artificial reefs. Currently bridge foundations and the Block Island Wind Facility may be considered artificial reefs and may have higher levels of recreational fishing, which increases the chances of sea turtles encountering lost fishing gear, resulting in possible ingestions, entanglement, injury, or death of individuals (Berreiros and Raykov 2014; Gregory 2009; Vegter et al. 2014) if present where these structures are located. At the scale of the OCS geographic analysis area for sea turtles, there are very few areas that would serve to concentrate recreational fishing and increase the likelihood that sea turtles would encounter lost fishing gear.</p>	<p>No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.</p>

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Presence of structures: Habitat conversion and prey aggregation	The Mid-Atlantic region has more than 130 artificial reefs. Hard-bottom (scour control and rock mattresses) and vertical structures (bridge foundations, Block Island Wind Facility WTGs, and two WTGs with the CVOW pilot project) in a soft-bottom habitat can create artificial reefs, thus inducing the reef effect (Taormina et al. 2018; NMFS 2015). The reef effect is usually considered a beneficial impact, associated with higher densities and biomass of fish and decapod crustaceans (Taormina et al. 2018), providing a potential increase in available forage items and shelter for sea turtles compared to the surrounding soft-bottoms.	The presence of structures associated with non-offshore wind development in near-shore coastal waters has the potential to provide habitat for sea turtles as well as preferred prey species. This reef effect has the potential to result in long-term, low-intensity beneficial impacts. Bridge foundations will continue to provide foraging opportunities for sea turtles with measurable benefits to some individuals.
Presence of structures: Avoidance/ displacement	No ongoing activities in the geographic analysis area for sea turtles beyond offshore wind facilities are measurably contributing to this sub-IPF. There may be some impacts resulting from the existing Block Island Wind Facility (5 WTGs) and the CVOW pilot project (2 WTGs) but given the limited number of WTGs, no measurable impacts are occurring.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Behavioral disruption - breeding and migration	No ongoing activities in the geographic analysis area for sea turtles beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.
Presence of structures: Displacement into higher risk areas (Vessels and Fishing)	No ongoing activities in the geographic analysis area for sea turtles beyond offshore wind facilities are measurably contributing to this sub-IPF.	Not contemplated for non-offshore wind facility sources.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Traffic: Vessel collisions	Current activities contributing to this sub-IPF include port traffic levels, fairways, TSS, commercial vessel traffic, recreational and fishing activity, and scientific and academic vessel traffic. Propeller and collision injuries from boats and ships are common in sea turtles. Vessel strike is an increasing concern for sea turtles, especially in the southeastern United States, where development along the coasts is likely to result in increased recreational boat traffic. In the United States, the percentage of strandings of loggerhead sea turtles that were attributed to vessel strikes increased from approximately 10% in the 1980s to a record high of 20.5% in 2004 (NMFS and USFWS 2007). Sea turtles are most susceptible to vessel collisions in coastal waters, where they forage from May through November. Vessel speed may exceed 10 knots in such waters, and evidence suggests that they cannot reliably avoid being struck by vessels exceeding 2 knots (Hazel et al. 2007).	Vessel traffic associated with non-offshore wind development has the potential to result in an increased collision risk. While these impacts would be high consequence, the patchy distribution of sea turtles makes stock or population-level effects unlikely (Navy 2018).
Climate change: Warming and sea level rise, storm severity/frequency	Increased storm frequency could lead to long-term, high-consequence impacts on sea turtle onshore beach nesting habitat, including changes to nesting periods, changes in sex ratios of nestlings, drowned nests, as well as loss or degradation of nesting beaches. Offshore impacts, including sedimentation of near-shore hard bottom habitats have the potential to result in long-term, high consequence changes to foraging habitat availability for green turtles.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Ocean acidification	This sub-IPF has the potential to lead to long-term, high-consequence impacts on marine ecosystems by contributing to reduced growth or the decline of invertebrates that have calcareous shells.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Warming and sea level rise, altered habitat/ecology	This sub-IPF has the potential to lead to long-term, high-consequence impacts on sea turtles by influencing distributions of sea turtles and/or prey resources. This sub-IPF has the potential to lead to long-term, high-consequence impacts on sea turtle breeding, foraging, and sheltering habitat use.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Climate change: Warming and sea level rise, altered migration patterns	This sub-IPF has the potential to lead to long-term, high-consequence impacts on sea turtle habitat use and migratory patterns.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Warming and sea level rise, disease frequency	Climate change, influenced in part by GHG emissions, is expected to continue to contribute to a gradual warming of ocean waters, influencing the frequencies of various diseases of sea turtles such as fibropapillomatosis.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Warming and sea level rise, protective measures (barriers, sea walls)	The proliferation of coastline protections have the potential to result in long-term, high-consequence impacts on sea turtle nesting by eliminating or precluding access to potentially suitable nesting habitat or access to potentially suitable habitat.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.
Climate change: Warming and sea level rise, storm severity, frequency, sediment erosion, deposition	Sediment erosion and/or deposition in coastal waters have the potential to result in long-term, high-consequence impacts on green sea turtle foraging habitat. Additionally, sediment erosion has the potential to result in the degradation or loss of potentially suitable nesting habitat.	No future activities were identified within the geographic analysis area for sea turtles other than ongoing activities.

µT = microtesla; AC = alternating current; CVOW = Coastal Virginia Offshore Wind; hazmat = hazardous materials

Table F1-22 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Scenic and Visual Resources

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat, suspended sediments, trash and debris	Ongoing offshore and onshore construction projects involve the use of vehicles, vessels, and equipment that contain fuel, fluids, and hazmat that have the potential for accidental release. Offshore and onshore construction can also result in sedimentation from land and seabed disturbance and accidental releases of trash and debris with associated visual impacts.	Future offshore and onshore construction projects have the potential to result in accidental releases from vehicles, vessels, and equipment that contain fuel, fluids, and hazmat. Future offshore and onshore construction could also result in sedimentation from land and seabed disturbance and accidental releases of trash and debris with associated visual impacts.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Land disturbance: Erosion and sedimentation, onshore construction, onshore land use changes	Onshore human-caused and naturally occurring erosion and sedimentation results from construction, maintenance, and weather events.	Ongoing onshore construction projects could generate noticeable disturbance in the landscape. Intensity and extent would vary depending on the location, type, and duration of activities.
Light: Offshore structures and vessels, onshore vehicles, roads, laydown, parking, facilities, equipment, and structures	Offshore vessels have an array of lights including navigational lights, deck lights, and interior lights. Various ongoing onshore and coastal construction projects have nighttime activities, as well as existing structures, facilities, and vehicles that would require nighttime lighting.	Ongoing onshore construction projects involving nighttime activity could generate nighttime lighting. Intensity and extent would vary depending on the location, type, direction, and duration of nighttime lighting.
Structures: Viewshed	Buoys are the only existing stationary structures within the offshore viewshed of the Projects. Typically, buoys are visible only in the immediate foreground (less than 1 mile). Stationary and moving barges, boats, and ships also are visible in the daytime and nighttime viewsheds.	Onshore wind-related structures that could be viewed in conjunction with the offshore project components would be limited to meteorological towers, substations, and electrical transmission towers and conductors.
Traffic: Helicopters, vessels, vehicles	Ongoing activities contribute air, marine, and onshore traffic and visible congestion.	Planned onshore and offshore construction projects involving vessel, vehicle, and helicopter traffic could generate noticeable changes in the characteristic seascape and landscape and viewer experience. Intensity and extent of the changes would vary depending on the location, type, direction, and duration of the traffic.

hazmat = hazardous materials

Table F1-23 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Water Quality

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Accidental releases: Fuel/fluids/hazmat	<p>Accidental releases of fuels and fluids occur during vessel usage for dredge material ocean disposal, fisheries use, marine transportation, military use, survey activities, and submarine cable lines, and pipeline laying activities. According to the DOE, 31,000 barrels of petroleum are spilled into U.S. waters from vessels and pipelines in a typical year. Approximately 40.5 million barrels of oil were lost as a result of tanker incidents from 1970 to 2009, according to International Tanker Owners Pollution Federation Limited, which collects data on oil spills from tankers and other sources. From 1990 to 1999, the average annual input to the coastal Northeast was 220,000 barrels of petroleum and into the offshore was < 70,000 barrels. Impacts on water quality from a small accidental release would be expected to be brief and localized due to containment and cleanup requirements, and petroleum weathering processes (i.e., the chemical and physical changes in the aquatic environment) that break down petroleum. Catastrophic accidental releases (e.g., a tanker grounding), although less common than small localized releases, would be anticipated to have long-term impacts on water quality due to the large area of surface water affected and volumes of petroleum that make it more difficult to contain and clean up.</p>	<p>Future accidental releases from offshore vessel usage, spills, and consumption will likely continue on a similar trend. Impacts are unlikely to affect water quality.</p>
Accidental releases: Trash and debris	<p>Trash and debris may be accidentally discharged through fisheries use, dredged material ocean disposal, marine minerals extraction, marine transportation, navigation and traffic, survey activities, and cables, lines, and pipeline laying. Accidental releases of trash and debris are expected to be low probability events. BOEM assumes operator compliance with federal and international requirements for management of shipboard trash; such events also have a relatively limited spatial impact.</p>	<p>As population and vessel traffic increase gradually over the next 35 years, accidental release of trash and debris may increase. However, there does not appear to be evidence that the volumes and extents anticipated would have any effect on water quality.</p>

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Anchoring	Impacts from anchoring occur due to ongoing military use and survey, commercial, and recreational activities.	Impacts from anchoring may occur semi-regularly over the next 35 years due to offshore military operations or survey activities. These impacts would include increased seabed disturbance resulting in increased turbidity levels. All impacts would be localized, short term, and temporary.
New cable emplacement/maintenance	Elevated suspended sediment concentrations can occur under natural tidal conditions and increase during storms, trawling, and vessel propulsion. Survey activities, and new cable and pipeline laying activities disturb bottom sediments and cause temporary increases in suspended sediment; these disturbances would be short-term and either be limited to the emplacement corridor or localized.	Suspension of sediments may continue to occur infrequently over the next 35 years due to survey activities, and submarine cable, lines, and pipeline-laying activities. Future new cables would occasionally disturb the seafloor and cause short-term increases in turbidity and minor alterations in localized currents resulting in local short-term impacts. If the cable routes enter the water quality geographic analysis area, short-term disturbance in the form of increased suspended sediment and turbidity would be expected.
Port utilization: Expansion	Between 1992 and 2012, global shipping traffic increased fourfold (Tournadre 2014). The U.S. OCS is no exception to this trend, and growth is expected to continue as human population increases. In addition, the general trend along the coastal region from Virginia to Maine is that port activity will increase modestly. The ability of ports to receive the increase in larger ships will require port modifications, which, along with additional vessel traffic, could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. The increased sediment suspension could be long-term depending on the vessel traffic increase. Certain types of vessel traffic have increased recently (e.g., ferry use and cruise industry) and may continue to increase in the foreseeable future.	The general trend along the coastal region from Virginia to Maine is that port activity will increase modestly over the next 35 years. Port modifications and channel deepening activities are being undertaken to accommodate the increase in vessel traffic and deeper-draft vessels that transit the Panama Canal Locks. The additional traffic and larger vessels could have impacts on water quality through increases in suspended sediments and the potential for accidental discharges. Certain types of vessel traffic have increased recently (e.g., ferry use and cruise industry) and may continue to increase in the foreseeable future.
Presence of structures	The installation of onshore and offshore structures leads to alteration of local water currents. These disturbances would be local but, depending on the hydrologic conditions, have the potential to impact water quality through the formation of sediment plumes.	Impacts associated with the presence of structures includes temporary sediment disturbance during maintenance. This sediment suspension would lead to interim and localized impacts.

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Non-Offshore Wind Activities Intensity/Extent
Discharges	Discharges impact water quality by introducing nutrients, chemicals, and sediments to the water. There are regulatory requirements related to prevention and control of discharges, the prevention and control of accidental spills, and the prevention and control of nonindigenous species.	Increased coastal development is causing increased nutrient pollution in communities. In addition, ocean disposal activity in the North and Mid-Atlantic is expected to gradually decrease or remain stable. Impacts of ocean disposal on water quality are minimized because USEPA has established dredge spoil criteria and regulate the disposal permits issued by USACE. The impact on water quality from sediment suspension during these future activities would be short-term and localized.
Land disturbance: erosion and sedimentation	Ground disturbance activities may lead to un-vegetated or otherwise unstable soils. Precipitation events could potentially mobilize the soils into nearby surface waters, leading to potential erosion and sedimentation effects and subsequent increased turbidity.	Ground disturbance associated with construction and installation of onshore components could lead to un-vegetated or unstable soils. Precipitation events could mobilize these soils leading to erosion and sedimentation effects and turbidity. The impacts for future offshore wind through this IPF would be staggered in time and localized. The impacts would be short term and localized with an increased likelihood of impacts limited to onshore construction periods.
Land disturbance: Onshore construction	Onshore construction activities may lead to un-vegetated or otherwise unstable soils as well as soil contamination due to leaks or spills from construction equipment. Precipitation events could potentially mobilize the soils into nearby surface waters, leading to increased turbidity and alteration of water quality.	The general trend along coastal regions is that port activity will increase modestly in the future. This increase in activity includes expansion needed to meet commercial, industrial, and recreational demand. Modifications to cargo handling equipment and conversion of some undeveloped land to meet port demand would be required to receive the increase in larger ships.

DOE = U.S. Department of Energy; hazmat = hazardous materials

Table F1-24 Summary of Non-offshore Wind Activities and the Associated Impact-Producing Factors for Wetlands

Associated IPFs: Sub-IPFs	Ongoing Activities	Planned Activities Intensity/Extent
Land disturbance: Erosion and sedimentation	Ground disturbance activities may lead to unvegetated or otherwise unstable soils. Precipitation events could potentially mobilize the soils into nearby wetlands, leading to potential erosion and sedimentation effects and subsequent increased turbidity.	Ground disturbance associated with construction and installation of onshore components could lead to unvegetated or unstable soils. Precipitation events could mobilize these soils, leading to erosion and sedimentation effects and turbidity. Impacts from future offshore wind activities through this IPF would be staggered in time and localized. The impacts would be short term and localized, with an increased likelihood of impacts limited to onshore construction periods.
Land disturbance: Onshore construction	Onshore construction activities may lead to unvegetated or otherwise unstable soils as well as soil contamination due to leaks or spills from construction equipment. Precipitation events could potentially mobilize the soils into nearby wetlands, leading to increased turbidity and alteration of water quality.	The general trend along coastal regions is that port activity and land development will increase modestly in the future. This increase in activity includes expansion needed to meet commercial, industrial, and recreational demand. Modifications to cargo-handling equipment and conversion of some undeveloped land to meet port demand would be required to receive the increase in larger ships.

References Cited

- Bartol, S. M. 1994. Auditory evoked potentials of the loggerhead sea turtle (*Caretta caretta*). Master's Thesis, College of William and Mary – Virginia Institute of Marine Science. 66 pp. Available: <https://scholarworks.wm.edu/cgi/viewcontent.cgi?article=2805&context=etd>.
- Baulch, S., and C. Perry. 2014. Evaluating the Impacts of Marine Debris on Cetaceans. *Marine Pollution Bulletin* 80:210–221.
- Bembenek-Bailey, S. A., J. N. Niemuth, P. D. McClellan-Green, M. H. Godfrey, C. A. Harms, H. Gracz, and M. K. Stoskopf. 2019. NMR Metabolomics Analysis of Skeletal Muscle, Heart, and Liver of Hatchling Loggerhead Sea Turtles (*Caretta caretta*) Experimentally Exposed to Crude Oil and/or Corexit. *Metabolites* 2019(9):21. doi:10.3390/metabo9020021.
- Berreiros J. P., and V. S. Raykov. 2014. Lethal Lesions and Amputation Caused by Plastic Debris and Fishing Gear on the Loggerhead Turtle *Caretta caretta* (Linnaeus, 1758). Three case reports from Terceira Island, Azores (NE Atlantic). *Marine Pollution Bulletin* 86:518–522.
- Briggs, K. T., M. E. Gershwin, and D. W. Anderson. 1997. Consequences of petrochemical ingestion and stress on the immune system of seabirds. *ICES Journal of Marine Science* 54:718–725.
- Browne, M. A., A. J. Underwood, M. G. Chapman, R. Williams, R. C. Thompson, and J. A. van Franeker. 2015. Linking Effects of Anthropogenic Debris to Ecological Impacts. *Proceedings of the Royal Society B* 282:20142929. Available: <http://dx.doi.org/10.1098/rspb.2014.2929>.
- Bugoni, L., L. Krause, and M. V. Petry. 2001. Marine Debris and Human Impacts on Sea Turtles in Southern Brazil. *Marine Pollution Bulletin* 42(12):1330–1334.
- Bureau of Ocean Energy Management (BOEM). 2019. National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf. Available: <https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/IPFs-in-the-Offshore-Wind-Cumulative-Impacts-Scenario-on-the-N-OCS.pdf>. Accessed: December 2020.
- Burge. C. A., C. M. Eakin, C. S. Friedman, B. Froelich, P. K. Hershberger, E. E. Hofmann, L. E. Petes, K. C. Prager, E. Weil, B. L. Willis, S. E. Ford, and C. D. Harvell. 2014. Climate Change Influences on Marine Infectious Diseases: Implications for Management and Society. *Annual Review of Marine Science* 6:249–277.
- Camacho, M., O. P. Luzardo, L. D. Boada, L. F. L. Jurado, M. Medina, M. Zumbado, and J. Orós. 2013. Potential Adverse Health Effects of Persistent Organic Pollutants on Sea Turtles: Evidence from a Cross-Sectional Study on Cape Verde Loggerhead Sea Turtles. *Science of the Total Environment*.
- Causon, Paul D., and Andrew B. Gill. 2018. Linking Ecosystem Services with Epibenthic Biodiversity Change Following Installation of Offshore Wind Farms. *Environmental Science and Policy* 89:340–347.

- Claissse, Jeremy T., Daniel J. Pondella II, Milton Love, Laurel A. Zahn, Chelsea M. Williams, Jonathan P. Williams, and Ann S. Bull. 2014. Oil Platforms off California are among the Most Productive Marine Fish Habitats Globally. *Proceedings of the National Academy of Sciences of the United States of America* 111(43):15462–15467. October 28, 2014. First published October 13, 2014. Available: <https://doi.org/10.1073/pnas.1411477111>. Accessed: March 2020.
- Cook, A. S. C. P., and N. H. K. Burton. 2010. *A review of Potential Impacts of Marine Aggregate Extraction on Seabirds*. Marine Environment Protection Fund Project 09/P130. Available: https://www.bto.org/sites/default/files/shared_documents/publications/research-reports/2010/rr563.pdf. Accessed: February 25, 2020.
- CSA Ocean Sciences, Inc. and Exponent. 2019. *Evaluation of Potential EMF Effects on Fish Species of Commercial or Recreational Fishing Importance in Southern New England*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2019-049.
- Degraer, S., R. Brabant, B. Rumes, and L. Vigin, eds. 2019. *Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea: Marking a Decade of Monitoring, Research and Innovation*. Brussels: Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management, 134 pp.
- Dolbeer, R. A., M. J. Begier, P. R. Miller, J. R. Weller, and A. L. Anderson. 2019. *Wildlife Strikes to civil aircraft in the United States, 1990 – 2018*. Federal Aviation Administration National Wildlife Strike Database Serial Report Number 25. 95 pp. + Appendices.
- Efroymson, R. A., W. Hodge Rose, S. Nemth, and G. W. Suter II. 2000. *Ecological Risk Assessment Framework for Low Altitude Overflights by Fixed-Wing and Rotary-Wing Military Aircraft*. Research sponsored by Strategic Environmental Research and Development Program of the U.S. Department of Defense under Interagency Agreement 2107-N218-S1. Publication No. 5010, Environmental Sciences Division, ORNL.
- Fabrizio, M. C., J. P. Manderson, and J. P. Pessutti. 2014. Home Range and Seasonal Movements of Black Sea Bass (*Centropristis striata*) during their Inshore Residency at a Reef in the Mid-Atlantic Bight. *Fishery Bulletin* 112:82–97 (2014). doi: 10.7755/FB.112.1.5.
- Gall, S. C., and R. C. Thompson. 2015. The Impact of Marine Debris on Marine Life. *Marine Pollution Bulletin* 92:170–179.
- Gill, A. B., I. Gloyne-Phillips, K. J. Neal, and J. A. Kimber. 2005. *The Potential Effects of Electromagnetic Fields Generated by Sub-Sea Power Cables Associated with Offshore Wind Farm Developments on Electrically and Magnetically Sensitive Marine Organisms - A Review*. Collaborative Offshore Wind Research into the Environment (COWRIE), Ltd, UK.
- Greene, J. K., M. G. Anderson, J. Odell, and N. Steinberg (editors). 2010. *The Northwest Atlantic Marine Ecoregional Assessment: Species, Habitats and Ecosystems. Phase One*. The Nature Conservancy, Eastern U.S. Division, Boston, MA.
- Gregory, M. R. 2009. Environmental Implications of Plastic Debris in Marine Settings – Entanglement, Ingestion, Smothering, Hangers-on, Hitch-Hiking, and Alien Invasion. *Philosophical Transactions of the Royal Society B* 364:2013–2025.

- Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, and E. Estela-Gomez. 2017. *Habitat Mapping and Assessment of Northeast Wind Energy Areas*. U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088.
- Haney, J. C., P. G. R. Jodice, W. A. Montevecchi, and D. C. Evers. 2017. Challenges to oil spill assessments for seabirds in the deep ocean. *Archives of Environmental Contamination and Toxicology* 73:33–39.
- Hann, Z. A., M. J. Hosler, and P. R. Mooseman, Jr. 2017. Roosting Habits of Two *Lasiurus borealis* (eastern red bat) in the Blue Ridge Mountains of Virginia. *Northeastern Naturalist* 24 (2):N15–N18.
- Hare J. A., W. E. Morrison, M. W. Nelson, M. M. Stachura, E. J. Teeters, and R. B. Griffis. 2016. A Vulnerability Assessment of Fish and Invertebrates to Climate Change on the Northeast U.S. Continental Shelf. *PLOS ONE* 11(2):e0146756. doi:10.1371/journal.pone.0146756.
- Hawkins, A., and A. Popper. 2017. A Sound Approach to Assessing the Impact of Underwater Noise on Marine Fishes and Invertebrates. *ICES Journal of Marine Science* 74(3):635–651. doi:10.1093/icesjms/fsw205.
- Hazel, J., I. R. Lawler, H. Marsh, and S. Robson. 2007. Vessel Speed Increases Collision Risk for the Green Turtle *Chelonia mydas*. *Endangered Species Research* 3:105–113.
- HDR. 2019. *Benthic Monitoring during Wind Turbine Installation and Operation at the Block Island Wind Farm, Rhode Island – Year 2. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs*. OCS Study BOEM 2019- 019. Available: https://espi.boem.gov/final%20reports/BOEM_2019-019.pdf. Accessed: February 12, 2020.
- Hoarau, L., L. Ainley, C. Jean, S. Ciccione. 2014. Ingestion and Defecation of Marine Debris by Loggerhead Sea Turtles, from By-catches in the South-West Indian Ocean. *Marine Pollution Bulletin* 84:90–96.
- Hüppop, O., J. Dierschke, K. Exo, E. Frerich, and R. Hill. 2006. Bird Migration and Potential Collision Risk with Offshore Wind Turbines. *Ibis* 148:90–109.
- Hutchison, Zoë, Peter Sigray, Haibo He, Andrew Gill, John King, and Carol Gibson. 2018. *Electromagnetic Field (EMF) Impacts on Elasmobranch (shark, rays, and skates) and American Lobster Movement and Migration from Direct Current Cables*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2018-003.
- Jensen, J. H., L. Bejder, M. Wahlberg, N. Aguilar Solo, M. Johnson, and P. T. Madsen. 2009. Vessel Noise Effects on Delphinid Communication. *Marine Ecology Progress Series* 395:161–175.
- Karp, M. A., J. O. Peterson, P. D. Lynch, R. B. Griffis, C. F. Adams, W. S. Arnold, L. A. Barnett, Y. deReynier, J. DiCosimo, and K. H. Fenske. 2019. Accounting for shifting distributions and changing productivity in the development of scientific advice for fishery management. *ICES Journal of Marine Science* 76 (5):1305–1315.

- Kellar, N. M., T. R. Speakman, C. R. Smith, S. M. Lane, B. C. Balmer, M. L. Trego, K. N. Catelani, M. N. Robbins, C. D. Allen, R. S. Wells, E. S. Zolman, T. K. Rowles, and L. H. Schwacke. 2017. Low Reproductive Success Rates of Common Bottlenose Dolphins *Tursiops truncatus* in the Northern Gulf of Mexico Following the Deepwater Horizon Disaster (2010-2015). *Endangered Species Research* 33:1432–158.
- Kerckhof, Francis, Bob Rumes, and Steven Degraer. 2019. About ‘Mytilisation’ and ‘Slimeification’: A Decade of Succession of the Fouling Assemblages on Wind Turbines off the Belgian Coast. In *Memoirs on the Marine Environment: Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea*, edited by Steven Degraer, Robin Brabant, Bob Rumes, and Laurence Vigin, pp. 73–84. Brussels: Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management. Available: https://odnature.naturalsciences.be/downloads/mumm/windfarms/winmon_report_2019_final.pdf. Accessed: February 12, 2020.
- Kirschvink, J. L. 1990. Geomagnetic Sensitivity in Cetaceans an Update with Live Strandings Recorded in the US. In *Sensory Abilities of Cetaceans*, edited by J. Thomas and R. Kastelein. Plenum Press, NY.
- Kite-Powell, H. L., A. Knowlton, and M. Brown. 2007. *Modeling the Effect of Vessel Speed on Right Whale Ship Strike Risk*. Unpublished Report for NOAA/NMFS Project NA04NMF47202394. 8 pp.
- Kraus, S. D., M. W. Brown, H. Caswell, C. W. Clark, M. Fujiwara, P. H. Hamilton, R. D. Kenney, A. R. Knowlton, S. Landry, C. A. Mayo, W. A. McLellan, M. J. Moore, D. P. Nowacek, D. A. Pabst, A. J. Read, and R. M. Rolland. 2005. North Atlantic Right Whales in Crisis. *Science* 309:561–562.
- Kraus, S. D., S. Leiter, K. Stone, B. Wikgren, C. Mayo, P. Hughes, R. D. Kenney, C. W. Clark, A. N. Rice, B. Estabrook, and J. Tielens. 2016. *Northeast Large Pelagic Survey Collaborative Aerial and Acoustic Surveys for Large Whales and Sea Turtles. Final Report*. U.S. Department of the Interior, Bureau of Ocean Energy Management, Sterling, Virginia. OCS Study BOEM 2016-054.
- La Sorte, Frank, K. Horton, C. Nilsson, and A. Dokter. 2018. Projected changes in wind assistance under climate change for nocturnally migrating bird populations. Available: <https://par.nsf.gov/servlets/purl/10092560>. Accessed: February 10, 2021.
- Law, K. L., S. Morét-Ferguson, N. A. Maximenko, G. Proskurowski, E. E. Peacock, J. Hafner, and C. M. Reddy. 2010. Plastic Accumulation in the North Atlantic Subtropical Gyre. *Science* 329:1185–1188.
- Luschi, P., S. Benhamou, C. Girard, S. Ciccione, D. Roos, J. Sudre, and S. Benvenuti. 2007. Marine Turtles use Geomagnetic Cues during Open Sea Homing. *Current Biology* 17:126–133.
- MacLeod, C. D. 2009. Global Climate Change, Range Changes, and Potential Implications for the Conservation of Marine Cetaceans: a Review and Synthesis. *Endangered Species Research* 7:125–136.
- Maggini, I., L. V. Kennedy, A. Macmillan, K. H. Elliot, K. Dean, and C. G. Guglielmo. 2017. Light oiling of feathers increases flight energy expenditure in a migratory shorebird. *Journal of Experimental Biology* 220:2372–2379.
- Mazet, J. A. K., I. A. Gardner, D. A. Jessup, and L. J. Lowenstine. 2001. Effects of Petroleum on Mink Applied as a Model for Reproductive Success in Sea Otters. *Journal of Wildlife Diseases* 37(4):686–692.

- McConnell, B. J., M. A. Fedak, P. Lovell, and P. S. Hammond. 1999. Movements and Foraging Areas of Grey Seals in the North Sea. *Journal of Applied Ecology* 36:573–590.
- McCreary, S., and B. Brooks. 2019. Atlantic Large Whale Take Reduction Team Meeting: Key Outcomes Meeting. April 23-26, 2019. Available: <https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-mammal-protection/atlantic-large-whale-take-reduction-plan>. Accessed: March 17, 2020.
- Miller, J. H., and G. R. Potty. 2017. Overview of Underwater Acoustic and Seismic Measurements of the Construction and Operation of the Block Island Wind Farm. *Journal of the Acoustical Society of America* 141(5):3993–3993. doi:10.1121/1.4989144.
- Minerals Management Service (MMS). 2007. *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf, Final Environmental Impact Statement*. October. OCS EIS/EA MMS 2007-046. Available: <https://www.boem.gov/Guide-To-EIS/>. Accessed: July 3, 2018.
- Mitchelmore, C. L., C. A. Bishop, and T. K. Collier. 2017. Toxicological Estimation of Mortality of Oceanic Sea Turtles Oiled during the Deepwater Horizon Oil Spill. *Endangered Species Research* 33:39–50.
- Mohr, F. C., B. Lasely, and S. Bursian. 2008. Chronic Oral Exposure to Bunker C Fuel Oil Causes Adrenal Insufficiency in Ranch Mink. *Archive of Environmental Contamination and Toxicology* 54:337–347.
- Moore, M. J., and J. M. van der Hoop. 2012. The Painful Side of Trap and Fixed Net Fisheries: Chronic Entanglement of Large Whales. *Journal of Marine Biology* 2012:Article ID 230653, 4 pp.
- Moser, J., and G. R. Shepherd. 2009. Seasonal Distribution and Movement of Black Sea Bass (*Centropristis striata*) in the Northwest Atlantic as Determined from a Mark-Recapture Experiment. *J. Northw. Atl. Fish. Sci.* 40:17–28. doi:10.2960/J.v40.m638.
- National Marine Fisheries Service (NMFS). 2015. *Endangered Species Act (ESA) Section 7 Consultation Biological Opinion, Deepwater Wind: Block Island Wind Farm and Transmission System*. June 5.
- National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and USFWS). 2007. *Loggerhead Sea Turtle (Caretta caretta) 5-Year Review: Summary and Evaluation*. National Marine Fisheries Service and U.S. Fish and Wildlife Service.
- National Oceanic and Atmospheric Administration (NOAA). 2018. *Biological Opinion on the Bureau of Ocean Energy Management's Issuance of Five Oil and Gas Permits for Geological and Geophysical Seismic Surveys off the Atlantic Coast of the United States, and the National Marine Fisheries Services' Issuance of Associated Incidental Harassment Authorizations*. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce. 267 pp. + appendices.
- National Oceanic and Atmospheric Administration (NOAA). 2020. *Section 7 Effect Analysis: Turbidity in the Greater Atlantic Region*. NOAA Greater Atlantic Regional Fisheries Office. Available: <https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effect-analysis-turbidity-greater-atlantic-region>.

- National Oceanic and Atmospheric Administration (NOAA). 2021. United States Coast Pilot 3. Chapter 4, New Jersey Coast. Available: <https://nauticalcharts.noaa.gov/publications/coast-pilot/index.html>. Accessed: September 27, 2021.
- National Science Foundation (NSF) and U.S. Geological Survey (USGS). 2011. *Final Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for marine seismic research funded by the National Science Foundation or conducted by the U.S. Geological Survey*. 514 pp. Available: https://www.nsf.gov/geo/oce/envcomp/usgs-nsf-marine-seismic-research/nsf-usgs-final-eis-oeis_3june2011.pdf.
- Nelms, S. E., E. M. Duncan, A. C. Broderick, T. S. Galloway, M. H. Godfrey, M. Hamann, P. K. Lindeque, and Bendan J. Godley. 2016. Plastic and Marine Turtles: a Review and Call for Research. *ICES Journal of Marine Science* 73(2):165–181.
- Normandeau Associates, Inc., Exponent, Inc., T. Tricas, and A. Gill. 2011. *Effects of EMFs from Undersea Power Cables on Elasmobranchs and Other Marine Species*. Final Report. U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09.
- Nunny, L., and M. P. Simmonds. 2019. *Climate Change and Cetaceans: an update*. International Whaling Commission. May.
- Pace, R. M., and G. K. Silber. 2005. Simple analysis of ship and large whale collisions: Does speed kill? Presentation at the Sixteenth Biennial Conference on the Biology of Marine Mammals, San Diego, CA, December 2005.
- Paruk, J. D., E. M. Adams, H. Uher-Koch, K. A. Kovach, D. Long, IV, C. Perkins, N. Schoch, and D. C. Evers. 2016. Polycyclic aromatic hydrocarbons in blood related to lower body mass in common loons. *Science of the Total Environment* 565:360–368.
- Patenaude, N. J., W. J. Richardson, M. A. Smultea, W. R. Koski, and G. W. Miller. 2002. Aircraft Sound and Disturbance to Bowhead and Beluga Whales During Spring Migration in the Alaskan Beaufort Sea. *Marine Mammal Science* 18(2):309–335.
- Popper, Arthur N., Anthony D. Hawkins, Richard R. Fay, David A. Mann, Soraya Bartol, Thomas J. Carlson, Sheryl Coombs, William T. Ellison, Roger L. Gentry, Michele B. Halvorsen, Svein Løkkeborg, Peter H. Rogers, Brandon L. Southall, David G. Zeddies, and William N. Tavolga. 2014. *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report*. Prepared by ANSI - Accredited Standards Committee S3/SC1 and Registered with ANSI. ASAPress/Springer. ASA S3/SC1.4 TR-2014.
- Record, N. R., J. A. Runge, D. E. Pendleton, W. M. Balch, K. T. A. Davies, A. J. Pershing, C. L. Johnson, K. Stamieszkin, Z. Feng, S. D. Kraus, R. D. Kenney, C. A. Hudak, C. A. Mayo, C. Chen, J. E. Salisbury, and C. R. S. Thompson. 2019. Rapid Climate-driven Circulation Changes Threaten Conservation of Endangered North Atlantic Right Whales. *Oceanography* 32(2):162–196.
- Roman, L., B. D. Hardesty, M. A. Hindell, and C. Wilcox. 2019. A quantitative analysis linking seabird mortality and marine debris ingestion. *Scientific Reports* 9(1):1–7.

- Samuel, Y., S. J. Morreale, C. W. Clark, C. H. Greene, and M. E. Richmond. 2005. Underwater, Low-frequency Noise in a Coastal Sea Turtle Habitat. *Journal of the Acoustical Society of America* 117(3):1465–1472.
- Schaub, A., J. Ostwald, and B. M. Siemers. 2008. Foraging bats avoid noise. *Journal of Experimental Biology* 211:3147–3180.
- Schuyler, Q. A., C. Wilcox, K. Townsend, B. D. Hardesty, and N. J. Marshall. 2014. Mistaken Identity? Visual Similarities of Marine Debris to Natural Prey Items of Sea Turtles. *BMC Ecology* 14(14). 7 pp.
- Secor, D. H., F. Zhang, M. H. P. O'Brien, and M. Li. 2018. Ocean Destratification and Fish Evacuation Caused by a Mid-Atlantic Tropical Storm. *ICES Journal of Marine Science* 76(2):573–584. Available: <https://doi.org/10.1093/icesjms/fsx241>.
- Shigenaka, G., S. Milton, P. Lutz, R. Hoff, R. Yender, and A. Mearns. 2010. *Oil and Sea Turtles: Biology, Planning, and Response*. NOAA Office of Restoration and Response Publication. 116 pp.
- Sigourney, D. B. C. D. Orphanides, J. M. Hatch. 2019. *Estimates of Seabird Bycatch in Commercial Fisheries off the East Coast of the United States from 2015-2016*. NOAA Technical Memorandum NMFS-NE-252. Woods Hole, Massachusetts. 27 pp.
- Simmons, A. M., K. N. Horn, M. Warnecke, and J. A. Simmons. 2016. Broadband Noise Exposure Does Not Affect Hearing Sensitivity in Big Brown Bats (*Eptesicus fuscus*). *Journal of Experimental Biology* 219:1031–1040.
- Smith, C. R., T. K. Rowles, L. B. Hart, F. I. Townsend, R. S. Wells, E. S. Zolman, B. C. Balmer, B. Quigley, M. Ivnicic, W. McKercher, M. C. Tumlin, K. D. Mullin, J. D. Adams, Q. Wu, W. McFee, T. K. Collier, and L. H. Schwacke. 2017. Slow Recovery of Barataria Bay Dolphin Health Following the Deepwater Horizon Oil Spill (2013-2014) with Evidence of Persistent Lung Disease and Impaired Stress Response. *Endangered Species Research* 33:127–142.
- Smith, James, Michael Lowry, Curtis Champion, and Iain Suthers. 2016. A Designed Artificial Reef is among the Most Productive Marine Fish Habitats: New Metrics to Address Production Versus Attraction. *Marine Biology* 163:188.
- Snoek, R., R. de Swart, K. Didden, W. Lengkeek, and M. Teunis. 2016. *Potential Effects of Electromagnetic Fields in the Dutch North Sea*. Final Report submitted to Rijkswaterstaat Water, Verkeer en Leefomgeving.
- Southall, B., A. Bowles, W. Ellison, J. Finneran, R. Gentry, C. Greene Jr., D. Kastak, D. Ketten, J. Miller, P. Nachtigall, W. Richardson, J. Thomas, and P. Tyack. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals* 33(4):411–509.
- Sullivan, L., T. Brosnan, T. K. Rowles, L. Schwacke, C. Simeone, and T. K. Collier. 2019. *Guidelines for Assessing Exposure and Impacts of Oil Spills on Marine Mammals*. NOAA Tech. Memo. NMFS-OPR-62, 82 pp.
- Takeshita, R., L. Sullivan, C. Smith, T. Collier, A. Hall, T. Brosnan, T. Rowles, and L. Schwacke. 2017. The Deepwater Horizon Oil Spill Marine Mammal Injury Assessment. *Endangered Species Research* 33:96–106.

- Taormina, B, J. Bald, A. Want, G. D. Thouzeau, M. Lejart, N. Desroy, and A. Carlier. 2018. A Review of Potential Impacts of Submarine Power Cables on the Marine Environment: Knowledge Gaps, Recommendations and Future Directions. *Renewable and Sustainable Energy Reviews* 96(2018):380–391.
- Thomás, J., R. Guitart, R. Mateo, and J. A. Raga. 2002. Marine Debris Ingestion in Loggerhead Turtles, *Caretta caretta*, from the Western Mediterranean. *Marine Pollution Bulletin* 44:211–216.
- Thomsen, Frank, A. B. Gill, Monika Kosecka, Mathias Andersson, Michel André, Seven Degraer, Thomas Folegot, Joachim Gabriel, Adrian Judd, Thomas Neumann, Alain Norro, Denise Risch, Peter Sigray, Daniel Wood, and Ben Wilson. 2015. *MaRVEN – Environmental Impacts of Noise, Vibrations and Electromagnetic Emissions from Marine Renewable Energy*. 10.2777/272281.
- Todd, V. L. G., I. B. Todd, J. C. Gardiner, E. C. N. Morrin, N. A. MacPherson, N. A. DiMarzio, and F. Thomsen. 2015. A Review of Impacts on Marine Dredging on Marine Mammals. *ICES Journal of Marine Science* 72(2):328–340.
- Tougaard, J., L. Hermannsen, and P. T. Madsen. 2020. How loud is the underwater noise from operating offshore wind turbines? *Journal of the Acoustical Society of America* 148(5):2885–2893.
- Tournadre, J. 2014. Anthropogenic Pressure on the Open Ocean: The Growth of Ship Traffic Revealed by Altimeter Data Analysis. *Geophysical Research Letters* 41:7924–7932. DOI:10.1002/2014GL061786.
- U.S. Department of the Navy (Navy). 2017. *Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III)*. Technical report. Available: https://nwtteis.com/portals/nwtteis/files/technical_reports/Criteria_and_Thresholds_for_U.S._Navy_Acoustic_and_Explosive_Effects_Analysis_June2017.pdf.
- U.S. Department of the Navy (Navy). 2018. *Hawaii-Southern California Training and Testing EIS/OEIS*. Available: <https://www.hstteis.com/Documents/2018-Hawaii-Southern-California-Training-and-Testing-Final-EIS-OEIS/Final-EIS-OEIS>.
- U.S. Energy Information Administration. 2020. New Jersey State Energy Profile. Last Updated: September 17, 2020. Available: <https://www.eia.gov/state/print.php?sid=NJ>.
- Vanderlaan, A. S. M., and C. T. Taggart. 2007. Vessel Collisions with Whales: The Probability of Lethal Injury Based on Vessel Speed. *Marine Mammal Science* 23(1):144–156.
- Vargo, S., P. Lutz, D. Odell, E. Van Vleet, and G. Bossart. 1986. *Effects of Oil on Marine Turtles. Final Report prepared for the Minerals Management Service (MMS)*. 12 pp. Available: http://www.seaturtle.org/PDF/VargoS_1986a_MMSTechReport.pdf.
- Vegter, A. C., M. Barletta, C. Beck, J. Borrero, H. Burton, M. L. Campbell, M. F. Costa, M. Eriksen, C. Eriksson, A. Estrades, K. V. K. Gilardi, B. D. Hardesty, J. A. Ivar do Sul, J. L. Lavers, B. Lazar, L. Lebreton, W. J. Nichols, C. A. Ribic, P. G. Ryan, Q. A. Schuyler, S. D. A. Smith, H. Takada, K. A. Townsend, C. C. C. Wabnitz, C. Wilcox, L. C. Young, and M. Hamann. 2014. Global Research Priorities to Mitigate Plastic Pollution Impacts on Marine Wildlife. *Endangered Species Research* 25:225–247.

- Walker, M. M., C. E. Diebel, and J. L. Kirschvink. 2003. Detection and Use of the Earth's Magnetic Field by Aquatic Vertebrates. In *Sensory Processing in Aquatic Environments*, edited by S. P. Collin and N. J. Marshall, pp. 53–74. Springer-Verlag, New York.
- Wallace, B. P., B. A. Stacey, E. Cuevas, C. Holyake, P. H. Lara, A. C. J. Marcondes, J. D. Miller, H. Nijkamp, N. J. Pilcher, I. Robinson, N. Rutherford, and G. Shigenaka. 2010. Oil Spills and Sea Turtles: Documented Effects and Considerations for Response and Assessment Efforts. *Endangered Species Research* 41:17–37.
- Weilgart, Lindy. 2018. The Impact of Ocean Noise Pollution on Fish and Invertebrates. Report for OceanCare. Switzerland. Available: https://www.oceancare.org/wp-content/uploads/2017/10/OceanNoise_FishInvertebrates_May2018.pdf. Accessed: April 21, 2020.
- Werner, S., A. Budziak, J. van Franeker, F. Galgani, G. Hanke, T. Maes, M. Matiddi, P. Nilsson, L. Oosterbaan, E. Priestland, R. Thompson, J. Veiga, and T. Vlachogianni. 2016. *Harm Caused by Marine Litter. MSFD GES TG Marine Litter - Thematic Report*. JRC Technical report; EUR 28317 EN; doi:10.2788/690366.
- Whitaker, J. O., Jr. 1998. Life History and Roost Switching in Six Summer Colonies of Eastern Pipistrelles in Buildings. *Journal of Mammalogy* 79(2):651–659.

This page intentionally left blank.

**ATTACHMENT 2
MAXIMUM-CASE SCENARIO ESTIMATES FOR OFFSHORE WIND
PROJECTS**

This page intentionally left blank.

LIST OF TABLES

Table F2-1	Offshore Wind Development Activities on the U.S. East Coast: Projects and Assumptions (Part 1, Turbine and Cable Design Parameters)	F-123
Table F2-2	Offshore Wind Development Activities on the U.S. East Coast: Projects and Assumptions (Part 2, Seabed/Anchoring Disturbance and Scour Protection)	F-126
Table F2-3	Offshore Wind Development Activities on the U.S. East Coast: Projects and Assumptions (Part 3, Gallons of Coolant, Oils, Lubricants, and Diesel Fuel)	F-127
Table F2-4	Offshore Wind Leasing Activities on the U.S. East Coast: Projects and Assumptions (Part 4, OCS Construction and Operation Emissions)	F-128

This page intentionally left blank.

The following tables provide maximum-case scenario estimates of potential offshore wind project impacts assuming maximum buildout within the Empire Wind EIS geographic analysis areas. BOEM developed these estimates based on offshore wind demand, as discussed in its 2019 study *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf* (BOEM 2019). Estimates disclosed in this EIS's Chapter 3, No Action analyses were developed by summing acreage or number calculations across all lease areas noted as occurring within, or overlapping, a given geographic analysis area. This likely overestimates some impacts in cases where lease areas only partially overlap analysis areas. However, this approach was used to provide the most conservative estimate of future offshore wind development.

This page intentionally left blank

Table F2-1 Offshore Wind Development Activities on the U.S. East Coast: Projects and Assumptions (Part 1, Turbine and Cable Design Parameters)

Region	Lease, Project, Lease Remainder ¹	Status	Geographic Analysis Area (X denotes lease area is within or overlaps geographic analysis area) ³						Estimated Construction Schedule ⁴	Turbine Number ⁵	Generating Capacity (MW)	Offshore Export Cable Length (statute miles) ⁶	Offshore Export Cable Installation Tool Disturbance Width (feet)	Interarray Cable Length (statute miles) ⁷	Hub Height (feet) ⁸	Rotor Diameter (feet) ⁸	Height of Turbine (feet) ⁸
			Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism									
ME	<i>Aqua ventus (state waters)</i>	<i>State Project</i>					X		2023	2	11					450	520
	Total Other State Waters Projects									2	11					450	520
Existing and Ongoing Projects																	
MA/RI	<i>Block Island (state waters)</i>	<i>Built</i>					X		<i>Built</i>	5	30	28	5	2	328	541	659
MA/RI	<i>Vineyard Wind 1 part of OCS-A 0501</i>	<i>COP Approved (ROD issued 2021), PPA, SAP</i>					X		2023	62	800	98	6.5	171	451	721	812
MA/RI	<i>South Fork, OCS-A 0517</i>	<i>COP Approved (ROD issued 2021), PPA, SAP</i>					X		2023	12	130	139	6.5	24	472	735	840
VA/NC	<i>CVOW, OCS-A 0497</i>	<i>RAP, FDR/FIR</i>					X		Built	2	12	27	3	9	364	506	620
	Total Existing and Ongoing Projects									81	972	292		206			
Planned Projects																	
Massachusetts/Rhode Island Region																	
MA/RI	Sunrise, OCS-A 0487	COP, PPA, SAP					X		2024	94	1,034	105	6.5	180	459	656	787
MA/RI	Revolution, part of OCS-A 0486	COP, PPA, SAP					X		2023–2024	100	880	100	131	155	512	722	873
MA/RI	New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 1 [i.e., Park City Wind])	COP, PPA, SAP					X		2024–2026	62	804	125	10	139	630	837	1,047
MA/RI	New England Wind, OCS-A 0534 and portion of OCS-A 0501 (Phase 2 [i.e., Commonwealth Wind])	COP, PPA, SAP							2024–2026	79	1,500	225	10	201	702	935	1,171
MA/RI	Mayflower OCS-A 0521	COP, PPA, SAP					X		2024–2028	147	2,400	1,179	6.5	497	605	919	1,066
MA/RI	Beacon Wind 1, part of OCS-A 0520	PPA, SAP							2024–2025	78	1,230	233	6.5	186	591	984	853
MA/RI	Beacon Wind 2, part of OCS-A 0520	SAP					X		2025–2026	77	1,200	233	6.5	186	591	984	853
MA/RI	Bay State Wind, part of OCS-A 0500	SAP, COP (unpublished); the MW is included in the description below in the 5,148 MW.					X		By 2030, spread over 2025–2030	110	4,200	120	6.5	172	492	722	853
MA/RI	Liberty Wind, part of OCS-A 0522	This group is exposed to 5,800 MW of demand—for MA (4,000 MW remaining), CT (900 MW remaining), and RI (900 MW expected). Collectively the remaining technical capacity is 5,148 MW.					X					120			492	722	853
MA/RI	OCS-A 0500 remainder						X					120			492	722	853
MA/RI	OCS-A 0487 remainder						X			227		120			492	722	853
MA/RI	Remaining MA/RI Lease Area Total ²	73%								337	4,400	480	6.5	540	492	722	853

Region	Lease, Project, Lease Remainder ¹	Status	Geographic Analysis Area (X denotes lease area is within or overlaps geographic analysis area) ³						Estimated Construction Schedule ⁴	Turbine Number ⁵	Generating Capacity (MW)	Offshore Export Cable Length (statute miles) ⁶	Offshore Export Cable Installation Tool Disturbance Width (feet)	Interarray Cable Length (statute miles) ⁷	Hub Height (feet) ⁸	Rotor Diameter (feet) ⁸	Height of Turbine (feet) ⁸
			Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism									
	Total MA/RI Leases²								974	13,248	2,680		2,084				
New York/New Jersey Region																	
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA, SAP					X		2023–2025	98	1,100	194 ¹¹	98	190	512	788	906
NY/NJ	Atlantic Shores South (OCS-A 0499)	COP, PPA, SAP					X		2024–2027	200	1,510	441	58	547	576	919	1,049
NY/NJ	Ocean Wind 2, OCS-A 0532	PPA					X		By 2030, spread over 2026–2030	111	1,554	120	5	173	512	788	906
NY/NJ	Empire Wind 1, part of OCS-A 0512	COP, PPA, SAP	X	X	X	X	X	X	2023–2026	57	816	46	5	133	525	853	951
NY/NJ	Empire Wind 2, part of OCS-A 0512	COP, PPA, SAP	X	X	X	X	X	X	2023–2027	90	1,260	30	5	166	525	853	951
NY/NJ	Atlantic Shores North, OCS-A 0549	SAP					X		By 2030, spread over 2026–2030	157	2,198	99	58	249	576	919	1,049
NY/NJ	OW Ocean Winds East LLC, OCS-A 0537				X		X	X	By 2030, spread over 2026–2030	100	1,200	120	5	157	492	722	853
NY/NJ	Attentive Energy LLC, OCS-A 0538						X	X	By 2030, spread over 2026–2030	102	1,224	120	5	160	492	722	853
NY/NJ	Bight Wind Holdings LLC, OCS-A 0539						X	X	By 2030, spread over 2026–2030	145	1,740	120	5	231	492	722	853
NY/NJ	Atlantic Shores Offshore Wind Bight LLC, OCS-A 0541						X		By 2030, spread over 2026–2030	93	1,116	120	5	147	492	722	853
NY/NJ	Invenergy Wind Offshore LLC, OCS-A 0542						X		By 2030, spread over 2026–2030	97	1,164	120	5	153	492	722	853
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544			X	X		X	X	By 2030, spread over 2026–2030	102	1,224	120	5	160	492	722	853
	Total NY/NJ Leases									1,352	16,106	1,650		2,466			
Maryland/Delaware Region																	
DE/MD	Skipjack, part of OCS-A 0519	COP, PPA, SAP					X		2024	16	120	40	10	30	492	722	853
DE/MD	US Wind, part of OCS-A 0490	COP, PPA, SAP					X		2024–2027	121	2,000	146	7	152	528	820	938
DE/MD	GSOE I, OCS-A 0482	Collectively the technical capacity of this is group is 1,080 MW (90 turbines). The remaining capacity may be utilized by demand from NJ or MD.					X		By 2030, spread over 2023–2030	90	1,080	-	-	-	492	722	853
DE/MD	OCS-A 0519 remainder						X					-	-	-			
DE/MD	Remaining DE/MD Lease Area Total									90	1,080	240	5	139			
	Total DE/MD Leases									227	3,200	426		321			
Virginia/North Carolina Region																	
VA/NC	CVOW-C, OCS-A 0483	COP, SAP					X		2025–2027	205	3,000	417	5	301	489	761	869

Region	Lease, Project, Lease Remainder ¹	Status	Geographic Analysis Area (X denotes lease area is within or overlaps geographic analysis area) ³						Estimated Construction Schedule ⁴	Turbine Number ⁵	Generating Capacity (MW)	Offshore Export Cable Length (statute miles) ⁶	Offshore Export Cable Installation Tool Disturbance Width (feet)	Interarray Cable Length (statute miles) ⁷	Hub Height (feet) ⁸	Rotor Diameter (feet) ⁸	Height of Turbine (feet) ⁸
			Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism									
VA/NC	Kitty Hawk North, OCS-A 0508	COP, SAP					X		2024–2030	69	1,242	100	30	149	574	935	1,042
VA/NC	Kitty Hawk South, OCS-A 0508	COP					X		2024–2027	121	1,242	353	30	200	574	935	1,042
	Total VA/NC Leases									395	5,484	870		650			
	OCS Total (Planned) ^{9,10}									2,948	38,038	5,626		5,522			

Projects in *italics* are projects that have already been constructed or that are ongoing projects. Completed and ongoing projects are not included in project totals.

¹ The spacing/layout for projects are as follows: NE State water projects include a single strand of WTGs and no OSS. For projects in the RI, MA, NY, NJ, DE, MD lease areas, a 1x1–nm grid spacing is assumed. For the CVOW-C Project, the spacing is 0.7 nm; and the Dominion commercial lease area off the coast of Virginia would utilize 0.5 nm average spacing, which is less than the 1x1–nm spacing due to the need to attain the state's goals.

² Because development could occur anywhere within the RI and MA lease areas and assumes a continuous 1x1–nm grid, the actual development for these projects is expected to be approximately 73% of the collective technical capacity. Under the scenario described in this appendix, the total area in the RI and MA lease areas is greater than the area needed to meet state demand. Therefore, if a project is not constructed, BOEM assumes that another future project would be constructed to fulfill the unmet demand.

³ This column identifies lease areas that are applicable to each resource based on the geographic analysis areas.

⁴ The estimated construction schedule is based on information known at the time of this analysis and could be different when an applicant submits a COP.

⁵ The number of turbines for those lease areas without an announced number of turbines has been calculated based on lease size, a 1x1–nm grid spacing, and/or the generating capacity.

⁶ BOEM assumes that each offshore wind development would have its own cable (both onshore and offshore) and that future projects would not utilize a regional transmission line. The length of offshore export cable for those lease areas without a known project size is assumed to include two offshore cables totaling 120 miles (193 kilometers). The offshore export cable would be buried a minimum of 4 feet (1.8 meters) but not more than 10 feet (3.1 meters).

⁷ If information for a future project could not be obtained from a COP, the length of interarray cabling is assumed to be the average amount per foundation based on the COPs submitted to date, which is 1.48 miles (2.4 kilometers). In addition, for those lease areas that require more than one OSS, it is assumed that an additional 6.2 miles (9.9 kilometers) of inter-link cable would be required to link the two OSS. Interarray cable is assumed to be buried between 4 and 6 feet.

⁸ The hub height, rotor diameter, and turbine height for lease areas is based on worst-case scenario for the resource area. Presentation of heights vary by COP and may be presented relative to MLLW, mean sea level, or height above highest astronomical tide.

⁹ BOEM recognizes that the estimates presented within this analysis are likely high, conservative estimates; however, BOEM believes that this analysis is appropriately capturing the potential cumulative impacts and errs on the side of maximum impacts. Totals by lease area and by OCS may not fully sum due to rounding errors.

¹⁰ New York's demand is not double-counted; this total comes from looking at New York's state demand, not adding up the potential of the areas because that would double-count New York.

CT = Connecticut; CVOW = Coastal Virginia Offshore Wind; DE = Delaware; FDR = Facility Design Report; FIR = Fabrication and Installation Report; MA = Massachusetts; MD = Maryland; NE = New England; NJ = New Jersey; NY = New York; PPA = Power Purchase Agreement; RAP = research activities plan; RI = Rhode Island

¹¹ Includes cable length from offshore export cables and substation interconnector cables.

Table F2-2 Offshore Wind Development Activities on the U.S. East Coast: Projects and Assumptions (Part 2, Seabed/Anchoring Disturbance and Scour Protection)

Region	Lease/Project/Lease Remainder ¹	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area) ³						Estimated Foundation Number ²	WTG Foundation Footprint ³ (acres)	WTG Seabed Disturbance (Foundation + Scour Protection) (acres) ⁴	Offshore Export Cable Seabed Disturbance (acres) ⁵	Offshore Export Cable Operating Seabed Footprint (acres) ⁶	Offshore Export Cable Hard Protection (acres) ⁷	Anchoring Disturbance (acres) ⁸	Interarray Construction Footprint/Seabed Disturbance (acres) ⁹	Interarray Operating Footprint/ Seabed Disturbance (acres) ¹⁰	Interarray Cable Hard Protection (acres) ¹¹
			Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism										
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA, SAP					X		101	4	84	1,935 ¹²	78	94	19	1,850 ¹³	144	77
NY/NJ	Atlantic Shores South, OCS-A 0499	COP, PPA, SAP					X		211	9	135	1,606	137	12	262	2,035	317	307
NY/NJ	Ocean Wind 2, OCS-A 0532	PPA					X		113	5	96	727	48	43	12	271	162	0
NY/NJ	Empire Wind 1, part of OCS-A 0512	COP, PPA, SAP	X	X	X	X	X	X	58	1	52	368	37	33	9	534	82	26
NY/NJ	Empire Wind 2, part of OCS-A 0512	COP, PPA, SAP	X	X	X	X	X	X	91	2	82	360	24	32	9	633	129	32
NY/NJ	Atlantic Shores North, OCS-A 0549	SAP					X		160	7	135	600	40	35	10	382	239	0
NY/NJ	OW Ocean Winds East LLC, OCS-A 0537				X		X	X	102	4	87	727	48	43	12	952	146	0
NY/NJ	Attentive Energy LLC, OCS-A 0538						X	X	104	4	88	727	48	43	12	970	149	0
NY/NJ	Bight Wind Holdings LLC, OCS-A 0539						X	X	148	6	126	727	48	43	12	1,403	212	0
NY/NJ	Atlantic Shores Offshore Wind Bight LLC, OCS-A 0541						X		95	4	81	727	48	43	12	890	136	0
NY/NJ	Invenergy Wind Offshore LLC, OCS-A 0542						X		99	4	84	727	48	43	12	925	142	0
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544			X			X		104	4	88	727	48	43	12	970	149	0
	Total NY/NJ Leases		X	X	X		X	X	1,386	54	1,138	9,959	652	506	393	11,815	2,006	442
	MA, RI, DE, MD, NC, VA Leases								1,630	206	3,466	140,321	1,814	1,017	2,009	22,484	2,529	697
	OCS Total								3,016	260	4,604	150,280	2,465	1,523	2,402	34,299	4,534	1,139

¹ This column identifies lease areas that are applicable to each resource based on the geographic analysis areas.

² The estimated number of foundations is the total number of turbines plus OSS. If information for a future project could not be obtained from a publicly available COP, it is assumed that for every 50 turbines there would be one OSS installed.

³ If information for a future project could not be obtained from a publicly available COP, the foundation footprint is assumed to be 0.04 acre, which is based on the largest monopile reported (12 MW) for all lease areas.

⁴ The seabed disturbance with the addition of scour protection was calculated based on scour protection expected in submitted COPs. If information for a future project could not be obtained from a publicly available COP, it is assumed that for all lease areas that a 12-MW foundation with addition of scour protection would be 0.85 acre per foundation.

⁵ Offshore export cable seabed bottom disturbance is assumed to be due to installation of the export cable, the use of jack-up vessels, and the need to perform dredging. If information for a future project could not be obtained from a publicly available COP, export cable seabed disturbance assumed to be 6.06 acres per mile.

⁶ If information for a future project could not be obtained from a publicly available COP, the offshore export cable operating seabed footprint assumed to be 0.4 acre per mile.

⁷ If information for a future project could not be obtained from a publicly available COP, the offshore export cable hard protection is assumed to be similar to Vineyard Wind 1 Project, which is 0.357 acre per mile of offshore export cable.

⁸ If information for a future project could not be obtained from a publicly available COP, anchoring disturbance for other lease areas is assumed to be a rate equal to 0.10 acre per mile of offshore export cable.

⁹ If information for a future project could not be obtained from a publicly available COP, interarray construction seabed disturbance is assumed to be 6.06 acres per mile.

¹⁰ If information for a future project could not be obtained from a publicly available COP, the interarray operating footprint is assumed to be a rate equal to the average amount per foundation of 1.43 acres per foundation.

¹¹ If information for a future project could not be obtained from a publicly available COP, the interarray cable hard protection is assumed to be zero.

¹² Includes disturbance from offshore export cables and substation interconnector cables. Assumes an 82-foot-wide corridor would be disturbed per cable, based on the Ocean Wind 1 COP.

¹³ Assumes an 82-foot-wide corridor would be disturbed, based on the Ocean Wind 1 COP.

nd = not defined; NJ = New Jersey; NY = New York; PPA = Power Purchase Agreement

Table F2-3 Offshore Wind Development Activities on the U.S. East Coast: Projects and Assumptions (Part 3, Gallons of Coolant, Oils, Lubricants, and Diesel Fuel)

Region	Lease/Project/Lease Remainder ¹	Status	Geographic Analysis Area (X denotes lease area is within or overlaps analysis area) ¹						Total Coolant Fluids in WTGs (gallons)	Total Coolant Fluids in OSS or ESP (gallons)	Total Oils and Lubricants in WTGs (gallons)	Total Oils and Lubricants in OSS or ESP (gallons)	Total Diesel Fuel in WTGs (gallons)	Total Diesel Fuel in OSS or ESP (gallons)
			Water Quality, Navigation	Benthic	Other Marine Uses (excluding research surveys & navigation)	Marine Archaeology	Birds, Bats, Marine Mammals, Sea Turtles, Finfish, Invertebrates, EFH, Fisheries, Research Surveys	Visual, Recreation & Tourism						
NY/NJ	Ocean Wind 1, OCS-A 0498	COP, PPA, SAP					X		39,690	-	187,964	238,707	77,714	158,502
NY/NJ	Atlantic Shores South, OCS-A 0499	COP, PPA, SAP					X		820,000	10,300	606,200	370,050	80,000	75,000
NY/NJ	Ocean Wind 2, part of OCS-A 0532 ²	PPA					X		44,953	-	212,888	160,732	88,019	105,673
NY/NJ	Empire Wind 1, part of OCS-A 0512	COP, PPA, SAP	X	X	X	X	X	X	49,704	-	285,684	158,503	-	7,925
NY/NJ	Empire Wind 2, part of OCS-A 0512	COP, PPA, SAP	X	X	X	X	X	X	78,480	-	451,080	158,503	-	7,925
NY/NJ	Atlantic Shores North, OCS-A 0549 ³	SAP					X		643,700	8,240	475,867	296,040	62,800	60,000
NY/NJ	OW Ocean Winds East LLC, OCS-A 0537 ²				X		X		40,500	-	191,800	243,579	79,300	161,737
NY/NJ	Attentive Energy LLC, OCS-A 0538 ²						X	X	35,235	-	195,363	248,450	80,886	164,971
NY/NJ	Bight Wind Holdings LLC, OCS-A 0539 ²						X	X	53,460	-	278,110	353,189	114,985	234,518
NY/NJ	Atlantic Shores Offshore Wind Bight LLC, OCS-A 0541 ²						X		36,045	-	178,374	226,528	73,749	150,415
NY/NJ	Invenergy Wind Offshore LLC, OCS-A 0542 ²						X		39,690	-	186,046	236,271	76,921	156,885
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544 ²		X	X	X		X	X	41,310	-	195,636	248,450	80,886	164,971
	Total NY/NJ Leases								1,935,322	18,540	3,445,285	2,939,003	815,260	1,448,523
	MA, RI, DE, MD, NC, VA Leases								2,068,080	21,537	5,193,820	5,662,633	1,355,996	1,062,241
	OCS Total								4,003,402	40,077	8,639,105	8,601,636	2,171,556	2,510,764

¹ This column identifies lease areas that are applicable to each resource based on the geographic analysis areas.

² Quantities of coolant, oil and lubricants, and diesel fuel are scaled to Ocean Wind 1 based on number turbines and OSS.

³ Quantities of coolant, oil and lubricants, and diesel fuel are scaled to Atlantic Shores South based on number turbines and OSS.
ESP = electrical service platform; NJ = New Jersey; NY = New York; PPA = Power Purchase Agreement

Table F2-4 Offshore Wind Leasing Activities on the U.S. East Coast: Projects and Assumptions (Part 4, OCS Construction and Operation Emissions)

Region	Lease/Project/Lease Remainder ¹	Status	Air Quality Geographic Analysis Area	2023	2024	2025	2026	2027	2028	2029	2030	Beyond 2030
Nitrogen oxides (tons)												
NY/NJ	Empire Wind (EW 1 & EW 2), OCS-A 0512	COP, PPA, SAP	X	1	779	3,330	3,597	2,422	479	479	479	479
NY/NJ	OW Ocean Wind East LLC, OCS-A 0537		X	--	--	--	2,280	2,280	2,280	2,280	2,280	162
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544		X	--	--	--	2,326	2,326	2,326	2,326	2,326	165
	Total Air Quality Analysis Area			1	779	3,330	8,203	7,028	5,085	5,085	5,085	806
Volatile organic compounds (tons)												
NY/NJ	Empire Wind (EW 1 & EW 2), OCS-A 0512	COP, PPA, SAP	X	0	31	168	150	103	21	21	21	21
NY/NJ	OW Ocean Winds East LLC, OCS-A 0537		X	--	--	--	60	60	60	60	60	4
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544		X	--	--	--	61	61	61	61	61	4
	Total Air Quality Analysis Area			1	31	168	271	224	142	142	142	29
Carbon monoxide (tons)												
NY/NJ	Empire Wind (EW 1 & EW 2), OCS-A 0512	COP, PPA, SAP	X	0	185	816	920	721	228	228	228	228
NY/NJ	OW Ocean Winds East LLC, OCS-A 0537		X	--	--	--	440	440	440	440	440	41
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544		X	--	--	--	449	449	449	449	449	42
	Total Air Quality Analysis Area			0	185	816	1,809	1,610	1,117	1,117	1,117	311
Particulate matter, 10 microns or less (tons)												
NY/NJ	Empire Wind (EW 1 & EW 2), OCS-A 0512	COP, PPA, SAP	X	0	19	91	108	75	13	13	13	13
NY/NJ	OW Ocean Winds East LLC, OCS-A 0537		X	--	--	--	75	75	75	75	75	6
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544		X	--	--	--	76	76	76	76	76	6
	Total Air Quality Analysis Area			1	19	91	259	226	164	164	164	25
Particulate matter, 2.5 microns or less (tons)												
NY/NJ	Empire Wind (EW 1 & EW 2), OCS-A 0512	COP, PPA, SAP	X	0	19	89	105	73	12	12	12	12
NY/NJ	OW Ocean Winds East LLC, OCS-A 0537		X	--	--	--	71	71	71	71	71	6
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544		X	--	--	--	73	73	73	73	73	6
	Total Air Quality Analysis Area			1	19	89	249	217	156	156	156	24
Sulfur dioxide (tons)												
NY/NJ	Empire Wind (EW 1 & EW 2), OCS-A 0512	COP, PPA, SAP	X	0	16	75	68	43	7	7	7	7
NY/NJ	OW Ocean Winds East LLC, OCS-A 0537		X	--	--	--	24	24	24	24	24	1
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544		X	--	--	--	24	24	24	24	24	1
	Total Air Quality Analysis Area			1	16	75	116	91	55	55	55	9
Carbon dioxide (tons)												
NY/NJ	Empire Wind (EW 1 & EW 2), OCS-A 0512	COP, PPA, SAP	X	280	48,380	202,661	215,973	160,035	45,918	45,918	45,918	45,918
NY/NJ	OW Ocean Winds East LLC, OCS-A 0537		X	--	--	--	133,941	133,941	133,941	133,941	133,941	11,992
NY/NJ	Vineyard Mid-Atlantic LLC, OCS-A 0544		X	--	--	--	136,620	136,620	136,620	136,620	136,620	12,232
	Total Air Quality Analysis Area			280	48,380	202,661	486,534	430,596	316,479	316,479	316,479	70,142

¹ This column identifies lease areas that are applicable to each resource based on the geographic analysis areas shown in Attachment 1 of this appendix.

Note: Emissions for OW Ocean Winds East LLC and Vineyard Mid-Atlantic LLC are scaled from Ocean Wind, based on number of turbines and estimated construction schedule.

NJ = New Jersey; NY = New York; PPA = Power Purchase Agreement

References Cited

Bureau of Ocean Energy Management (BOEM). 2019. *National Environmental Policy Act Documentation for Impact-Producing Factors in the Offshore Wind Cumulative Impacts Scenario on the North Atlantic Outer Continental Shelf*. Available: <https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/IPFs-in-the-Offshore-Wind-Cumulative-Impacts-Scenario-on-the-N-OCS.pdf>. Accessed: December 2020.

This page intentionally left blank.

Appendix G. Assessment of Resources with Minor (or Lower) Adverse Impacts

This page intentionally left blank.

TABLE OF CONTENTS

G.1. Introduction	G-1
3.4. Air Quality	3.4-1
3.4.1 Description of the Affected Environment for Air Quality	3.4-1
3.4.2 Impact Level Definitions for Air Quality.....	3.4-6
3.4.3 Impacts of the No Action Alternative on Air Quality.....	3.4-6
3.4.4 Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives	3.4-11
3.4.5 Impacts of the Proposed Action on Air Quality.....	3.4-11
3.4.6 Impacts of Alternatives B, C, D, E, F, G, and H on Air Quality.....	3.4-26
3.4.7 Comparison of Alternatives	3.4-27
3.4.8 Summary of Impacts of the Preferred Alternative	3.4-29
3.4.9 Proposed Mitigation Measures	3.4-29
3.5. Bats.....	3.5-1
3.5.1 Description of the Affected Environment for Bats.....	3.5-1
3.5.2 Impact Level Definitions for Bats	3.5-5
3.5.3 Impacts of the No Action Alternative on Bats	3.5-6
3.5.4 Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives	3.5-9
3.5.5 Impacts of the Proposed Action on Bats	3.5-10
3.5.6 Impacts of Alternatives B, E, and F on Bats	3.5-12
3.5.7 Impacts of Alternative C, D, and G on Bats.....	3.5-13
3.5.8 Impacts of Alternative H on Bats	3.5-14
3.5.9 Comparison of Alternatives	3.5-14
3.5.10 Summary of Impacts of the Preferred Alternative	3.5-15
3.5.11 Proposed Mitigation Measures	3.5-15
3.7. Birds.....	3.7-1
3.7.1 Description of the Affected Environment for Birds.....	3.7-1
3.7.2 Impact Level Definitions for Birds	3.7-9
3.7.3 Impacts of the No Action Alternative on Birds	3.7-9
3.7.4 Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives	3.7-18
3.7.5 Impacts of the Proposed Action on Birds	3.7-19
3.7.6 Impacts of Alternatives B, E, and F on Birds.....	3.7-29
3.7.7 Impacts of Alternative C, D, and G on Birds.....	3.7-29
3.7.8 Impacts of Alternative H on Birds	3.7-30
3.7.9 Comparison of Alternatives	3.7-30
3.7.10 Summary of Impacts of the Preferred Alternative	3.7-31
3.7.11 Proposed Mitigation Measures	3.7-31
3.8. Coastal Habitat and Fauna	3.8-1
3.8.1 Description of the Affected Environment for Coastal Habitat and Fauna.....	3.8-1
3.8.2 Impact Level Definitions for Coastal Habitat and Fauna	3.8-5
3.8.3 Impacts of the No Action Alternative on Coastal Habitat and Fauna	3.8-5
3.8.4 Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives	3.8-7
3.8.5 Impacts of the Proposed Action on Coastal Habitat and Fauna	3.8-8
3.8.6 Impacts of Alternatives B, E, and F on Coastal Habitat and Fauna	3.8-11
3.8.7 Impacts of Alternative C, D, and G on Coastal Habitat and Fauna.....	3.8-11
3.8.8 Impacts of Alternative H on Coastal Habitat and Fauna	3.8-12
3.8.9 Comparison of Alternatives	3.8-12
3.8.10 Summary of Impacts of the Preferred Alternative	3.8-13
3.8.11 Proposed Mitigation Measures	3.8-13

3.11.	Demographics, Employment, and Economics.....	3.11-1
3.11.1	Description of the Affected Environment for Demographics, Employment, and Economics	3.11-1
3.11.2	Impact Level Definitions for Demographics, Employment, and Economics	3.11-7
3.11.3	Impacts of the No Action Alternative on Demographics, Employment, and Economics	3.11-8
3.11.4	Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives	3.11-15
3.11.5	Impacts of the Proposed Action on Demographics, Employment, and Economics	3.11-16
3.11.6	Impacts of Alternatives B, C, D, E, F, G, and H on Demographics, Employment, and Economics	3.11-22
3.11.7	Comparison of Alternatives	3.11-23
3.11.8	Summary of Impacts of the Preferred Alternative	3.11-23
3.11.9	Proposed Mitigation Measures	3.11-24
3.18.	Recreation and Tourism	3.18-1
3.18.1	Description of the Affected Environment for Recreation and Tourism	3.18-1
3.18.2	Impact Level Definitions for Recreation and Tourism.....	3.18-4
3.18.3	Impacts of the No Action Alternative on Recreation and Tourism.....	3.18-4
3.18.4	Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives	3.18-11
3.18.5	Impacts of the Proposed Action on Recreation and Tourism	3.18-12
3.18.6	Impacts of Alternatives B, E, and F on Recreation and Tourism	3.18-19
3.18.7	Impacts of Alternatives C, D, G, and H on Recreation and Tourism	3.18-20
3.18.8	Comparison of Alternatives	3.18-20
3.18.9	Summary of Impacts of the Preferred Alternative	3.18-21
3.18.10	Proposed Mitigation Measures	3.18-21
3.19.	Sea Turtles.....	3.19-1
3.19.1	Description of the Affected Environment for Sea Turtles	3.19-1
3.19.2	Impact Level Definitions for Sea Turtles.....	3.19-5
3.19.3	Impacts of the No Action Alternative on Sea Turtles.....	3.19-6
3.19.4	Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives	3.19-15
3.19.5	Impacts of the Proposed Action on Sea Turtles	3.19-16
3.19.6	Impacts of Alternatives B, E, and F on Sea Turtles.....	3.19-25
3.19.7	Impacts of Alternative C, D, and G on Sea Turtles	3.19-26
3.19.8	Impacts of Alternative H on Sea Turtles	3.19-26
3.19.9	Comparison of Alternatives	3.19-27
3.19.10	Summary of Impacts of the Preferred Alternative	3.19-27
3.19.11	Proposed Mitigation Measures	3.19-28
3.22.	Wetlands.....	3.22-1
3.22.1	Description of the Affected Environment for Wetlands.....	3.22-1
3.22.2	Impact Level Definitions for Wetlands	3.22-4
3.22.3	Impacts of the No Action Alternative on Wetlands	3.22-5
3.22.4	Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives	3.22-7
3.22.5	Impacts of the Proposed Action on Wetlands	3.22-7
3.22.6	Impacts of Alternatives B, E, and F on Wetlands	3.22-11
3.22.7	Impacts of Alternative C on Wetlands	3.22-11
3.22.8	Impacts of Alternative D on Wetlands	3.22-12
3.22.9	Impacts of Alternative G on Wetlands	3.22-12
3.22.10	Impacts of Alternative H on Wetlands	3.22-13
3.22.11	Comparison of Alternatives	3.22-14
3.22.12	Summary of Impacts of the Preferred Alternative	3.22-14
3.22.13	Proposed Mitigation Measures	3.22-15

LIST OF FIGURES

Figure 3.4-1a	Air Quality Geographic Analysis Area (New York)	3.4-3
Figure 3.4-1b	Air Quality Geographic Analysis Area (South Carolina and Texas)	3.4-4
Figure 3.4-2	Air Quality Status of the Geographic Analysis Area	3.4-5
Figure 3.5-1	Bats Geographic Analysis Area	3.5-3
Figure 3.7-1	Birds Geographic Analysis Area	3.7-2
Figure 3.7-2	Total Avian Relative Abundance Distribution Map	3.7-14
Figure 3.7-3	Total Avian Relative Abundance Distribution Map for the Higher Collision Sensitivity Species Group	3.7-23
Figure 3.7-4	Total Avian Relative Abundance Distribution Map for the Higher Displacement Sensitivity Species Group	3.7-24
Figure 3.8-1	Coastal Habitat and Fauna Geographic Analysis Area	3.8-2
Figure 3.11-1	Demographics, Employment, and Economics Geographic Analysis Area	3.11-2
Figure 3.18-1	Recreation and Tourism Geographic Analysis Area	3.18-2
Figure 3.19-1	Sea Turtles Geographic Analysis Area	3.19-2
Figure 3.22-1	Wetlands Geographic Analysis Area	3.22-2

LIST OF TABLES

Table 3.4-1	Impact Level Definitions for Air Quality	3.4-6
Table 3.4-2	Empire Wind Total Construction Emissions	3.4-13
Table 3.4-3	Empire Wind Operations and Maintenance Emissions	3.4-15
Table 3.4-4	COBRA Estimate of Annual Avoided Health Effects with Proposed Action	3.4-16
Table 3.4-5	Estimated Social Cost of GHGs associated with the Proposed Action	3.4-17
Table 3.4-6	Net Emissions of Carbon Dioxide Equivalent for Each Alternative	3.4-19
Table 3.4-7	Empire Wind Decommissioning Emissions (U.S. tons)	3.4-21
Table 3.4-8	Maximum Predicted Pollutant Concentrations Associated with SBMT	3.4-23
Table 3.4-9	Combined Empire Wind and SBMT Emissions During Empire Wind Construction	3.4-24
Table 3.5-1	Bats Present in New York and their Conservation Status	3.5-1
Table 3.5-2	Impact Level Definitions for Bats	3.5-5
Table 3.5-3	Proposed Measures: Bats	3.5-15
Table 3.7-1	Bird Presence in the Offshore Project Area by Bird Group	3.7-4
Table 3.7-2	Impact Level Definitions for Birds	3.7-9

Table 3.7-3	Percentage of Atlantic Seabird Populations that Are Expected to Overlap with Anticipated Offshore Wind Energy Development on the Outer Continental Shelf by Season.....	3.7-15
Table 3.7-4	Proposed Measures: Birds	3.7-32
Table 3.8-1	Impact Level Definitions for Coastal Habitat and Fauna	3.8-5
Table 3.11-1	Impact Level Definitions for Demographics, Employment, and Economics	3.11-7
Table 3.18-1	Impact Level Definitions for Recreation and Tourism.....	3.18-4
Table 3.19-1	Sea Turtles Likely to Occur in the Project Area.....	3.19-3
Table 3.19-2	Sea Turtle Hearing Ranges	3.19-5
Table 3.19-3	Impact Level Definitions for Sea Turtles.....	3.19-5
Table 3.19-4	Mean Number of Sea Turtles Predicted to Receive Sound Levels Above Injury and Behavioral Thresholds over 2-Year Construction Period	3.19-19
Table 3.19-5	Proposed Measures: Sea Turtles	3.19-28
Table 3.22-1	NWI Wetland Communities in the Geographic Analysis Area.....	3.22-1
Table 3.22-2	Impact Level Definitions for Wetlands	3.22-4
Table 3.22-3	NWI Wetland Communities Potentially Affected by the EW 2 Project	3.22-7
Table 3.22-4	Proposed Measures: Wetlands	3.22-15

G.1. Introduction

To focus on the impacts of most concern in the main body of this Final EIS, BOEM has included the analysis of resources with no greater than **minor** adverse impacts below. These include air quality; bats; birds; coastal habitat and fauna; demographics, employment, and economics; recreation and tourism; sea turtles; and wetlands. Those resources with potential impact ratings greater than **minor** are included in Final EIS Chapter 3.

This page intentionally left blank.

3.4. Air Quality

This section discusses potential impacts on air quality from the proposed Projects, alternatives, and ongoing and planned activities in the air quality geographic analysis area. The air quality geographic analysis area, as shown on Figure 3.4-1a and Figure 3.4-1b, includes the airshed within 25 miles (40 kilometers) of the Wind Farm Development Area (corresponding to the OCS permit area) and the airshed within 15.5 miles (25 kilometers) of onshore construction areas and ports that may be used for the Projects.

3.4.1 Description of the Affected Environment for Air Quality

The overall geographic analysis area for air quality covers portions of northeastern New Jersey, New York City, and western Long Island; the area around the Port of Albany, New York; and over the ocean southeast of New York Harbor. This area includes the air above the Wind Farm Development Area and adjacent OCS area, the offshore and onshore export cable routes, the onshore substations, the construction staging areas, the onshore construction and proposed Project-related sites, and the ports used to support proposed Project activities. In addition, some construction-related activity could occur in the Corpus Christi, Texas area. COP Section 4.3 (Empire 2023) provides further description of the air quality geographic analysis area. Appendix I provides information on climate and meteorological conditions in the Project region.

Air quality within a region is measured in comparison to the National Ambient Air Quality Standards (NAAQS), which are standards established by USEPA pursuant to the CAA (42 USC 7409) for several common pollutants, known as criteria pollutants, to protect human health and welfare. The criteria pollutants are CO, lead, nitrogen dioxide (NO₂), ozone, PM₁₀, PM_{2.5}, and SO₂. New York, New Jersey, and Texas have established ambient air quality standards (AAQS) that are similar to the NAAQS. COP Table 4.3-1 (Empire 2023) shows the NAAQS. Emissions of lead from Project-associated sources would be negligible because lead is not a component of liquid or gaseous fuels; accordingly, lead is not analyzed in this EIS. Ozone is not emitted directly but is formed in the atmosphere from precursor chemicals, primarily NO_x and VOC, in the presence of sunlight. Potential impacts of a project on ozone levels are evaluated in terms of NO_x and VOC emissions.

USEPA designates all areas of the country as attainment, nonattainment, or unclassified for each criteria pollutant. An attainment area is an area where all criteria pollutant concentrations are within all NAAQS. A nonattainment area does not meet the NAAQS for one or more pollutants. Unclassified areas are those where attainment status cannot be determined based on available information and are regulated as attainment areas. An area can be in attainment for some pollutants and nonattainment for others. If an area was nonattainment at any point in the last 20 years but is currently attainment, then the area is designated a maintenance area. Nonattainment and maintenance areas are required to prepare a State Implementation Plan (SIP), which describes the region's program to attain and maintain compliance with the NAAQS. The attainment status of an area can be found at 40 CFR 81 and in the USEPA Green Book, which the agency revises from time to time (USEPA 2021a). Attainment status is determined through evaluation of air quality data from a network of monitors.

The nearest onshore areas to the offshore Wind Farm Development Area are the New York City boroughs of Brooklyn, Queens, and Staten Island; the southern portion of Nassau County and the southwestern portion of Suffolk County, New York; and the northeastern portion of Monmouth County, New Jersey. Project emissions potentially could occur during construction or operations in the following nonattainment and maintenance areas:

- New York-Northern New Jersey-Long Island Area, NY-NJ-CT Ozone Nonattainment Area (2008 and 2015 NAAQS)
- New York-Northern New Jersey-Long Island Area, NY-NJ-CT Carbon Monoxide Maintenance Area (1971 NAAQS)
- New York County, NY PM₁₀ Nonattainment Area (1987 Annual NAAQS)
- New York-Northern New Jersey-Long Island Area, NY-NJ-CT PM_{2.5} Maintenance Area (1997 Annual NAAQS)
- New York-Northern New Jersey-Long Island Area, NY-NJ-CT PM_{2.5} Maintenance Area (2006 24-Hour NAAQS)

The nonattainment and maintenance areas include port facilities that the Projects could use for construction or operations including the SBMT, New York. More distant ports that may be used include the Port of Albany, New York, the Port of Coeymans, New York, the Nexans submarine cable manufacturing facility north of Charleston, South Carolina, and Corpus Christi, Texas, which are in areas designated attainment for all pollutants.¹ Figure 3.4-2 displays the nonattainment and maintenance areas that intersect the geographic analysis area.

The CAA prohibits federal agencies from approving any activity that does not conform to a SIP. This prohibition applies only with respect to nonattainment or maintenance areas (i.e., areas that were previously nonattainment and for which a maintenance plan is required). Conformity to a SIP means conformity to a SIP's purpose of reducing the severity and number of violations of the NAAQS to achieve attainment of such standards. The activities for which BOEM has authority are outside of any nonattainment or maintenance area and therefore not subject to the requirement to show conformity. All other federal agencies responsible for approval, permitting, or financing of project components within any nonattainment or maintenance area associated with the Projects should complete their own analysis to determine if conformity applies to their decisions.

The CAA defines Class I areas as certain national parks and wilderness areas where very little degradation of air quality is allowed. Class I areas consist of national parks larger than 6,000 acres and wilderness areas larger than 5,000 acres that were in existence before August 1977. Projects subject to federal air quality permits are required to notify the federal land managers responsible for designated Class I areas within 62 miles (100 kilometers) of a project.² The federal land manager identifies appropriate air quality-related values for the Class I area and evaluates the impact of the Projects on air quality-related values. The nearest Class I area to the Projects is the Brigantine Wilderness Area in New Jersey, about 67 miles (108 kilometers) southwest of the Projects.

¹ The Port of Albany and the Port of Coeymans are in the former Albany-Schenectady-Troy Area, New York Ozone Nonattainment Area for the 1979 and 1997 NAAQS. However, USEPA has revoked these standards.

² The 100-kilometer distance applies to notification and is not a threshold for use in evaluating impacts. Impacts at Class I areas at distances greater than 100 kilometers may need to be considered for larger emission sources if there is reason to believe that such sources could affect the air quality in the Class I area (USEPA 1992).

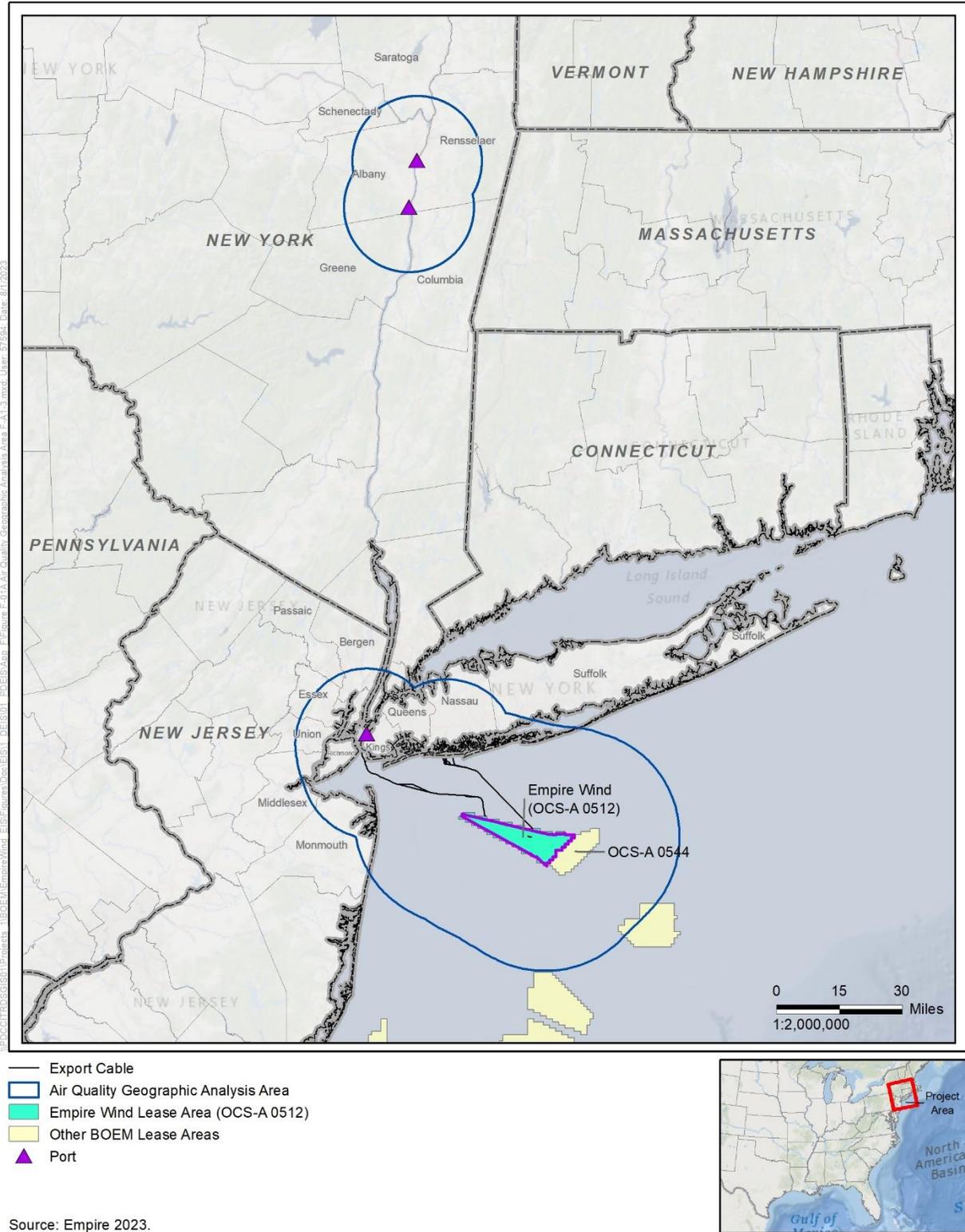
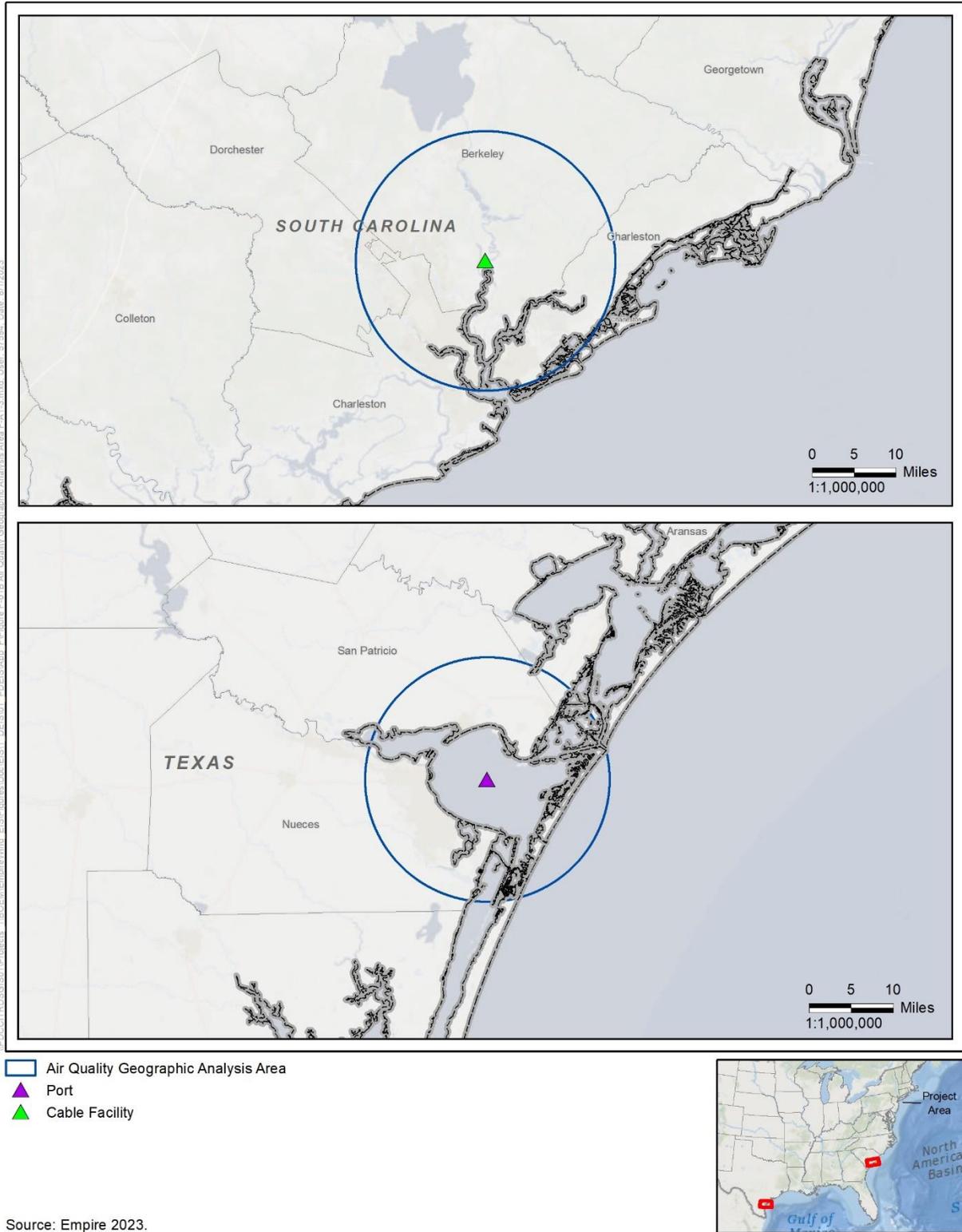


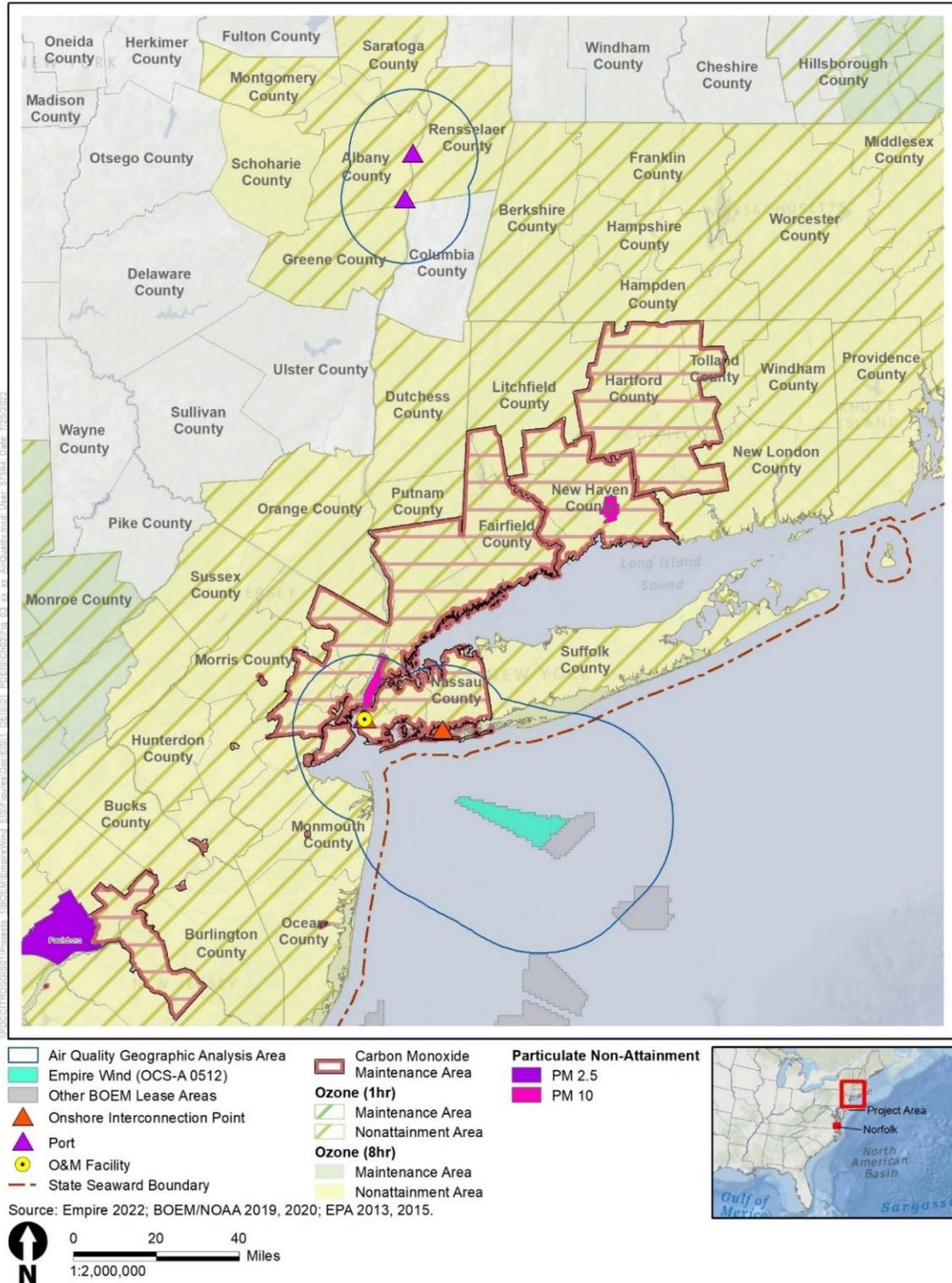
Figure 3.4-1a Air Quality Geographic Analysis Area (New York)



Source: Empire 2023.



Figure 3.4-1b Air Quality Geographic Analysis Area (South Carolina and Texas)



Note: Charleston, South Carolina and Corpus Christi, Texas areas are not shown.

Figure 3.4-2 Air Quality Status of the Geographic Analysis Area

The CAA amendments directed USEPA to establish requirements to control air pollution from OCS oil- and gas-related activities along the Pacific, Arctic, and Atlantic Coasts and along the U.S. Gulf Coast off Florida, east of 87° 30' west longitude. The OCS Air Regulations (40 CFR 55) establish the applicable air pollution control requirements, including provisions related to permitting, monitoring, reporting, fees, compliance, and enforcement for facilities subject to the CAA. These regulations apply to OCS sources that are beyond state seaward boundaries. Projects within 25 nm of a state seaward boundary are required to comply with the air quality requirements of the nearest or corresponding onshore area, including applicable permitting requirements.

3.4.2 Impact Level Definitions for Air Quality

Definitions of impact levels are provided in Table 3.4-1. Impact levels are intended to serve NEPA purposes only, and are not intended to establish thresholds or other requirements with respect to permitting under the CAA.

Table 3.4-1 Impact Level Definitions for Air Quality

Impact Level	Impact Type	Definition
Negligible	Adverse	Increases in ambient pollutant concentrations due to Project emissions would not be detectable.
	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would not be detectable.
Minor to Moderate	Adverse	Increases in ambient pollutant concentrations due to Project emissions would be detectable but would not lead to exceedance of the NAAQS.
	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would be detectable.
Major	Adverse	Changes in ambient pollutant concentrations due to Project emissions could lead to exceedance of the NAAQS.
	Beneficial	Decreases in ambient pollutant concentrations due to Project emissions would be larger than for minor to moderate impacts.

3.4.3 Impacts of the No Action Alternative on Air Quality

When analyzing the impacts of the No Action Alternative on air quality, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities on the baseline conditions for air quality. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix F, *Planned Activities Scenario*.

3.4.3.1 Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for air quality described in Section 3.4.1, *Description of the Affected Environment for Air Quality*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on air quality are generally associated with existing onshore land uses, including residential, commercial, industrial, and transportation activities as well as onshore construction activities. Other ongoing activities that could contribute to air quality impacts include construction of undersea transmission lines, gas pipelines, and other submarine cables; marine minerals use and ocean-dredged material disposal; military

use; marine transportation; and oil and gas activities. These activities and associated impacts are expected to continue at current trends and have the potential to affect air quality through their emissions. Impacts associated with climate change could affect ambient air quality through increased formation of ozone and particulate matter associated with increasing air temperatures. See Appendix F, Table F1-1 for a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for air quality. There are no ongoing offshore wind activities within the geographic analysis area for air quality.

State policies and plans to encourage and develop renewable energy sources in the region are summarized below.

New York

The New York State Climate Leadership and Community Protection Act set an expanded Clean Energy Standard, which requires that 70 percent of New York's electricity come from renewable sources by 2030. In 2014, Governor Andrew Cuomo launched an energy policy, Reforming the Energy Vision, to build an integrated energy network able to harness the combined benefits of the central grid with clean, locally generated power. The State Energy Plan sets a roadmap for the Reforming the Energy Vision policy, combining agency coordination, regulatory reform, and measures to encourage private capital investment. The initiatives outlined in the State Energy Plan, along with private sector innovation and investment fueled by Reforming the Energy Vision, are intended to put New York State on a path to achieving the following GHG emissions limits and clean energy goals:

- 40-percent reduction in GHG emissions from 1990 levels
- 50 percent of energy generation from renewable energy sources
- 600 trillion British thermal unit–increase in statewide energy efficiency (reduction in energy use through efficiency improvements)

NYSERDA led the development of the New York State Offshore Wind Master Plan and is leading the coordination of offshore wind opportunities in New York state and supporting the development of 9,000 MW of offshore wind energy by 2035.

New Jersey

NJDEP has projected that under a scenario of continuation of current regulations and policies, emissions from electricity generation would decline slowly through 2050 due to improvements in efficiency and switching to cleaner fuels (NJDEP 2019). Under the No Action Alternative, without implementation of other future offshore wind projects, the electricity that would have been generated by offshore wind would likely be provided by fossil fuel-fired facilities.³ As a result, the No Action Alternative could lead to less decline in emissions than would occur with offshore wind development. An overall mix of natural gas, solar, wind, and energy storage would likely occur in the future due to market forces and state energy policies. New Jersey Executive Order 92 (November 19, 2019) sets a goal of developing 7,500 MW of offshore wind energy off the coast of New Jersey by 2035. The New Jersey Energy Master Plan (New Jersey Board of Public Utilities 2019) sets a goal of transitioning New Jersey to 100 percent renewable electricity by 2050.

³ In 2020, the generation mix of the PJM Interconnection, the regional grid that serves New Jersey, was approximately 40 percent natural gas, 34 percent nuclear, 19 percent coal, 3 percent wind, 2 percent hydroelectric, and 2 percent other sources, on an annual average basis (Monitoring Analytics 2021).

3.4.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities within the geographic analysis area that contribute to cumulative impacts on air quality are generally associated with existing onshore land uses, including residential, commercial, industrial, and transportation activities as well as onshore construction activities. Other planned non-offshore wind activities that could contribute to air quality impacts include construction of undersea transmission lines, gas pipelines, and other submarine cables; marine minerals use and ocean-dredged material disposal; military use; marine transportation; and oil and gas activities (Appendix F). These planned non-offshore wind activities have the potential to affect air quality through their emissions. Impacts associated with climate change could affect ambient air quality through increased formation of ozone and particulate matter associated with increasing air temperatures.

Other planned offshore wind activities within the geographic analysis area that could contribute to impacts on air quality include:

- Construction of the Ocean Winds East project (100 WTGs), expected 2026–2030
- Construction of the Vineyard Mid-Atlantic LLC project (102 WTGs), expected 2026–2030

BOEM expects planned offshore wind activities to affect air quality through the following primary IPFs.

Air emissions: Most air pollutant emissions and air quality impacts from planned offshore wind projects would occur during construction, potentially from multiple projects occurring simultaneously. Construction activity would occur at different locations and could overlap temporally with activities at other locations, including operational activities at previously constructed projects. As a result, air quality impacts would shift spatially and temporally across the air quality geographic analysis area. All projects would be required to comply with the CAA. Primary emission sources would include vessel traffic, increased public and commercial vehicular traffic, air traffic, combustion emissions from construction equipment, and fugitive particle emissions from construction-generated dust. During operations, emissions from planned offshore wind projects within the air quality geographic analysis area would overlap temporally, but operations would contribute few criteria pollutant emissions compared to construction and decommissioning. Operational emissions would come largely from commercial vessel traffic and emergency diesel generators. The aggregate operational emissions for all projects within the air quality geographic analysis area would vary by year as successive projects begin operation. As wind energy projects come online, power generation emissions overall would decrease and the region as a whole would realize a net benefit to air quality.

The planned offshore wind projects other than the Proposed Action that may result in air pollutant emissions and air quality impacts within the air quality geographic analysis area include projects within all or portions of lease areas OCS-A 0537 and OCS-A 0544. Wind energy projects currently proposed in these lease areas include Ocean Winds East and Vineyard Mid-Atlantic LLC, respectively. These projects would produce renewable power from the installation of 202 WTGs (Table F2-1). Based on the assumed offshore construction schedule in Table F2-1, construction of Ocean Winds East (2026–2030), Vineyard Mid-Atlantic LLC (2026–2030), and the Proposed Action (2023–2027) would overlap in 2026 and 2027. Ocean Winds East and Vineyard Mid-Atlantic LLC would produce 2,424 MW of renewable power from the installation of 202 WTGs (Table F2-1). Based on the assumed offshore construction schedule in Table F2-1, those projects within the geographic analysis area (Ocean Winds East and Vineyard Mid-Atlantic LLC) would have overlapping construction periods beginning in 2026 and continuing through 2030.

During the construction phase, the total emissions of criteria pollutants and ozone precursors from offshore wind projects other than Empire Wind (Ocean Winds East and Vineyard Mid-Atlantic LLC) proposed within the air quality geographic analysis area, summed over all construction years, are estimated to be 4,445 tons of CO, 23,030 tons of NO_x, 754 tons of PM₁₀, 721 tons of PM_{2.5}, 136 tons of SO₂, 604 tons of VOCs, and 1,352,808 tons of CO₂ (Table F2-4). Most emissions would occur from diesel-fueled construction equipment, vessels, and commercial vehicles. The magnitude of the emissions and the resulting air quality impacts would vary spatially and temporally during the construction phases. Construction activity would occur at different locations and could overlap temporally with activities at other locations, including operational activities at previously constructed projects. As a result, air quality impacts would shift spatially and temporally across the air quality geographic analysis area.

During operations, emissions from planned offshore wind projects within the air quality geographic analysis area would overlap temporally, but operations would contribute few criteria pollutant emissions compared to construction and decommissioning. Operational emissions would come largely from commercial vessel traffic and emergency diesel generators. The aggregate operational emissions for all projects within the air quality geographic analysis area (Ocean Winds East and Vineyard Mid-Atlantic LLC) would vary by year as successive projects begin operation. Estimated operational emissions would be 83 tons per year of CO, 327 tons per year of NO_x, 12 tons per year of PM₁₀, 11 tons per year of PM_{2.5}, 2 tons per year of SO₂, 8 tons per year of VOCs, and 24,224 tons per year of CO₂ (Table F2-4). Cumulatively, operational emissions would be intermittent and dispersed throughout the offshore wind lease areas and the vessel routes from the onshore O&M facility, and would generally contribute to small and localized air quality impacts.

Offshore wind energy development, by displacing fossil-fuel energy, would help offset emissions from fossil fuels, improving regional air quality and reducing GHG. An analysis by Katzenstein and Apt (2009), for example, estimates that CO₂ emissions can be reduced by up to 80 percent and NO_x emissions can be reduced up to 50 percent by implementing wind energy projects.⁴ An analysis by Barthelmie and Pryor (2021) calculated that, depending on global trends in GHG emissions and the amount of wind energy expansion, development of wind energy could reduce predicted increases in global surface temperature by 0.3–0.8 °C (0.5–1.4 °F) by 2100. Estimations and evaluations of potential health and climate benefits from offshore wind activities for specific regions and project sizes rely on information about the air pollutant emission contributions of the existing and projected mixes of power generation sources, and generally estimate the annual health benefits of an individual commercial scale offshore wind project to be valued in the hundreds of millions of dollars (Kempton et al. 2005; Buonocoure et al. 2016).

Construction and operation of offshore wind projects would produce GHG emissions that would contribute incrementally to climate change. CO₂ is relatively stable in the atmosphere and, for the most part, mixed uniformly throughout the troposphere and stratosphere. As such, the impact of GHG emissions does not depend upon the source location. Increasing energy production from offshore wind projects would likely reduce regional GHG emissions by displacing energy from fossil fuels. This reduction would more than offset the GHG emissions from offshore wind projects. This reduction in regional GHG emissions would be noticeable in the regional context, would contribute incrementally to

⁴ Katzenstein and Apt (2009) modeled a system of two types of natural gas generators, four wind farms, and one solar farm. The power output of wind and solar facilities can vary relatively rapidly, and the natural gas generators change their power output accordingly to meet electrical demand. When gas generators change their power output their emission rates may increase above their steady-state levels. As a result, the net emissions reductions realized from gas generators reducing their output in response to wind and solar power can be less than the reduction that would be expected based on the amount of wind and solar power. The study found that reductions in CO₂ emissions would be about 80 percent, and in NO_x emissions about 30–50 percent, of the emissions reductions expected if the power fluctuations caused no additional emissions.

reducing climate change, and would represent a moderate beneficial impact in the regional context but a negligible beneficial impact in the global context.

Accidental releases: Planned offshore wind activities could release air toxics or hazardous air pollutants (HAP) because of accidental chemical spills within the air quality geographic analysis area. Section 3.21, *Water Quality*, includes a discussion of the nature of releases that would be anticipated. Based on Table F2-3, up to about 128,184 gallons (485,229 liters) of coolants and 736,764 gallons (2.8 million liters) of oils and lubricants would be contained within the 202 WTGs, and 317,006 gallons (1.2 million liters) of oils and lubricants and 15,580 gallons (60,000 liters) of diesel fuel would be contained in the 202 WTGs and four OSS for the wind energy projects within the air quality geographic analysis area. If accidental releases occur, they would be most likely during construction but could occur during operations and decommissioning of offshore wind facilities. These may lead to short periods (hours to days)⁵ of HAP emissions through surface evaporation. HAP emissions would consist of VOCs, which may be important for ozone formation. By comparison, the smallest tanker vessel operating in these waters (a general-purpose tanker) has a capacity of between 3.2 and 8 million gallons (12.1 million and 30.3 million liters). Tankers are relatively common in these waters, and the total WTG chemical storage capacity within the geographic analysis area for air quality is much less than the volume of hazardous liquids transported by ongoing activities (U.S. Energy Information Administration 2014). Moreover, liquids associated with the Projects would be distributed among hundreds of independent marine-grade containers spread out over many different structures, thus making any kind of full release extremely unlikely. BOEM expects air quality impacts from accidental releases would be temporary and limited to the area near the accidental release location. Accidental spills would occur infrequently over a 35-year period with a higher probability of spills during planned project construction, but they would not be expected to contribute appreciably to cumulative impacts on air quality.

3.4.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, air quality would continue to be affected by existing environmental trends and ongoing activities. Additional, higher-emitting, fossil-fuel energy facilities would be kept in service to meet power demand, fired by natural gas, oil, or coal. BOEM anticipates that ongoing non-offshore wind activities would result in **moderate** impacts on air quality because of air pollutant emissions and GHGs. Ongoing activities would result in moderate impacts on air quality because their emissions would incrementally increase ambient pollutant concentrations, though not by enough to cause a new violation of the NAAQS, New Jersey AAQS, or New York AAQS or contribute substantially to an existing violation. Although the proposed Projects would not be built under the No Action Alternative, BOEM expects ongoing non-offshore wind activities would continue to have regional air quality impacts primarily through air pollutant emissions, accidental releases, and climate change.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, air quality would continue to be affected by natural and human-caused IPFs. Planned non-offshore wind activities may also contribute to impacts on air quality because air pollutant and GHG emissions would increase through construction and operation of new energy generation facilities to meet future power demands (Table F1-1). Continuation of current regional trends in energy development could include new power plants that could contribute to air quality and GHG impacts in New York and the neighboring states. BOEM expects the combination of ongoing and planned activities other than offshore wind to result in **moderate** impacts on air quality, primarily driven by recent market and permitting trends indicating future fossil-fueled electric generating units would most likely include natural-gas-fired facilities.

⁵ For example, small diesel fuel spills (500–5,000 gallons) usually will evaporate and disperse within a day or less (NOAA 2006).

Offshore wind activities in the geographic analysis area would contribute to the emissions of criteria pollutants, VOCs, HAPs, and GHGs, mostly released during construction and decommissioning. Impacts would be minor because these emissions would incrementally increase ambient pollutant concentrations, though not by enough to cause a violation of the NAAQS, New Jersey AAQS, or New York AAQS or contribute substantially to an existing violation. Pollutant emissions during operations would be generally lower and more transient. Most air pollutant emissions and air quality impacts would occur during multiple overlapping project construction phases from 2026 through 2030 (Table F2-4). Adverse air quality impacts from planned offshore wind projects are expected to be relatively small and transient. Planned offshore wind projects likely would lead to reduced emissions from fossil-fueled power generating facilities and consequent minor to moderate beneficial impacts on regional air quality after offshore wind projects are operational.

BOEM anticipates that the cumulative impacts of the No Action Alternative would result in **moderate** adverse impacts due to emissions of criteria pollutants, VOCs, HAPs, and GHGs, mostly released during construction and decommissioning, because these emissions would incrementally increase ambient pollutant concentrations (more than would activities without offshore wind or offshore wind alone), though not by enough to cause a violation of the NAAQS, New Jersey AAQS, or New York AAQS or contribute substantially to an existing violation.

BOEM expects **minor to moderate beneficial** impacts on regional air quality after offshore wind projects are operational because these projects likely would lead to reduced emissions from fossil-fueled power generating facilities.

3.4.4 Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix E) would influence the magnitude of the impacts on air quality:

- Emission ratings of construction equipment and vehicle engines;
- Location of construction laydown areas;
- Choice of cable-laying locations and pathways;
- Choice of marine traffic routes to and from the Wind Farm Development Area and offshore export cable routes;
- Soil characteristics at excavation areas, which may affect fugitive emissions; and
- Emission control strategy for fugitive emissions due to excavation and hauling operations.

Changes to the design capacity of the WTGs would not alter the maximum potential air quality impacts for the Proposed Action and other action alternatives because the maximum-case scenario involved the maximum number of WTGs allowed in the PDE.

3.4.5 Impacts of the Proposed Action on Air Quality

The Projects may generate emissions and affect air quality in the New York City region and nearby coastal waters during construction, O&M, and decommissioning activities. Onshore emissions would occur in the onshore export cable corridors and at points of interconnection. Offshore emissions would be within the OCS and state offshore waters. Offshore emissions would occur in the Lease Area and the

offshore export cable corridors. COP Section 8.2 (Empire 2023) provides additional information on land use and proposed ports.

Air quality in the geographic analysis area may be affected by emissions of criteria pollutants from sources involved in the construction or maintenance of the proposed Projects and, potentially, during operations. These impacts, while generally localized to the areas near the emission sources, may occur at any location associated with the proposed Projects, be it offshore in the Wind Farm Development Area or at any of the onshore construction or support sites. Ozone levels in the region also could be affected.

The proposed Projects' WTGs, substations, and offshore and onshore cable corridors would not themselves generate air pollutant emissions during normal operations. However, air pollutant emissions from equipment used in the construction, O&M, and decommissioning phases could affect air quality in the proposed Project area and nearby coastal waters and shore areas. Most emissions would occur temporarily during construction, offshore in the Wind Farm Development Area, onshore at the landfall sites, along the offshore and onshore export cable routes, at the onshore substations, and at the construction staging areas. Additional emissions related to the proposed Projects could also occur at nearby ports used to transport material and personnel to and from the Project site. However, the proposed Projects would provide beneficial impacts on the air quality near the proposed Project location and the surrounding region to the extent that energy produced by the Projects would displace energy produced by fossil-fueled power plants in the region.

The majority of air pollutant and GHG emissions from the Proposed Action would come from the main engines, auxiliary engines, and auxiliary equipment on marine vessels used during offshore construction activities. Fugitive dust emissions would occur as a result of excavation and hauling of soil during onshore construction activities. Emissions from the OCS source, as defined in the CAA, would be permitted as part of the OCS permitting process that is underway by Empire.

The emissions estimates in this section do not include emissions from raw material extraction, materials processing, and manufacturing of components, i.e., full life-cycle analysis. However, recently published studies have analyzed the life-cycle impacts of offshore wind (Ferraz de Paula and Carmo 2022; Rueda-Bayona et al. 2022; Shoaib 2022). These studies concluded that the materials that have the greatest impact on life-cycle emissions generally are steel and concrete and that materials recycling rates have a large influence on life-cycle emissions. NREL harmonized approximately 3,000 life-cycle assessment studies with around 240 published life-cycle analyses of land-based and offshore wind technologies (NREL 2021). Although wind has higher upstream emissions than many other generation methods, its life-cycle GHG emissions are orders of magnitude lower. NREL (2021) estimated that the central 50 percent of GHG estimates reviewed were in the range of 9.4–14 grams of CO₂ equivalent per kilowatt-hour while life-cycle GHG estimates for coal and natural gas are on the scale of 1,000 grams of CO₂ equivalent per kilowatt-hour (Dolan and Heath 2012) and 480 grams of CO₂ equivalent per kilowatt-hour (O'Donoghue et al. 2014), respectively.

Air emissions – construction: Fuel combustion and solvent use would cause construction-related emissions. The air pollutants would include criteria pollutants, VOCs, and HAPs, as well as GHGs. During the construction phase, the activities of additional workers, increased traffic congestion, additional commuting miles for construction personnel, and increased air-polluting activities of supporting businesses also could have impacts on air quality. Construction equipment would comply with all applicable emissions and fuel-efficiency standards to minimize combustion emissions and associated air quality impacts. The total estimated construction emissions of each pollutant are summarized in Table 3.4-2. The emissions estimates presented in Section 3.4.5 apply to the Empire Wind Projects and do not include impacts of the connected action. The connected action is described in Section 3.4.5.1.

Table 3.4-2 Empire Wind Total Construction Emissions

Year	(U.S. tons)						(metric tons)				
	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC	CO ₂	CH ₄	N ₂ O	SF ₆	CO _{2e} ¹
2023	<1	1	<1	<1	<1	<1	251	<1	<1	NA	254
2024	199	668	16	16	12	28	42,901	1	2	NA	43,496
2025	871	2,297	70	67	53	186	161,619	2	7	NA	163,878
2026	907	1,907	61	59	34	137	143,572	2	7	NA	146,409
2027	672	701	28	27	8	78	84,490	1	4	NA	145,181
Total	2,650	5,574	176	168	108	429	432,833	6	20	NA	499,217

Source: Appendix F, Table F2-4; COP Appendix K, Table K-1-29 (Empire 2023).

Sum of individual values may not equal total due to rounding.

¹ Calculation of CO_{2e} is based on 100-year global warming potentials published by USEPA in Table A-1 of 40 CFR Part 98, Subpart A. The global warming potentials are 1 for CO₂, 25 for methane, 298 for nitrous oxide, and 22,800 for sulfur hexafluoride.

< = less than; CH₄ = methane; CO_{2e} = carbon dioxide equivalent; N₂O = nitrous oxide; NA = not applicable

Offshore Construction

Emissions from construction activities would vary throughout the construction and installation of offshore components. Emissions from offshore activities would occur during pile and scour protection installation, offshore cable laying, turbine installation, and substation installation. Offshore construction-related emissions also would come from diesel-fueled generators used to temporarily supply power to the WTGs and OSS so that workers could operate lights, controls, and other equipment before cabling is in place. There also would be emissions from engines used to power pile-driving hammers and air compressors used to supply compressed air to noise-mitigation devices during pile driving (if used). Emissions from vessels used to transport workers, supplies, and equipment to and from the construction areas would result in additional air quality impacts. The Projects may need emergency generators at times, potentially resulting in increased emissions for limited periods. Empire’s APMs to reduce air quality impacts include compliance with applicable emissions standards (APM 28 and APM 31) and fuel sulfur content standards (APM 29 and APM 30), purchase of emission-reduction credits where required (APM 27), data and information sharing with BOEM and USEPA (APM 32 and APM 33), and compliance with state regulations on engine idling (APM 34) (Appendix H, Attachment H-2).

The nearest Class I area, the Brigantine Wilderness Area in New Jersey, is more than 67 miles (108 kilometers) from the Projects. This distance is greater than the 100-kilometer distance within which USEPA recommends that the federal land manager of the Class I area be notified about a project that requires a federal air quality permit. Winds blow from the Project area toward the Brigantine Wilderness Area for only a small proportion of the year (see Appendix I, Figure I-1). Emissions from Project construction activities would not be concentrated at a single point but would occur throughout the geographic analysis area. As a result, Project emissions would be relatively well dispersed before being transported toward the Brigantine Wilderness Area. For these reasons, adverse air quality impacts are not expected at the Brigantine Wilderness area due to the Projects.

Air quality impacts due to offshore wind projects within the air quality geographic analysis area are anticipated to be small relative to those of combined impacts of larger emission sources in the region, such as fossil-fueled power plants. The largest air quality impacts of offshore wind projects are anticipated during construction, with smaller and more infrequent impacts anticipated during decommissioning. Most emissions would occur from diesel-fueled construction equipment, vessels, and commercial vehicles. The magnitude of the emissions and the resulting air quality impacts would vary spatially and temporally during the construction phases.

Construction activity would occur at different locations and could overlap temporally with activities at other locations, including operational activities at previously constructed projects. As a result, air quality impacts would shift spatially and temporally across the air quality geographic analysis area. The largest combined air quality impacts from offshore wind would occur during overlapping construction and decommissioning of multiple offshore wind projects. Construction of the proposed Projects would overlap with the early years of construction of Ocean Winds East and Vineyard Mid-Atlantic LLC (Table F2-4). Most air quality impacts would remain offshore because the highest emissions would occur in the offshore region and the westerly prevailing winds would result in most emission plumes remaining offshore for some distance. Although air quality offshore is subject to the NAAQS in federal waters and the OCS permit area, the amount of human exposure offshore is typically very low. However, ozone and some particulate matter are formed in the atmosphere from precursor emissions and can be transported longer distances, potentially over land.

Onshore Construction

Onshore activities of the Proposed Action would consist primarily of HDD, duct bank construction, cable-pulling operations, and onshore substation construction. Emissions would primarily be from operation of diesel-powered equipment and vehicle activity such as bulldozers, excavators, and heavy trucks, and fugitive particulate emissions from excavation and hauling of soil. Empire's APMs include complying with applicable emissions standards (APM 28 and APM 31) and fuel sulfur content standards (APM 29 and APM 30), purchase of emission-reduction credits where required (APM 27), data and information sharing with BOEM and USEPA (APM 32 and APM 33), and compliance with state regulations on engine idling (APM 34) (Appendix H, Attachment H-1).

These onshore emissions would be highly variable and limited in spatial extent at any given period and would result in minor impacts, as they would be temporary in nature. Fugitive particulate emissions would vary depending on the spatial extent of the excavated areas, soil type, soil moisture content, and magnitude and direction of ground-level winds.

Air emissions – O&M: During O&M, air quality impacts are anticipated to be smaller in magnitude compared to construction and decommissioning. Offshore O&M activities would consist of WTG operations, planned maintenance, and unplanned emergency maintenance and repairs. The WTGs operating under the Proposed Action would have no pollutant emissions. Emergency generators on the WTGs and the substations would operate only during emergencies or testing, so emissions from these sources would be small and transient. Pollutant emissions from O&M would be mostly the result of operations of ocean vessels and helicopters used for maintenance activities. Crew transfer vessels and helicopters would transport crews to the Wind Farm Development Area for inspections, routine maintenance, and repairs. Jack-up vessels, multipurpose offshore support vessels, and rock-dumping vessels would travel infrequently to the Wind Farm Development Area for significant maintenance and repairs. The proposed Projects' contribution would be additive with the impact(s) of any and all other operational activities, including offshore wind activities, that occur within the air quality geographic analysis area. COP Section 3.5 (Empire 2023) provides a more detailed description of offshore and onshore O&M activities, and COP Table 4.3-9 summarizes emissions during O&M. The annual estimated emissions for O&M are summarized in Table 3.4-3.

Table 3.4-3 Empire Wind Operations and Maintenance Emissions

Period	(US. tons)						(metric tons)				
	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC	CO ₂	CH ₄	N ₂ O	SF ₆	CO _{2e} ¹
Annual	246	187	6	6	2	20	31,989	1	1	<1	37,796
Lifetime (35 years)	8,597	6,536	221	213	84	688	1,119,614	18	51	4	1,322,844

Source: Appendix F, Table F2-4; COP Appendix K, Table K-1-29 (Empire 2023).

¹ Calculation of CO_{2e} is based on 100-year global warming potentials published by USEPA in Table A-1 of 40 CFR Part 98, Subpart A. The global warming potentials are 1 for CO₂, 25 for methane, 298 for nitrous oxide, and 22,800 for sulfur hexafluoride.

<1 = less than 1; CH₄ = methane; CO_{2e} = carbon dioxide equivalent; N₂O = nitrous oxide; SF₆ = sulfur hexafluoride

BOEM anticipates that air quality impacts from O&M of the Proposed Action would be minor, occurring for short periods of time several times per year during the proposed 35 years.

Emissions from onshore O&M activities would be limited to periodic use of construction vehicles and equipment. Onshore O&M activities would include occasional inspections and repairs to the onshore substation and splice vaults, which would require minimal use of worker vehicles and construction equipment. Empire intends to construct and maintain an O&M facility to support O&M activities. A location for this facility at the SBMT is being considered (see COP Section 3.5; Empire 2023). BOEM anticipates that air quality impacts due to onshore O&M from the Proposed Action would be minor, intermittent, and occurring for short periods.

Increases in renewable energy could lead to reductions in emissions from fossil-fueled power plants. The USEPA Avoided Emissions and Generation Tool (USEPA 2021b) was used to estimate the emissions avoided as a result of the Proposed Action. Once operational, the Proposed Action would result in annual avoided emissions of 953 tons of NO_x, 292 tons of PM_{2.5}, 232 tons of SO₂, and 3,573,860 tons of CO₂. This estimate is derived assuming the electricity generation mix of 2018 for generating units in New York and New Jersey that is included in the Avoided Emissions and Generation Tool. If renewable energy sources make up more of the electricity generation mix in the future, these potential benefits would be proportionally diminished as overall air emissions decrease and air quality improves. The avoided CO₂ emissions are equivalent to the emissions generated by about 705,000 passenger vehicles in a year (USEPA 2020a). Accounting for construction emissions and assuming decommissioning emissions would be the same, and including emissions from future operations, operation of the Proposed Action would offset emissions related to its development and eventual decommissioning within different time periods of operation depending on the pollutant: PM_{2.5} and SO₂ each would be offset in approximately 1 year of operation, and CO₂ in 3 months. NO_x emissions would be offset in approximately 34 years, or nearly the Projects' lifetime. If emissions from future operations and decommissioning were not included, the times required for emissions to "break even" would be shorter. From that point, the Projects would be offsetting emissions that would otherwise be generated from another source.

The potential health benefits of avoided emissions can be evaluated using USEPA's CO-Benefits Risk Assessment (COBRA) health impacts screening and mapping tool (USEPA 2020b). COBRA is a tool that estimates the health and economic benefits of clean energy policies. COBRA was used to analyze the avoided emissions that were calculated for the Proposed Action. Table 3.4-4 presents the estimated avoided health effects. The estimates in Table 3.4-4 are based on the reduction in electrical generation from fossil fuel combustion during Project operation. If emissions increases from Project O&M were included, the net avoided health effects and monetized benefits would be lower.

Table 3.4-4 COBRA Estimate of Annual Avoided Health Effects with Proposed Action

Discount Rate ¹ (2023)	Avoided Mortality (cases per year)		Monetized Total Health Benefits (U.S. dollars per year)	
	Low Estimate ²	High Estimate ²	Low Estimate ²	High Estimate ²
3%	7.613	17.223	\$84,807,165	\$191,089,005
7%	7.613	17.223	\$75,691,313	\$170,408,581

¹ The discount rate is used to express future economic values in present terms. Not all health effects and associated economic values occur in the year of analysis. Therefore, COBRA accounts for the “time value of money” preference (i.e., a general preference for receiving economic benefits now rather than later) by discounting benefits received later (USEPA 2020c).

² The low and high estimates are derived using two sets of assumptions about the sensitivity of adult mortality and non-fatal heart attacks to changes in ambient PM_{2.5} levels. Specifically, the high estimates are based on studies that estimated a larger effect of changes in ambient PM_{2.5} levels on the incidence of these health effects (USEPA 2020c).

The overall impacts of GHG emissions can be assessed using “social costs.” The “social cost of carbon,” “social cost of nitrous oxide,” and “social cost of methane”—together, the “social cost of greenhouse gases” (SC-GHG)—are estimates of the monetized damages associated with incremental increases in GHG emissions in a given year.

NEPA does not require monetizing costs and benefits but allows the use of the social cost of carbon, SC-GHG, or other monetized costs and benefits of GHGs in weighing the merits and drawbacks of alternative actions. In January 2023, CEQ issued interim guidance (CEQ 2023) that updates its 2016 guidance document (CEQ 2016) on consideration of GHGs and climate change under NEPA. The interim guidance recommends that agencies provide context for GHG emissions, including through the use of SC-GHG estimates, to translate climate impacts into the more accessible metric of dollars.

For federal agencies, the best currently available estimates of SC-GHG are the interim estimates of the social costs of CO₂, methane, and nitrous oxide developed by the Interagency Working Group (IWG) on SC-GHG and published in its Technical Support Document (IWG 2021). IWG’s SC-GHG estimates are based on complex models describing how GHG emissions affect global temperatures, sea level rise, and other biophysical processes; how these changes affect society through, for example, agricultural, health, or other effects; and monetary estimates of the market and nonmarket values of these effects. One key parameter in the models is the discount rate, which is used to estimate the present value of the stream of future damages associated with emissions in a particular year. The discount rate accounts for the “time value of money,” i.e., a general preference for receiving economic benefits now rather than later, by discounting benefits received later. A higher discount rate assumes that future benefits or costs are more heavily discounted than benefits or costs occurring in the present (i.e., future benefits or costs are less valuable or are a less significant factor in present-day decisions). IWG developed the current set of interim estimates of SC-GHG using three different annual discount rates: 2.5 percent, 3 percent, and 5 percent (IWG 2021).

There are multiple sources of uncertainty inherent in the SC-GHG estimates. Some sources of uncertainty relate to physical effects of GHG emissions, human behavior, future population growth and economic changes, and potential adaptation (IWG 2021). To better understand and communicate the quantifiable uncertainty, the IWG method generates several thousand estimates of the social cost for a specific gas, emitted in a specific year, with a specific discount rate. These estimates create a frequency distribution based on different values for key uncertain climate model parameters. The shape and characteristics of that frequency distribution demonstrate the magnitude of uncertainty relative to the average or expected outcome.

To further address uncertainty, IWG recommends reporting four SC-GHG estimates in any analysis. Three of the SC-GHG estimates reflect the average damages from the multiple simulations at each of the three discount rates. The fourth value represents higher-than-expected economic impacts from climate change. Specifically, it represents the 95th percentile of damages estimated, applying a 3-percent annual discount rate for future economic effects. This is a low-probability but high-damage scenario and represents an upper bound of damages within the 3-percent discount rate model. The estimates below follow the IWG recommendations.

Table 3.4-5 presents the SC-GHG associated with estimated emissions from the Proposed Action. These estimates represent the present value of future market and nonmarket costs associated with CO₂, methane, and nitrous oxide emissions. In accordance with IWG’s recommendation, four estimates were calculated based on IWG estimates of social cost per metric ton of emissions for a given emissions year and Empire’s estimates of emissions in each year. In Table 3.4-5, negative values represent social benefits of avoided GHG emissions. The negative values for net SC-GHG indicate that the impact of the Proposed Action on GHG emissions and climate would be a net benefit in terms of SC-GHG.

Table 3.4-5 Estimated Social Cost of GHGs associated with the Proposed Action

Description	Social Cost of GHGs (2020\$) ^{1,2,3}			
	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
SC-CO₂				
Construction, Operation, and Conceptual Decommissioning	\$16,434,000	\$65,146,000	\$99,718,000	\$197,966,000
Avoided Emissions	-\$969,983,000	-\$4,036,297,000	-\$6,236,114,000	-\$12,340,427,000
Net SCC-CO ₂	-\$953,549,000	-\$3,971,151,000	-\$6,136,396,000	-\$12,142,461,000
SC-CH₄				
Construction, Operation, and Conceptual Decommissioning	\$63,000	\$214,000	\$307,000	\$568,000
Avoided Emissions	-\$3,318,000	-\$9,366,000	-\$12,911,000	-\$24,981,000
Net SCC-CH ₄	-\$3,255,000	-\$9,152,000	-\$12,604,000	-\$24,413,000
SC-N₂O				
Construction, Operation, and Conceptual Decommissioning	\$306,000	\$1,119,000	\$1,703,000	\$2,974,000
Avoided Emissions	-\$3,830,000	-\$14,809,000	-\$22,772,000	-\$39,467,000
Net SCC-N ₂ O	-\$3,524,000	-\$13,690,000	-\$21,069,000	-\$36,493,000
SC-SF₆				
Construction, Operation, and Conceptual Decommissioning	\$707,000	\$2,929,000	\$4,521,000	\$8,950,000
Avoided Emissions	\$0	\$0	\$0	\$0
Net SCC-SF ₆	\$707,000	\$2,929,000	\$4,521,000	\$8,950,000

Description	Social Cost of GHGs (2020\$) ^{1,2,3}			
	Average Value, 5% discount rate	Average Value, 3% discount rate	Average Value, 2.5% discount rate	95th Percentile Value, 3% discount rate
SC-GHG³				
Construction, Operation, and Conceptual Decommissioning	\$17,510,000	\$69,408,000	\$106,249,000	\$210,458,000
Avoided Emissions	-\$977,131,000	-\$4,060,472,000	-\$6,271,797,000	-\$12,404,875,000
Net SC-GHG	-\$959,621,000	-\$3,991,064,000	-\$6,165,548,000	-\$12,194,417,000

Estimates are the sum of the social costs for CO₂, CH₄, N₂O, and SF₆ over the Project lifetime.

Estimates are rounded to the nearest \$1,000.

¹ Negative cost values indicate benefits.

² The following calendar years were used in calculating SC-GHG: construction 2023–2027, operation (30 years) 2028–2057, and decommissioning 2058–2059.

³ NYSDEC calculates SC-GHG using discount rates of 1%, 2%, and 3% (NYSDEC 2022), which differ from the IWG recommended rates used in the table. If the estimated SC-GHG for the Proposed Action were calculated using the NYSDEC discount rates, the estimates would differ from those shown in the table.

CH₄ = methane; N₂O = nitrous oxide; SF₆ = sulfur hexafluoride

Table 3.4-6 presents the annual emissions, avoided emissions, and net emissions of CO₂ over the operational lifetime of the Proposed Action. Net emissions are the Proposed Action emissions minus the avoided emissions. The No Action Alternative would result in no emissions during construction and O&M because no project would be built, but would also offer no avoided emissions, resulting in higher GHG emissions over the Project duration due to not displacing fossil-fueled power generation via offshore wind. The emissions not avoided, 3,195,903 metric tons per year of CO₂ (Table 3.4-6), would be equivalent to about 700,000 additional passenger vehicles per year. These estimates are relative to the 2018 grid configuration as noted above, but the actual annual quantity of avoided emissions attributable to this proposed facility is expected to diminish over time if the electric grid becomes lower-emitting due to the addition of other renewable energy facilities and retirement of high-emitting generators.

Table 3.4-6 Net Emissions of Carbon Dioxide Equivalent for Each Alternative

Alternative	CO ₂ e Emissions (metric tons) ^{1,2}											
	Construction 2023–2027						Operation 2028–2062				Decommissioning 2063–2064	Construction + Operation + Decommissioning 2023–2064
	2023	2024	2025	2026	2027	Total Construction	O&M Emissions (Annual)	Avoided Emissions ³ (Annual)	Net Emissions ⁴ (Annual)	Operational Lifetime Net Emissions ²	Total Decommissioning	Total Lifetime Net Emissions
A (No Action)	0		0	0	0	0	0	0	3,204,339 ⁵	0	0	113,474,701 ⁵
A (Proposed Action)	254	43,496	163,878	146,409	145,181	499,217	37,796	-3,242,134	-3,204,339	-112,151,857	48,841	-111,603,799
B	254	43,496	163,878	146,409	145,181	499,217	37,796	-3,242,134	-3,204,339	-112,151,857	48,841	-111,603,799
C-1	254	43,496	163,878	146,409	145,181	499,217	37,796	-3,242,134	-3,204,339	-112,151,857	48,841	-111,603,799
C-2	254	43,496	163,878	146,409	145,181	499,217	37,796	-3,242,134	-3,204,339	-112,151,857	48,841	-111,603,799
D	254	43,496	163,878	146,409	145,181	499,217	37,796	-3,242,134	-3,204,339	-112,151,857	48,841	-111,603,799
E	254	43,496	163,878	146,409	145,181	499,217	37,796	-3,242,134	-3,204,339	-112,151,857	48,841	-111,603,799
F	239	40,868	153,979	137,565	136,411	469,063	35,513	-3,046,301	-3,010,788	-105,377,584	45,891	-104,862,630
G	254	43,496	163,878	146,409	145,181	499,217	37,796	-3,242,134	-3,204,339	-112,151,857	48,841	-111,603,799
H	254	43,496	163,878	146,409	145,181	499,217	37,796	-3,242,134	-3,204,339	-112,151,857	48,841	-111,603,799
Preferred Alternative	239	40,868	153,979	137,565	136,411	469,063	35,513	-3,046,301	-3,010,788	-105,377,584	45,891	-104,862,630

¹ Emissions for Alternative B through the Preferred Alternative are estimated as the Proposed Action emissions times the ratio of the number of foundations for the alternative to the number of foundations for the Proposed Action.

² Positive values are emissions increases; negative values are emissions decreases.

³ Avoided emissions are expressed as CO₂ due to limitations of the USEPA AVERT model.

⁴ Annual net emissions equal O&M minus avoided emissions.

⁵ Represents emissions from the grid in the absence of the Projects, relative to the Proposed Action.

CO₂e = carbon dioxide equivalent

This page intentionally left blank.

Air emissions – decommissioning: At the end of the operational lifetime of the Projects, Empire would decommission the Projects. Empire anticipates that all structures above the seabed level or aboveground would be completely removed. The decommissioning sequence would generally be the reverse of the construction sequence, involve similar types and numbers of vessels, and use similar equipment.

The dismantling and removal of the turbine components (blades, nacelle, and tower) and other offshore components would largely be a “reverse installation” process subject to the same constraints as the original construction phase. Onshore decommissioning activities would include removal of facilities and equipment and restoration of the sites to pre-Project conditions where warranted. Emissions from Project decommissioning would be less than for construction, as shown in Table 3.4-7. The Projects anticipate pursuing a separate OCS Air Permit for those activities because it is assumed that marine vessels, equipment, and construction technology will change substantially in the next 35 years and in the future will have lower emissions than current vessels and equipment. BOEM anticipates minor and temporary air quality impacts from the Proposed Action due to decommissioning.

Table 3.4-7 Empire Wind Decommissioning Emissions (U.S. tons)

Period	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC	CO _{2e} ¹
Total	322	588	22	21	17	76	53,838

Source: COP Appendix K, Table K-8 (Empire 2023)

¹ Calculation of CO_{2e} is based on 100-year global warming potentials published by USEPA in Table A-1 of 40 CFR Part 98, Subpart A. The global warming potentials are 1 for CO₂, 25 for methane, 298 for nitrous oxide, and 22,800 for sulfur hexafluoride.

CO_{2e} = carbon dioxide equivalent

The Proposed Action would produce GHG emissions that contribute to climate change; however, its contribution would be less than the emissions displaced during operation of the Projects. Because GHG emissions disperse and mix within the troposphere, the climatic impact of GHG emissions does not depend upon the source location. Therefore, regional climate impacts are largely a function of global emissions. Consequently, the Proposed Action would have negligible impacts on climate change during construction and operation, and an overall net beneficial impact on criteria pollutant and ozone precursor emissions as well as GHGs, compared to a similarly sized fossil-fueled power plant or to the generation of the same amount of energy by the existing grid.

Accidental releases: The proposed Projects could release VOCs or HAPs because of accidental chemical spills. Based on Table F2-3, the Proposed Action would have up to about 128,184 gallons (485,228 liters) of coolants and damping liquid, 1,053,770 gallons (4.0 million liters) of oils and lubricants, and 15,850 gallons (59,999 liters) of diesel fuel in its 147 WTGs and 2 OSS. Accidental releases including spills from vessel collisions and allisions may lead to short periods of VOC and HAP emissions through evaporation. VOC emissions also would be a precursor to ozone formation. Air quality impacts would be temporary and limited to the local area at and around the accidental release location. BOEM anticipates that a major spill is very unlikely due to vessel and offshore wind energy industry safety measures, as discussed in Section 3.21.3.2, as well as the distributed nature of the material. BOEM anticipates that these activities would have a negligible air quality impact as a result of the Proposed Action.

3.4.5.1. Impact of the Connected Action

The connected action would affect air quality in the geographic analysis area through the following IPFs: accidental releases and air pollutant emissions. The connected action was evaluated in the Full Environment Assessment Form Supplemental Analysis for SBMT (NYCEDC 2023), which is included in this EIS as Appendix Q.

Accidental releases: Accidental releases of fuel, fluids, or hazardous materials could occur during staging and assembly of Project components at SBMT. NYCEDC would develop and implement a SWPPP or SPCC plan to manage accidental spills or releases of oil, fuel, or hazardous materials during construction and operation of improvements at the SBMT. The provisions of the SWPPP or SPCC plan would minimize emissions to the atmosphere that could occur due to accidental releases. Accordingly, accidental releases from the connected action alone would have localized, short-term, negligible to minor impacts on air quality.

Air emissions: The SBMT infrastructure improvement project would improve the terminal site that Empire would use for construction and staging of some Project components. Construction and operation of SBMT, and some Project construction and O&M activities, would occur in close proximity to each other on the site and would overlap in time.

Emission sources associated with construction and operations of SBMT would include land-based non-road equipment and on-road vehicles, vessels performing dredging; heating, ventilation, and air conditioning equipment; emergency generators; and vessels berthed at the site⁶ for staging and construction of the Projects. SBMT performed air quality dispersion modeling to estimate pollutant concentrations for the highest-emissions periods for SBMT construction and operation. The results showed that all concentrations during each phase would be well within the NAAQS and New York AAQS and are reproduced below in Table 3.4-8 (NYCEDC 2023, Table 3.20-6; Draft EIS Appendix P, SBMT EA Appendix P at page 205).

⁶ SBMT EA Appendix P (Supplemental Air Analysis) at Section 2.2.1 indicates that emissions from such vessels during transit are separately captured in Appendix K to the COP (“The vessels associated with transit for [offshore wind] construction have been accounted for in the Empire Wind Projects’ COP (May 2022) so they are not considered in this analysis”).

Table 3.4-8 Maximum Predicted Pollutant Concentrations Associated with SBMT

Pollutant	Averaging Period	Background	Maximum Modeled Increment	Total Concentration	CEQR <i>de minimis</i> Criteria	NAAQS	Exceed <i>de minimis</i> Criteria or NAAQS
PM _{2.5} ¹	24-hour ²	—	1.84 µg/m ³	--	9.95 µg/m ³ ³	—	No
PM _{2.5} ¹	Annual (12-month) Local ²	—	0.03 µg/m ³	--	0.3 µg/m ³	—	No
PM _{2.5}	24-hour ⁴	15.1 µg/m ³	1.84 µg/m ³	16.94 µg/m ³	—	35 µg/m ³	No
PM _{2.5}	Annual ³	5.9 µg/m ³	0.03 µg/m ³	5.93 µg/m ³	—	12 µg/m ³	No
PM ₁₀	24-hour	29.3 µg/m ³	4.91 µg/m ³	34.21 µg/m ³	—	150 µg/m ³	No
NO ₂	Annual	31.0 µg/m ³	0.49 µg/m ³	30.13 µg/m ³	—	100 µg/m ³	No
CO	1-hour	1.7 ppm	0.38 ppm	2.08 ppm	—	35 ppm	No
CO	8-hour	1.2 ppm	0.05 ppm	1.25 ppm	—	9 ppm	No

Source: NYCEDC 2023, Table 3.20-6; Draft EIS Appendix P, SBMT EA Appendix P at page 205.

¹ PM_{2.5} incremental concentrations were compared to the applicable City Environmental Quality Review (CEQR) *de minimis* criteria. Total concentrations were compared to the NAAQS.

² Monitored concentration is not added to modeled PM_{2.5} value for comparison to CEQR *de minimis* criteria.

³ PM_{2.5} CEQR *de minimis* criterion — 24-hour average, not to exceed more than half the difference between the background concentration and the 24-hour standard of 35 µg/m³.

⁴ PM_{2.5} comparison is to NAAQS including the background concentration.

µg/m³ = micrograms per cubic meter; ppm = parts per million

Comparison of the relative emissions for the Projects and SBMT indicates that the combined concentrations for the Projects and SBMT would be expected to be within the NAAQS and New York AAQS for each pollutant, for all years of the Projects’ construction and operation.

3.4.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities, and the connected action at SBMT.

Offshore construction. The contribution of the Proposed Action to the cumulative impacts on air quality from ongoing and planned activities would be minor during construction. During overlapping construction activities, there could be higher levels of impacts, but these effects would be temporary in nature, as the overlap in the air quality geographic analysis area would be limited in duration.

Onshore construction. The contribution of the Proposed Action to cumulative air quality impacts from ongoing and planned activities associated with onshore construction would be minor. Emissions from ongoing and planned activities, including the Proposed Action, would be highly variable and limited in spatial extent at any given period. As with the Proposed Action, fugitive particulate emissions would vary depending on the spatial extent of the excavated areas, soil type, soil moisture content, and magnitude and direction of ground-level winds.

Construction and operation of SBMT would occur at the same time as some construction activities for the Proposed Action and could contribute to cumulative impacts. The combined activities could have potential for localized air quality impacts. Table 3.4-9 summarizes the combined emissions for those pollutants that are of concern for localized impacts.

Table 3.4-9 Combined Empire Wind and SBMT Emissions During Empire Wind Construction

Activity	Emissions (tons per year)			
	NO _x	CO	PM ₁₀	PM _{2.5}
2023				
SBMT construction	1.0	0.4	0.1	0.1
SBMT operation during Empire Wind construction	NA	NA	NA	NA
Empire Wind construction emissions in Kings County	0.69	0.25	0.03	0.03
2023 Total	1.69	0.65	0.13	0.13
2024				
SBMT construction	7.5	3.5	0.6	0.5
SBMT operation during Empire Wind construction	NA	NA	NA	NA
Empire Wind construction emissions in Kings County	221.99	47.49	5.29	5.13
2024 Total	229.49	50.99	5.89	5.63
2025				
SBMT construction	2.7	1.7	0.2	0.2
SBMT operation during Empire Wind construction	NA	NA	NA	NA
Empire Wind construction emissions in Kings County	313.69	65.78	7.27	7.05
2025 Total	316.39	67.48	7.47	7.25
2026				
SBMT construction	NA	NA	NA	NA
SBMT operation during Empire Wind construction	14.7	6.3	0.8	0.6

Activity	Emissions (tons per year)			
	NO _x	CO	PM ₁₀	PM _{2.5}
Empire Wind construction emissions in Kings County	31.47	13.82	1.05	1.02
2026 Total	46.17	20.12	1.85	1.62
2027				
SBMT construction	NA	NA	NA	NA
SBMT operation during Empire Wind construction	14.7	6.3	0.8	0.6
Empire Wind construction emissions in Kings County	35.64	14.99	1.09	1.06
2027 Total	50.34	21.29	1.89	1.66

NA = not applicable

Air emissions – O&M. The contribution of the Proposed Action O&M emissions to the combined impacts of ongoing and planned activities would be minor. O&M emissions associated with planned offshore wind activities would largely be due to the same source types as for the Proposed Action, including commercial vessel traffic, air traffic such as helicopters, and operation of emergency diesel generators. Such activity would result in intermittent, and widely dispersed emissions. Planned offshore wind activities, including the Proposed Action, are estimated to emit 522 tons per year of CO, 743 tons per year of NO_x, 36 tons per year of PM₁₀, 34 tons per year of PM_{2.5}, 16 tons per year of SO₂, 49 tons per year of VOCs, and 111,383 tons per year of CO₂ when all projects are operating (Table F2-4). Anticipated impacts on air quality from O&M emissions would be transient, small in magnitude, and localized. Additionally, some emissions associated with O&M activities could overlap with other projects' construction-related emissions. The largest magnitude air quality impacts and largest spatial extent would result from the overlapping operations activities from the offshore wind projects within the air quality geographic analysis area. However, a net improvement in air quality is expected on a regional scale as the Projects begin operation and displaces emissions from fossil-fueled sources.

Air emissions – decommissioning. The contribution of decommissioning of the Proposed Action to the combined air quality impacts from ongoing and planned activities would be minor. The decommissioning process for all offshore wind projects is expected to be similar, and impacts would be similar in nature to impacts of construction but would be less in degree. Because the emissions related to onshore activities would be widely dispersed and transient, BOEM expects all air quality impacts to occur close to the emitting sources. If decommissioning activities for projects overlap in time, then impacts could be greater for the duration of the overlap. In context of reasonably foreseeable environmental trends, the contribution of the Proposed Action to the combined GHG impacts on air quality from ongoing and planned activities would be beneficial from the net decrease in GHG emissions, to the extent that fossil-fueled generating facilities would reduce operations as a result of increased energy generation from offshore wind projects.

Accidental releases. Based on Table F2-3, there would be up to about 209,994 gallons (794,913 liters) of coolants, 1,933,235 gallons (7.3 million liters) of oils and lubricants, and 342,558 gallons (1.3 million liters) of diesel fuel contained in the 355 WTGs and OSS associated with the Proposed Action and other planned offshore wind projects in the air quality geographic analysis area. BOEM expects that in context of reasonably foreseeable environmental trends, the contribution of the Proposed Action to the combined accidental release impacts on air quality from ongoing and planned activities would be negligible due to the temporary nature and localized potential effects. Accidental spills would occur infrequently over the 35-year period with a higher probability of spills during construction of projects, but they would not be expected to contribute appreciably to cumulative impacts on air quality, as the total storage capacity within the air quality geographic analysis area is considerably less than the existing volumes of hazardous

liquids being transported by ongoing activities and is distributed among many different locations and containers.

3.4.5.3. Conclusions

Impacts of the Proposed Action. The Proposed Action would result in a net decrease in overall emissions over the region compared to the installation of a conventional fossil-fueled power plant. Although there would be some air quality impacts due to various activities associated with construction, maintenance, and eventual decommissioning, these emissions are not expected to lead to violation of the NAAQS, New Jersey AAQS, or New York AAQS. The Proposed Action would result in air quality–related health effects avoided in the region due to the reduction in emissions associated with fossil-fueled energy generation (Table 3.4-4). **Minor** air quality impacts would be anticipated for a limited time during construction, maintenance, and decommissioning, but there would be a **minor beneficial** impact on air quality near the Wind Farm Development Area and the surrounding region overall to the extent that energy produced by the Projects would displace energy produced by fossil-fueled power plants. Empire has committed to APMs that would reduce potential impacts through complying with applicable emissions standards (APM 28 and APM 31) and fuel sulfur content standards (APM 29 and APM 30), purchase of emission-reduction credits where required (APM 27), data and information sharing with BOEM and USEPA (APM 32 and APM 33), and compliance with state regulations on engine idling (APM 34) (Appendix H, Attachment H-1). Because of the amounts of emissions, the fact that emissions are spread out in time (5 years for construction and then lesser emissions annually during operation), and the large geographic area over which they would be dispersed (throughout the 79,350-acre Lease Area and the vessel routes from the onshore facilities), air pollutant concentrations associated with the Proposed Action are not expected to exceed the NAAQS, New York AAQS, or New Jersey AAQS.

BOEM expects that the connected action alone would have **negligible to minor** impacts on air quality due to accidental releases and air pollutant emissions, because all concentrations would be well below the NAAQS and New York AAQS. Empire’s use of the SBMT marine terminal for WTG staging and as an O&M facility would have **minor** impacts on existing air quality and long-term **minor** impacts on air quality due to the increased industrial and transportation activity at SBMT, because pollutant concentrations would remain below the NAAQS and New York AAQS. Combined impacts from SBMT and Empire Wind construction on pollutants of concern for localized impacts are expected to remain below the NAAQS and New York AAQS with implementation of APMs for Empire Wind and mitigation planned by SBMT (NYCEDC 2023, Section 3.20.4.2.2.4).

Cumulative Impacts of the Proposed Action. Considering all the IPFs together, BOEM anticipates that the contribution of the Proposed Action and the connected action to the air quality impacts of ongoing and planned activities would be **minor**. The main driver for this impact rating is emissions related to construction activities increasing commercial vessel traffic, air traffic, and truck and worker vehicle traffic. Combustion emissions from construction equipment, and fugitive emissions, would be higher during overlapping construction activities but temporary in nature, as the overlap would be limited in duration. Cumulative impacts on air quality in combination with other ongoing and planned activities would likely be **moderate** due to the contribution of moderate impacts from ongoing and planned activities on air quality in the geographic analysis area, as summarized in Section 3.4.3.3. Displacement of fossil-fuel energy by wind energy would result in **moderate beneficial** impacts regionally because the magnitude of the potential reduction in emissions from displacing fossil-fuel-generated power would be small relative to total energy generation emissions in the region.

3.4.6 Impacts of Alternatives B, C, D, E, F, G, and H on Air Quality

Impacts of Alternatives B, C, D, E, F, G, and H. The air quality and climate impacts associated with all action alternatives would be similar to those of the Proposed Action, but with somewhat lower emissions

for Alternative F due to the smaller number of WTGs. Alternative F would alter the turbine array layout compared to the Proposed Action; as a result, Alternative F would allow for 138 WTGs. Each of these alternatives also would allow for installation of up to two OSS as defined in Empire's PDE.

Alternatives B, C-1, C-2, D, E, and G would have the same number of WTGs as the Proposed Action and, therefore, the same anticipated emissions from WTG construction and operation. These alternatives would have differing locations and lengths of offshore and onshore cables, and so would have different emissions associated with cable construction and installation compared to the Proposed Action. Alternative H would have the same number of WTGs and the same cable configurations as the Proposed Action but could differ in the dredging and sediment disposal methods used for construction of the EW 1 landfall in the vicinity of the SBMT, so the emissions from this construction-related activity could differ as well. Overall, the differences in emissions among the action alternatives and the Proposed Action would be relatively small, and the air quality and climate impacts from all action alternatives would be substantially the same as described for the Proposed Action.

Similarly, the quantities of coolants, oils and lubricants, and diesel fuel under the other action alternatives would be similar to those of the Proposed Action and therefore the impacts on air quality from accidental releases are expected to be similar to those of the Proposed Action.

Cumulative Impacts of Alternatives B, C, D, E, F, G, and H. In context of reasonably foreseeable environmental trends, the contributions of the action alternatives to the impacts of ongoing and planned activities would not be materially different from those described under the Proposed Action.

3.4.6.1. Conclusions

Impacts of Alternatives B, C, D, E, F, G, and H. Expected **minor** impacts associated with the Proposed Action would not change under the other action alternatives. The same construction, O&M, and decommissioning activities would still occur, albeit at slightly differing scales as identified. Alternatives B, C-1, C-2, D, E, and G would have the same number of WTGs, although with some differences in cable construction and installation, and therefore similar **minor** impacts on air quality to those of the Proposed Action. Alternative F could have slightly less, but not materially different, **minor** impacts on air quality compared to the Proposed Action due to the reduced number of WTGs. Alternative H would differ from the Proposed Action only in the dredging/disposal methods used at SBMT, and so would have similar **minor** impacts on air quality to those of the Proposed Action. As under the Proposed Action, the action alternatives would result in **minor beneficial** impacts on air quality and climate overall due to reduced emissions from fossil-fueled power plants.

Cumulative Impacts of Alternatives B, C, D, E, F, G, and H. In context of reasonably foreseeable environmental trends, the contributions of the action alternatives to the impacts of individual IPFs affecting air quality and climate from ongoing and planned activities would be the same as those of the Proposed Action. The combined air quality impacts of ongoing and planned non-offshore wind activities, offshore wind projects other than the action alternatives, and the action alternatives are expected to be **moderate**. Offshore wind projects, including the action alternatives, would result in **moderate beneficial** cumulative impacts due to reduced emissions from fossil-fueled power plants.

3.4.7 Comparison of Alternatives

This section provides a summary comparison of the anticipated impacts of ongoing activities, planned activities, the connected action, and Project impacts.

Under the No Action Alternative, air quality would continue to follow current regional trends and respond to IPFs introduced by other ongoing and planned activities. Ongoing and planned non-offshore wind activities and offshore wind activities would have continuing regional impacts primarily through air

pollutant emissions and accidental releases. Combined impacts of ongoing and planned non-offshore wind activities as well as offshore wind activities, including air pollutant emissions and GHGs, would be **moderate** because the emissions would incrementally increase ambient pollutant concentrations, though not by enough to cause a violation of the NAAQS, New Jersey AAQS, or New York AAQS. Offshore wind projects likely would lead to reduced emissions from fossil-fueled power generating facilities and consequently **minor to moderate beneficial** impacts on air quality and climate.

Under the Proposed Action, air quality impacts would occur due to emissions associated with construction, O&M, and eventual decommissioning, but these impacts are not expected to lead to violation of the NAAQS, New Jersey AAQS, or New York AAQS. Impacts would be **minor** because the emissions would incrementally increase ambient pollutant concentrations, though not by enough to cause a violation of the NAAQS, New Jersey AAQS, or New York AAQS. There would be a **minor beneficial** impact on air quality in the region overall to the extent that energy produced by the Projects would displace energy produced by fossil-fueled power plants. The Proposed Action would result in air quality–related health effects avoided in the region due to the reduction in emissions associated with fossil-fueled energy generation.

Alternative F would alter the turbine array layout compared to the Proposed Action, resulting in somewhat lower emissions due to the smaller number of WTGs. Regional benefits due to reduced emissions associated with fossil-fueled energy generation would be somewhat less for Alternative F than for the Proposed Action, based on the smaller number of WTGs.

Alternative G would have the same number of WTGs and OSS as the Proposed Action but would use a cable bridge to cross Barnums Channel. The cable bridge is included in the PDE for the Proposed Action and narrowing the PDE to a cable bridge crossing of Barnums Channel would not result in substantially different onshore construction emissions for Alternative G. O&M emissions would be the same as for the Proposed Action. Overall, impacts under Alternative G are expected to be similar to those for the Proposed Action.

Alternative H would have the same number of WTGs and OSS as the Proposed Action and the same onshore facilities. However, construction at the SBMT would use a method of dredge or fill activities that would reduce the discharge of dredged material. The proposed method for dredge and fill activities under Alternative H is included in the PDE for the Proposed Action and narrowing the PDE to a preferred method for dredging for the EW 1 landfall would not result in substantially different construction emissions. O&M emissions would be the same as for the Proposed Action. Overall, impacts under Alternative H are expected to be similar to those for the Proposed Action.

In context of other reasonably foreseeable environmental trends, and considering all the IPFs together, BOEM anticipates that the overall impacts associated with the Proposed Action when combined with the impacts from ongoing and planned activities including offshore wind would be **moderate** adverse and **moderate beneficial**. The overall adverse impact on air quality would likely be moderate because pollutant concentrations are not expected to exceed the NAAQS, New Jersey AAQS, or New York AAQS. The Proposed Action and other offshore wind projects would benefit air quality in the region surrounding the Projects to the extent that energy produced by the Projects would displace energy produced by fossil-fueled power plants. BOEM anticipates an overall **moderate beneficial** impact because the magnitude of this potential reduction would be small relative to total energy generation emissions in the area. Overall impacts with Alternatives B, C, D, E, G, and H would be similar to those with the Proposed Action. Overall impacts with Alternative F would be somewhat less than with the Proposed Action. Overall impacts with the Preferred Alternative would be similar to those with Alternative F and somewhat less than those with the Proposed Action.

3.4.8 Summary of Impacts of the Preferred Alternative

The Preferred Alternative would alter the turbine array layout compared to the Proposed Action. The air quality and climate impacts associated with the Preferred Alternative would be similar to those of the Proposed Action, but with somewhat lower emissions due to the smaller number of WTGs. The Preferred Alternative also would have different locations and lengths of offshore and onshore cables, and so would have different emissions associated with cable construction and installation compared to the Proposed Action. Overall, the differences in emissions between the Proposed Action and the Preferred Alternative would be relatively small, and the air quality and climate impacts from the Preferred Alternative would be substantially the same as described for the Proposed Action.

Similarly, the quantities of coolants, oils and lubricants, and diesel fuel under the Preferred Alternative would be similar to those of the Proposed Action but with somewhat lesser quantities due to the smaller number of WTGs. Therefore, the impacts on air quality from accidental releases are expected to be similar to those of the Proposed Action.

3.4.9 Proposed Mitigation Measures

Empire has committed to measures to avoid, minimize, and mitigate air quality impacts of the Projects. These measures include, among others, compliance with all applicable emissions and fuel-efficiency standards to minimize combustion emissions and associated air quality impacts, as discussed in Section 3.4.5. Appendix H, Attachment H-1 provides details of these measures. In addition, Empire will comply with the requirements of the OCS air permit, when issued, for emissions reduction and mitigation. The OCS air permit requirements may include emission controls that meet Best Available Control Technology or Lowest Achievable Emission Rate criteria, development of emission offsets, or other mitigation measures. No agency-proposed mitigation measures for air quality have been identified in Appendix H.

This page intentionally left blank.

3.5. Bats

This section discusses potential impacts on bat resources from the proposed Projects, alternatives, and ongoing and planned activities in the bat geographic analysis area. The bat geographic analysis area, as shown on Figure 3.5-1, includes the United States coastline from Maine to Florida, and extends 100 miles (161 kilometers) offshore and 5 miles (8 kilometers) inland to capture the movement range for species in this group.

3.5.1 Description of the Affected Environment for Bats

The number of bat species in the geographic analysis area varies by state, ranging from eight species (Rhode Island, New Hampshire, and Maine) to 17 (Virginia and North Carolina) (Rhode Island Department of Environmental Management n.d.; Maine Department of Inland Fisheries and Wildlife 2021; New Hampshire Fish and Game n.d.; Virginia Department of Wildlife Resources 2021; North Carolina Wildlife Resources Commission 2017).

There are nine species of bats present in the state of New York, eight of which may be present in the Project area and six that are year-round residents (Table 3.5-1) (Empire 2023). These species can be broken down into cave-hibernating bats and migratory tree bats based on their wintering strategy. Both groups are nocturnal insectivores that use a variety of forested and open habitats for foraging during the summer (Empire 2023 citing Barbour and Davis 1969). Cave-hibernating bats are generally not observed offshore at distances where WTGs are proposed (Empire 2023 citing Dowling and O’Dell 2018) and, in the winter, migrate from summer habitat to hibernacula in the Mid-Atlantic region (Empire 2023 citing Maslo and Leu 2013). Migratory tree bats fly to southern parts of the United States in the winter and are observed offshore during migration (Empire 2023 citing Hatch et al. 2013).

Table 3.5-1 Bats Present in New York and their Conservation Status

Common Name	Scientific Name	State Status	Federal Status
Cave-Hibernating Bats			
Eastern small-footed bat	<i>Myotis leibii</i>	SC	-
Little brown bat	<i>Myotis lucifugus</i>	SGCN	Under Review ³
Northern long-eared bat ¹	<i>Myotis septentrionalis</i>	T	T
Indiana bat ²	<i>Myotis sodalist</i>	E	E
Tri-colored bat	<i>Perimyotis subflavus</i>	SGCN	Under Review ⁴
Big brown bat	<i>Eptesicus fuscus</i>	-	-
Migratory Tree Bats			
Eastern red bat	<i>Lasiurus borealis</i>	-	-
Hoary bat	<i>Lasiurus cinereus</i>	-	-
Silver-haired bat	<i>Lasionycteris noctivagans</i>	-	-

Source: Empire 2023; USFWS 2021a, 2021b.

¹ On March 23, 2022, USFWS published a proposal to reclassify the northern long-eared bat as endangered. The U.S. District Court for the District of Columbia has ordered USFWS to complete a new final listing determination by November 2022 (Case 1:15-cv-00477, March 1, 2021).

² Range does not indicate species presence in the Project area.

³ Currently under a USFWS discretionary status review. Results of the review may be to propose listing, make a species a candidate for listing, provide notice of a not warranted candidate assessment, or other action as appropriate. USFWS anticipates a decision in Fiscal Year 2022.

⁴ Currently under 12-month finding review on a petition to list the species. If listing is warranted, USFWS would generally proceed with a concurrent proposed listing rule and proposed critical habitat. USFWS anticipates a decision in Fiscal Year 2022.

E = Endangered; SC = Special Concern; SGCN = Species of Greatest Conservation Need; T = Threatened; USFWS = U.S. Fish and Wildlife Service

There is uncertainty on the specific movements of bats offshore, but bats have been documented in the offshore marine environment, particularly during migration (Empire 2023 citing Grady and Olson 2006; Cryan and Brown 2007; Empire 2023 citing Johnson et al. 2011; Empire 2023 citing BOEM 2013; Empire 2023 citing Hatch et al. 2013; Empire 2023 citing Lagerveld et al. 2017; Empire 2023 citing Dowling and O'Dell 2018). Bats have been documented temporarily roosting on structures on nearshore islands such as lighthouses (Empire 2023 citing Dowling et al. 2017) and there is historical evidence of bats, particularly the eastern red bat, migrating offshore in the Atlantic (Empire 2023 citing Hatch et al. 2013). In a Mid-Atlantic bat acoustic study conducted during the spring and fall of 2009 and 2010, the maximum distance that bats were detected from shore was 13.6 miles (21.9 kilometers) and the mean distance was 5.2 miles (8.4 kilometers) (Empire 2023 citing Sjollema et al. 2014). In Maine, bats were detected on islands up to 25.8 miles (41.6 kilometers) from the mainland (Empire 2023 citing Peterson et al. 2014). In the Mid-Atlantic acoustic study, eastern red bat represented 78 percent of all bat detections offshore and bat activity decreased as wind increased (Empire 2023 citing Sjollema et al. 2014). In addition, eastern red bats were detected in the Mid-Atlantic up to 27.3 miles (44 kilometers) offshore by high-definition video aerial surveys (Empire 2023 citing Hatch et al. 2013).

Cave-hibernating bats hibernate regionally in caves, mines, and other structures and feed primarily on insects in terrestrial and fresh-water habitats. These species generally exhibit lower activity in the offshore environment than the migratory tree bats (Empire 2023 citing Sjollema et al. 2014), with movements primarily during the fall. In the Mid-Atlantic, the maximum distance *Myotis* bats were detected offshore was 7.2 miles (11.5 kilometers) (Empire 2023 citing Sjollema et al. 2014). A recent nano-tracking study on Martha's Vineyard recorded little brown bat movements off the island in late August and early September, with one individual flying from Martha's Vineyard to Cape Cod (Empire 2023 citing Dowling et al. 2017). Big brown bats were also detected migrating from the island later in the year (October–November) (Empire 2023 citing Dowling et al. 2017). These findings are supported by an acoustic study conducted on islands and buoys off the Gulf of Maine that indicated the greatest percentage of activity in July–October (Empire 2023 citing Peterson et al. 2014). Given that the use of the coastline as a migratory pathway by cave-hibernating bats is likely limited to their fall migration period, that acoustic studies indicate lower use of the offshore environment by cave-hibernating bats, and that cave-hibernating bats do not regularly feed on insects over the ocean, exposure to the Wind Farm Development Area is unlikely for this group.

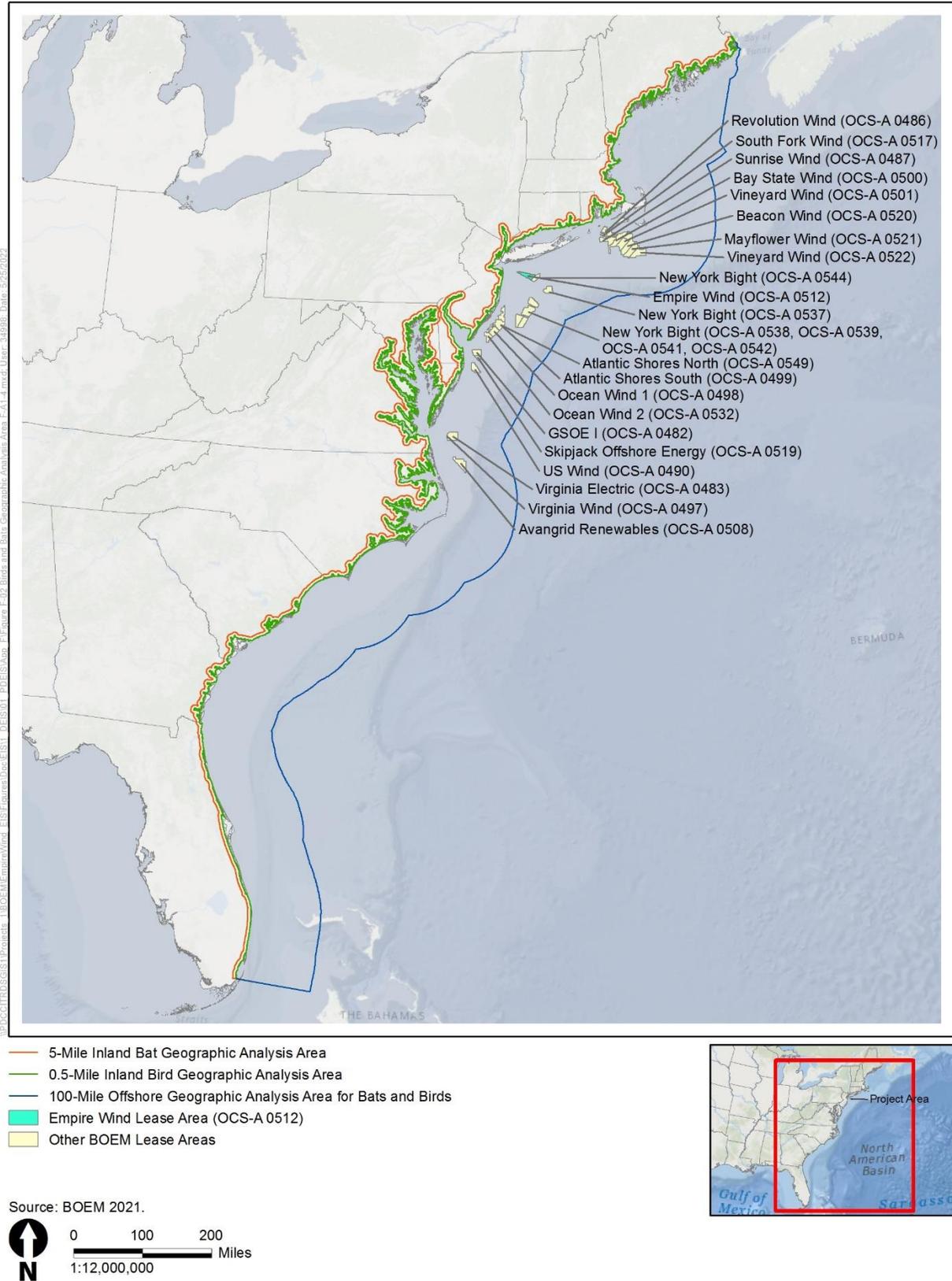


Figure 3.5-1 Bats Geographic Analysis Area

Tree bats migrate south to overwinter and have been documented in the offshore environment (Empire 2023 citing Hatch et al. 2013). Eastern red bats have been detected migrating from Martha's Vineyard late in the fall, with one bat tracked as far south as Maryland (Empire 2023 citing Dowling et al. 2017). These results are supported by historical observations of eastern red bats offshore and recent acoustic and survey results (Empire 2023 citing Hatch et al. 2013; Empire 2023 citing Peterson et al. 2014; Empire 2023 citing Sjollem et al. 2014). While little local data are available for the Project area, recent offshore acoustic surveys recorded bats within the Lease Area, with observations primarily composed of eastern red bats and silver-haired bats, concentrated during fall migration. Big brown bats were documented infrequently in the Lease Area, and hoary bats were also detected in the offshore environment, but closer to shore and not within the Lease Area. NYSERDA remote metocean data from buoys 29 miles southeast and 45 miles south-southeast of the Lease Area, respectively, detected a total of nine silver-haired bats and one unknown low-frequency bat between September 2019 and February 2022 (NYSERDA 2022). The closest buoy detected three bats in September/October 2019 and no bats for the remaining years. The other buoy detected three bats in September 2019, one bat in August 2020, and two bats in October 2020; no bats were detected in the remaining time frame. These data suggest that some tree bats are most likely to pass through the Lease Area, mainly red and silver-haired bats during the migration period (late summer/early fall) (COP Volume 3, Appendix R; Empire 2023).

Onshore coastal areas throughout the geographic analysis area provide a variety of habitats that support a diversity of bat species. The EW 1 onshore substation site and O&M facility consist primarily of highly urbanized environments and existing infrastructure with few natural habitat areas. Because the EW 1 area is highly urbanized, it is not expected to provide bat habitat. The proposed onshore export cable routes and onshore substation sites for EW 2 occur in a highly developed area bordered by commercial and residential developments. A portion of the EW 2 Onshore Substation C site is characterized by an area with trees and shrubs, which may support bats for foraging and roosting during summer, but this area is not expected to be important habitat for any species and is completely isolated by surrounding developments. The EW 2 Onshore Substation A site is previously developed and currently supports a recycling facility.

Three isolated areas along onshore export cable route segment IP-C between Long Beach Road and Daly Boulevard consist of scrub-shrub habitat with some scattered trees/woody vegetation, but are unlikely to provide important bat habitat. Forested habitats can provide roosting areas for both migratory and non-migratory species. All bat species present in New York are known to utilize forested areas of varying types during summer for roosting and foraging. Some of these species roost solely in the foliage of trees, while others select dead and dying trees where they roost in peeling bark or inside crevices. Some species may select forest interior sites, while others prefer edge habitats (Empire 2023 citing Barbour and Davis 1969). None of the bat species that occur in New York are likely to use the urbanized, developed areas within the onshore portions of the Project area. However, there is some likelihood that they could utilize the treed areas for foraging and roosting and open water areas for foraging at EW 2 during the bat active period (generally April to October).

Hibernacula are documented in New York, but the numbers of individuals at the sites have declined dramatically because of the fungal disease white-nose syndrome (WNS) (Empire 2023 citing Ingersoll et al. 2016; Empire 2023 citing NJ Division of Fish and Wildlife 2017). Since 2011, WNS has substantially reduced *Myotis* bat populations in New York (Empire 2023 citing NJ Division of Fish and Wildlife 2017). The nearest known hibernaculum to the EW 2 onshore export and interconnection cable corridor occurs approximately 75 miles (120 kilometers) to the east, in the town of East Hampton. Overall, none of potentially suitable summer habitat in the EW 2 area would be reasonably considered optimal habitat given the lack of connectivity with contiguous forest and forested wetland habitats. Therefore, the presence of both cave-hibernating and migratory tree bats that may occur in areas around EW 2 is expected to be minimal.

One bat species protected under the ESA may occur or potentially occur in the Project area: the northern long-eared bat (USFWS 2021a). Northern long-eared bats are not expected to be exposed to the Wind Farm Development Area. This is substantiated by a tracking study on Martha’s Vineyard (n = 8; July–October 2016) where no offshore movements were recorded (Empire 2023 citing Dowling et al. 2017) and by the 2018 acoustic data collected within the Lease Area (Empire 2023 citing Tetra Tech 2019). Because research on the movements of these bats in the marine environment is limited, there remains uncertainty as to whether this species travels offshore. If northern long-eared bats were to migrate over water, movements would likely be in close proximity to the mainland.

The related little brown bat has been documented to migrate from Martha’s Vineyard to Cape Cod, and northern long-eared bats may likewise migrate to mainland hibernacula from these islands in August through September (Empire 2023 citing Dowling et al. 2017). In addition, while in a different area, the Vineyard Wind 1 BA concluded that “it is extremely unlikely northern long-eared bats would traverse offshore portions” of that project (Empire 2023 citing BOEM 2019). Given that there is little evidence of use of the offshore environment by northern long-eared bat, exposure to the Wind Farm Development Area is anticipated to be minimal. None of the potentially suitable summer habitat in the EW 2 area would be reasonably considered optimal habitat for any bat species given the lack of connectivity with contiguous forest or forested wetland habitats. Maternity roosts, active detections (mist net captures and acoustic recordings), and hibernacula have been reported for northern long-eared bats in several areas of Long Island (particularly in the eastern portion), suggesting a year-round presence of northern long-eared bat. Although northern long-eared bat presence has been detected within approximately 19 miles (30 kilometers) of the EW 2 onshore substation sites, no detections have been reported within the Onshore Project area. The Empire Wind BA provides a detailed discussion of ESA-listed species and potential impacts on these species as a result of the Projects (BOEM 2022). Results of ESA consultation with USFWS are included in Section 3.5.5.3.

Cave bat species, including the northern long-eared bat, are experiencing drastic declines due to WNS. WNS has been confirmed present in every state in the geographic analysis area, except Florida (Whitenosesyndrome.org 2021). WNS was confirmed present in New York in 2006 and has killed large numbers of cave bats during hibernation—more than 90 percent at many sites (Whitenosesyndrome.org 2021). Proposed Project-related impacts have the potential to affect cave bat populations already affected by WNS. The unprecedented mortality of more than 5.5 million bats in northeastern North America as of 2015 reduces the likelihood of many individuals being present within the onshore portions of the proposed Project area (USFWS 2015). However, given the drastic reduction in cave bat populations in the region, the biological significance of mortality resulting from the proposed Projects, if any, may be increased.

3.5.2 Impact Level Definitions for Bats

Definitions of impact levels are provided in Table 3.5-2. There are no beneficial impacts on bats.

Table 3.5-2 Impact Level Definitions for Bats

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable.
Minor	Adverse	Most impacts would be avoided; if impacts occur, the loss of one or few individuals or temporary alteration of habitat could represent a minor impact, depending on the time of year and number of individuals involved.
Moderate	Adverse	Impacts are unavoidable but would not result in population-level effects or threaten overall habitat function.

Impact Level	Impact Type	Definition
Major	Adverse	Impacts would result in severe, long-term habitat or population-level effects on species.

3.5.3 Impacts of the No Action Alternative on Bats

When analyzing the impacts of the No Action Alternative on bats, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for bats. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with the other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*.

3.5.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for bats described in Section 3.5.1, *Description of the Affected Environment for Bats*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on bats are generally associated with onshore construction and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to affect bat species through temporary and permanent habitat removal and temporary noise impacts, which could cause avoidance behavior and displacement. Mortality of individual bats could occur but population-level effects would not be anticipated. Impacts associated with climate change have the potential to reduce reproductive output and increase individual mortality and disease occurrence.

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on bats include:

- Continued O&M of the Block Island project (five WTGs) installed in state waters;
- Continued O&M of the Coastal Virginia Offshore Wind project (two WTGs) installed in OCS-A 0497; and
- Ongoing construction of two offshore wind projects, the Vineyard Wind 1 project (62 WTGs and 1 OSS) in OCS-A 0501 and the South Fork project (12 WTGs and 1 OSS) in OCS-A 0517.

Ongoing O&M of the Block Island and Coastal Virginia Offshore Wind projects and ongoing construction of the Vineyard Wind 1 and South Fork projects would affect bats through the primary IPFs of noise, presence of structures, and land disturbance. Ongoing offshore wind activities would have the same type of impacts from noise, presence of structures, and land disturbance described in detail in Section 3.5.3.2 for planned offshore wind activities but the impacts would be of lower intensity.

3.5.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impact of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Other planned non-offshore wind activities that may affect bats include new submarine cables and pipelines, oil and gas activities, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures on the OCS (see Section F.2 in Appendix F for a complete

description of planned activities). These activities may result in temporary or permanent displacement and injury or mortality to individual bats, but population-level effects would not be expected. See Table F1-2 for a summary of potential impacts associated with planned non-offshore wind activities by IPF for bats.

BOEM expects planned offshore wind activities to affect bats through the following primary IPFs.

Noise: Anthropogenic noise on the OCS associated with planned offshore wind development, including noise from pile-driving and construction activities, has the potential to affect bats on the OCS. Additionally, onshore construction noise has the potential to affect bats. BOEM anticipates that these impacts would be temporary and highly localized.

In the planned activities scenario (Appendix F, *Planned Activities Scenario*), the construction of 2,803 WTGs and 66 OSS would create noise and may temporarily affect some migrating tree bats, if conducted at night during spring or fall migration. The greatest impact of noise is likely to be caused by pile-driving activities during construction. Noise from pile driving would occur during installation of foundations for offshore structures at a frequency of 4 to 6 hours at a time over an 8-year period. Construction activity would be temporary and highly localized. Auditory impacts are not expected to occur, as recent research has shown that bats may be less sensitive to TTS than other terrestrial mammals (Simmons et al. 2016). Habitat-related impacts (i.e., displacement from potentially suitable habitats) could occur as a result of construction activities, which could generate noise sufficient to cause avoidance behavior by individual migrating tree bats (Schaub et al. 2008). These impacts would likely be limited to behavioral avoidance of pile-driving or construction activity, and no temporary or permanent hearing loss would be expected (Simmons et al. 2016). However, these impacts are highly unlikely to occur, as use of the OCS by bats is limited, and only during spring and fall migration.

Some potential for temporary, localized habitat impacts arising from onshore construction noise exists; however, no auditory impacts on bats would be expected to occur. Recent literature suggests that bats are less susceptible to temporary or permanent hearing loss from exposure to intense sounds (Simmons et al. 2016). Nighttime work may be required on an as-needed basis. Some temporary displacement or avoidance of potentially suitable foraging habitat could occur, but these impacts would not be expected to be biologically significant. Some bats roosting in the vicinity of construction activities may be disturbed during construction but would be expected to move to a different roost farther from construction noise. This would not be expected to result in any impacts, as frequent roost switching is common among bats (Hann et al. 2017; Whitaker 1998).

Non-routine activities associated with the offshore wind facilities would generally require intense, temporary activity to address emergency conditions. The noise made by onshore construction equipment or offshore repair vessels could temporarily deter bats from approaching the site of a given non-routine event. Impacts on bats, if any, would be temporary and last only as long as repair or remediation activities were necessary to address these non-routine events.

Given the temporary and localized nature of potential impacts and the expected biologically insignificant response to those impacts, no individual fitness or population-level impacts would be expected to occur as a result of onshore or offshore noise associated with planned offshore wind development.

Presence of structures: Planned offshore wind-related activities would add up to 2,803 WTGs and 66 OSS to the geographic analysis area and the presence of these structures could result in potential long-term effects on bats. Cave bats (including the federally listed as threatened northern long-eared bat) do not tend to fly offshore (even during fall migration) and, therefore, exposure to construction vessels during construction or maintenance activities, or the rotor-swept zone (RSZ) of operating WTGs in the offshore wind lease areas, is expected to be negligible, if exposure occurs at all (BOEM 2015; Pelletier et al. 2013).

Tree bats, however, may pass through the offshore wind lease areas during the fall migration, with limited potential for migrating bats to encounter vessels during construction and decommissioning of WTGs, OSS, and offshore export cable corridors, although structure and vessel lights may attract bats due to increased prey abundance. As discussed above, while bats have been documented at offshore islands, relatively little bat activity has been documented in open water habitat. Several authors, such as Cryan and Barclay (2009), Cryan et al. (2014), and Kunz et al. (2007), discuss several hypotheses as to why bats may be attracted to WTGs. Many of these, including the creation of linear corridors, altered habitat conditions, or thermal inversions, would not apply to WTGs on the Atlantic OCS (Cryan and Barclay 2009; Cryan et al. 2014; Kunz et al. 2007).

Other hypotheses associated with the Atlantic OCS regarding bat attraction to WTGs include bats perceiving the WTGs as potential roosts, potentially increased prey base, visual attraction, disorientation due to EMF or decompression, or attraction due to mating strategies (Arnett et al. 2008; Cryan 2007; Kunz et al. 2007). However, no definitive answer as to why, if at all, bats are attracted to WTGs; it is possible that some bats may encounter, or perhaps be attracted to, OSS and non-operational WTG towers to opportunistically roost or forage. Bats' echolocation abilities and agility make it unlikely that these stationary objects (OSS and non-operational WTGs) or moving vessels would pose a collision risk to migrating individuals; this assumption is supported by the evidence that bat carcasses are rarely found at the bases of onshore turbine towers (Choi et al. 2020).

Tree bat species that may encounter the operating WTGs in the offshore wind lease areas include the eastern red bat, hoary bat, and silver-haired bat. Offshore O&M would present a seasonal risk factor to migratory tree bats that may utilize the offshore habitats during fall migration. While some potential exists for migrating tree bats to encounter operating WTGs during fall migration, the overall occurrence of bats on the OCS is relatively very low (Stantec 2016). Unlike with terrestrial migration routes, there are no landscape features that would concentrate bats and thereby increase exposure to the offshore wind lease areas. Given the expected infrequent and limited use of the OCS by migrating tree bats, very few individuals would be expected to encounter operating WTGs or other structures associated with planned offshore wind development. With the proposed 0.6 to 1-nm (1.9-kilometer) spacing between many structures associated with planned offshore wind development and the distribution of anticipated projects, individual bats migrating over the OCS within the RSZ of project WTGs would likely pass through projects with only slight course corrections, if any, to avoid operating WTGs because, unlike with terrestrial migration routes, there are no landscape features that would concentrate migrating tree bats and increase exposure to offshore wind lease areas on the OCS.

The potential collision risk to migrating tree bats is associated with weather conditions; specifically, bat activity is associated with relatively low wind speeds and warm temperatures (Arnett et al. 2008; Cryan and Brown 2007; Fiedler 2004; Kerns et al. 2005). Given the rarity of tree bats in the offshore environment, the WTGs being widely spaced, and the patchiness of projects, the likelihood of collisions is expected to be low. Additionally, the likelihood of a migrating individual encountering one or more operating WTGs during adverse weather conditions is extremely low, as bat activity is low during periods of strong winds, low temperatures, and rain (Arnett et al. 2008; Erickson et al. 2002).

Land disturbance: A small amount of infrequent construction impacts associated with onshore power infrastructure would be required over the next 8 years to connect planned offshore wind energy projects to the electrical grid. Typically, this would require only small amounts of habitat removal, if any, and would occur in previously disturbed areas. Short-term and long-term impacts associated with habitat loss or avoidance during construction may occur, but no injury or mortality of individuals would be expected. As such, onshore construction activities associated with planned offshore wind development would not be expected to appreciably contribute to cumulative impacts on bats.

In addition to electrical infrastructure, some amount of habitat conversion may result from port expansion activities required to meet the demands for fabrication, construction, transportation, and installation of wind energy structures. The general trend along the coastal region from Virginia to Maine is that port activity will increase modestly and require some conversion of undeveloped land to meet port demand. This conversion will result in permanent habitat loss for local bat populations. However, the incremental increase from planned offshore wind development would be a minimal contribution in the port expansion required to meet increased commercial, industrial, and recreational demand.

3.5.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, bats would continue to be affected by existing environmental trends and ongoing activities. BOEM expects ongoing activities to have continuing temporary, long-term, and permanent impacts (disturbance, displacement, injury, mortality, and habitat conversion) on bats primarily through the onshore construction impacts, the presence of structures, and climate change. Given the infrequent and limited anticipated use of the OCS by migrating tree bats during spring and fall migration, and given that cave bats do not typically occur on the OCS, ongoing offshore wind activities would not appreciably contribute to impacts on bats. Temporary disturbance and permanent loss of habitat onshore may occur as a result of offshore wind development. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects within the geographic analysis area. The No Action Alternative would result in **negligible** impacts on bats.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and bats would continue to be affected by natural and human-caused IPFs. Planned activities would contribute to the impacts on bats due to habitat loss from increased onshore construction. BOEM anticipates cumulative impacts of the No Action Alternative would likely be **negligible** because bat presence on the OCS is anticipated to be limited and onshore bat habitat impacts are expected to be minimal.

3.5.4 Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on bats:

- The onshore export cable routes, including routing variants, and extent of ground disturbance for new onshore substations, which could require the removal of trees suitable for roosting and foraging;
- The number, size, and location of WTGs; and
- The time of year during which construction occurs.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- WTG number, size, and location: The level of hazard related to WTGs is proportional to the number of WTGs installed; fewer WTGs would present less hazard to bats.
- Onshore export cable routes and substation footprints: The route chosen (including variants within the general route) and substation footprints would determine the amount of habitat affected.

- Season of construction: The active season for bats in this area is from April through October. Construction outside of this window would have a lesser impact on bats than construction during the active season.

3.5.5 Impacts of the Proposed Action on Bats

The sections below summarize the potential impacts of the Proposed Action on bats during the various phases of the proposed Projects. Routine activities would include construction, O&M, and decommissioning of the proposed Projects, as described in Chapter 2, *Alternatives Including the Proposed Action*.

Noise: Pile-driving noise and onshore and offshore construction noise associated with the Proposed Action is expected to result in temporary and highly localized impacts. Auditory impacts are not expected to occur, as recent research has shown that bats may be less sensitive to TTS than other terrestrial mammals (Simmons et al. 2016). Impacts, if any, are expected to be limited to behavioral avoidance of pile-driving or construction activity, and no temporary or permanent hearing loss would be expected (Simmons et al. 2016).

Presence of structures: The various types of impacts on bats that could result from the presence of structures, such as migration disturbance and turbine strikes, are described in detail in Section 3.5.3.2. The Proposed Action would add up to 147 WTGs and two OSS to the Lease Area where none currently exist. The structures associated with Proposed Action would remain until decommissioning of the proposed Projects is complete and could pose long-term effects on bats.

At this time, there is some uncertainty regarding the level of bat use of the OCS and the ultimate consequences of mortality, if any, associated with operating WTGs. Migratory tree bats have the potential to pass through the Lease Area, but overall a small number of bats is expected in the Lease Area given its distance from shore (Empire 2023 citing BOEM 2014). While there is evidence of bats visiting WTGs close to shore (2.5–4.3 miles [4–7 kilometers]) in the Baltic Sea (enclosed by land) (Empire 2023 citing Ahlén et al. 2009; Empire 2023 citing Rydell and Wickman 2015) and bats are demonstrated to be vulnerable to collisions, the individual bats entering the Lease Area and vulnerable to collision are expected to occur in low numbers, except possibly during late summer/fall migration.

Recent data from 3 years of post-construction monitoring around Block Island Wind Farm found relatively low numbers of bats and only during fall, and no northern long-eared bats (Stantec Consulting Services 2020). Empire would implement measures to avoid and minimize bat impacts, including conducting bat surveys (APM 75), implementing lighting restrictions (APM 76 and APM 78), reporting dead and injured bats (APM 79) to further understand the long-term effects of structures, and revegetating disturbed areas (APM 83) (Appendix H, Attachment H-2). In addition, Empire has committed to implementing a *Bird and Bat Monitoring Framework* that outlines an approach to post-construction bat monitoring that supports advancement of the understanding of bat interactions with offshore wind farms (Appendix H, Attachment H-3). Therefore, population-level impacts are unlikely given what appear to be high numbers of these species in the region relative to the low numbers likely to be affected by Project operations and the measures that would be implemented by Empire to avoid and minimize bat impacts.

Land disturbance: Impacts associated with construction of onshore elements of the Proposed Action could occur if construction activities occur during the active season (generally April through October), and may result in injury or mortality of individuals, particularly juveniles who are unable to flush from a roost, if occupied by bats at the time of removal. The primary potential effect on bats from the Projects' onshore components is localized and minor habitat modification. The majority of the proposed onshore export and interconnection cable routes are in already-disturbed urban areas (e.g., roadways). If tree cutting is required along onshore cable routes, particularly in the three isolated areas along segment IP-C

between Long Beach Road and Daly Boulevard, it would be a long-term impact but is not expected to cause loss of important habitat. Similarly, some of the scattered trees at the EW 2 Onshore Station C site could be cut, but this is not expected to cause a loss of important habitat. Any remnant habitat within the permanent substation site would be converted to developed land with landscaping for the duration of the Projects' operational lifetime, which would be considered a long-term effect. Overall, habitat loss would be limited, and any potential effects would be indirect and unlikely to affect individual or population levels of bat species.

New York State restricts tree clearing between March through November on Long Island; however, as the northern long-eared bat has not been documented at the EW 2 onshore substation sites, Empire intends to work with the applicable agencies to minimize this restriction, as appropriate. Furthermore, Empire would implement measures to avoid and minimize bat impacts, including siting onshore Project components in disturbed areas as much as practicable (APM 74), conducting acoustic bat surveys for EW 2 to establish presence or absence of bats (APM 75), implementing lighting restrictions (APM 76 and APM 78), and revegetating disturbed areas (APM 83). With the lack of suitable habitat in most of the onshore area and with Empire's commitment to implement measures to avoid and minimize bat impacts, BOEM anticipates that land disturbance would not result in individual fitness or population-level effects on bats.

Empire could leave some onshore facilities in place for future use (see COP Volume 1, Section 3.6, *Decommissioning Activities*; Empire 2023). Disturbance to the land surface or terrestrial habitat during the course of Proposed Action decommissioning would be minimal, such as disconnecting and cutting buried cables at the fence site below ground (and retiring cable in place). Therefore, onshore temporary impacts of decommissioning would be negligible.

3.5.5.1. Impact of the Connected Action

As described in Chapter 2, infrastructure improvements have been proposed at SBMT to provide the necessary structural capacity, berthing facilities, and water depths to operate as an offshore wind hub for several proposed offshore wind projects, including the Proposed Action. These improvements include in-water activities (i.e., dredging and dredged material management, replacement and strengthening of existing bulkheads, installation of new pile-supported and floating platforms, installation of new fenders), as well as some upland activities (building construction and paving). BOEM expects the connected action to affect bats through the noise IPF. Because there is no bat habitat in the vicinity of the SBMT, land disturbance and presence of structures IPFs would not pose a risk to bats.

Noise: As stated for the Proposed Action, pile-driving noise and onshore construction noise alone is expected to be temporary and highly localized. However, because there is no bat habitat in the area of the SBMT due to the highly developed nature of the area, noise impacts on bats are not anticipated. Even if a bat were flying within a distance of the SBMT where construction noise could be detected above ambient urban noise conditions, auditory impacts are not expected to occur, as recent research has shown that bats may be less sensitive to TTS than other terrestrial mammals (Simmons et al. 2016). Impacts, if any, are expected to be limited to behavioral avoidance of pile-driving or construction activity, and no temporary or permanent hearing loss would be expected (Simmons et al. 2016).

3.5.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind activities, other planned offshore wind activities, and the connected action at SBMT. Ongoing and planned non-offshore wind activities related to submarine cables and pipelines, oil and gas activities, marine minerals extraction, onshore development (including a planned substation and underground loop-in/loop-out lines for the Oceanside POI), and port expansions would contribute to impacts on bats through the primary IPFs of noise, presence of structures,

and land disturbance. Construction related to the connected action would generate temporary and localized noise impacts on bats. The construction, O&M, and decommissioning of both onshore and offshore infrastructure for offshore wind activities across the geographic analysis area would also contribute to the primary IPFs of noise, presence of structures, and land disturbance. Given the infrequent and limited anticipated use of the OCS by migrating tree bats during spring and fall migration, and given that cave bats do not typically occur on the OCS, offshore wind activities would not appreciably contribute to impacts on bats. Temporary disturbance and permanent loss of onshore habitat may occur as a result of constructing onshore infrastructure such as onshore substations and onshore export cables for offshore wind development or for connection to the existing power grid. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects within the geographic analysis area. Ongoing and planned offshore wind activities in combination with the Proposed Action would result in an estimated 3,031 WTGs, of which the Proposed Action would contribute 147 or about 5 percent.

The cumulative impacts on bats would likely be negligible because the occurrence of bats offshore is low, and onshore habitat loss is expected to be minimal. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the cumulative noise, presence of structures, and land disturbance impacts on bats.

3.5.5.3. Conclusions

Impacts of the Proposed Action. Construction and decommissioning of the Proposed Action would have **negligible** impacts on bats, especially if conducted outside the active season. The main significant risk would be from operation of the offshore WTGs and potential onshore removal of habitat, which could lead to negligible long-term impacts in the form of mortality, although BOEM anticipates this to be rare. Noise effects from construction are expected to be limited to temporary and localized behavioral avoidance that would cease once construction is complete. Similarly, the connected action is anticipated to have **negligible** impacts on bats with the potential for temporary and localized noise impacts during construction.

BOEM prepared a BA assessing the potential effects on federally listed species (BOEM 2022). Consultation with USFWS pursuant to Section 7 of the ESA was concluded June 22, 2023. In USFWS's transmittal letter for the Biological Opinion, USFWS concurred with BOEM's determination of not likely to adversely affect for the northern long-eared bat (*Myotis septentrionalis*; endangered) and the tri-colored bat (*Perimyotis subflavus*; proposed endangered) (USFWS 2023).

Cumulative Impacts of the Proposed Action. BOEM anticipates that the cumulative impacts on bats in the geographic analysis area would be **negligible**. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the cumulative impacts on bats would be undetectable. Because the occurrence of bats offshore is low, the Proposed Action would contribute to the cumulative impacts primarily through the long-term impacts from onshore habitat loss related to the EW 2 Onshore Station C site and cable route that would cross three isolated habitat areas.

3.5.6 Impacts of Alternatives B, E, and F on Bats

Impacts of Alternatives B, E, and F. Alternatives B and E would alter the turbine array layout compared to the Proposed Action; however, each of these alternatives would allow for installation of up to 147 WTGs as defined in Empire's PDE. Under Alternative F, a maximum of 138 WTGs could be constructed, compared to up to 147 WTGs under the Proposed Action (reduction of 9 WTGs). The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Projects under Alternatives B and E would be the same as those described under the Proposed Action because these alternatives allow for the same number of WTGs to be constructed throughout the Lease

Area. While up to nine WTGs may be removed from the Lease Area under Alternative F, impacts on bats would not materially change compared to the Proposed Action. All other offshore and onshore Project components of Alternatives B, E, and F would be the same as under the Proposed Action.

Cumulative Impacts of Alternatives B, E, and F. The cumulative impacts on bats would likely be negligible for the same reasons described for the Proposed Action (i.e., bat presence offshore is low and onshore habitat loss would be minimal). In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B, E, and F to the cumulative impacts on bats would be similar to those of the Proposed Action.

3.5.6.1. Conclusions

Impacts of Alternatives B, E, and F. As discussed above, the expected **negligible** impacts associated with the Proposed Action would not change under Alternative B, E, or F.

Cumulative Impacts of Alternatives B, E, and F. Because the impact determination for the Proposed Action would not change under Alternatives B, E, and F, BOEM anticipates that the cumulative impacts of Alternatives B, E, and F would be the same as described for the Proposed Action: **negligible**. Like the Proposed Action, because the occurrence of bats offshore is low, Alternatives B, E, and F would contribute to the overall impact rating primarily through the long-term impacts from onshore habitat loss related to the EW 2 Onshore Station C site and cable route that would cross three small, isolated habitat areas.

3.5.7 Impacts of Alternative C, D, and G on Bats

Impacts of Alternatives C, D, and G. The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Projects under Alternative C, D, or G would be the same those described under the Proposed Action. Submarine and onshore cable route options around the Gravesend Anchorage (Alternative C-1) and the Ambrose Navigation Channel (Alternative C-2), to avoid the sand borrow area (Alternative D), or to use a cable bridge to cross Barnums Channel (Alternative G) are already covered under the Proposed Action as part of the PDE approach, and narrowing the submarine and onshore cable route options under Alternative C, D, or G would not materially change the analyses of any IPF. All other offshore and onshore Project components would be the same as under the Proposed Action.

Cumulative Impacts of Alternatives C, D, and G. The cumulative impacts on bats would likely be negligible because the occurrence of bats offshore is low, and onshore habitat loss is expected to be minimal. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative C, D, or G to the cumulative impacts on bats would be the same as those of the Proposed Action.

3.5.7.1. Conclusions

Impacts of Alternatives C, D, and G. As discussed above, the expected **negligible** impacts associated with the Proposed Action would not change under Alternative C, D, or G.

Cumulative Impacts of Alternatives C, D, and G. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative C, D, or G to the cumulative impacts on bats would be undetectable. Because the impacts of the Proposed Action would not change under Alternatives C, D, and G, BOEM anticipates that the cumulative impacts of Alternatives C, D, and G would be the same as described for the Proposed Action: **negligible**. Like the Proposed Action, because the occurrence of bats offshore is low, Alternatives C, D, and G would contribute to the cumulative impact rating

primarily through the long-term impacts from onshore habitat loss related to the EW 2 Onshore Station C site and cable route that would cross three small, isolated habitat areas.

3.5.8 Impacts of Alternative H on Bats

Impacts of Alternative H. The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Projects under Alternative H would be the same those described under the Proposed Action. An alternate method of dredge and fill activity at the SBMT would not materially change the analysis of any IPF, as the Onshore Project area is heavily developed with no natural bat habitat. BOEM does not anticipate that any change in dredge and fill activity would affect undisturbed or natural areas. All other offshore and onshore Project components of Alternative H would be the same as under the Proposed Action.

Cumulative Impacts of Alternative H. The cumulative impacts on bats would likely be negligible because the occurrence of bats offshore is low, and onshore habitat loss is expected to be minimal. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative H to cumulative impacts would be the same as described under the Proposed Action.

3.5.8.1. Conclusions

Impacts of Alternative H. As discussed above, the expected **negligible** impacts associated with the Proposed Action would not change under Alternative H.

Cumulative Impacts of Alternative H. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative H to cumulative impacts on bats would be undetectable. Because the impacts of the Proposed Action would not change under Alternative H, BOEM anticipates that the cumulative impacts of Alternative H would be the same as described for the Proposed Action: **negligible**. Like the Proposed Action, because the occurrence of bats offshore is low, Alternative H would contribute to the cumulative impact rating primarily through the long-term impacts from onshore habitat loss related to the EW 2 Onshore Station C site and cable route that would cross three small, isolated habitat areas.

3.5.9 Comparison of Alternatives

Alternatives B and E would modify the turbine array layout while Alternative F would have up to nine fewer WTGs compared to the Proposed Action, which would result in similar impacts on bats; the overall impact level would not change—**negligible**.

Alternative C, D, or G would not materially change the analysis compared to the Proposed Action because the cable route options that would be constructed under these alternatives are already covered under the Proposed Action as part of the PDE approach. Therefore, the overall impact level on bats would not change—**negligible**.

Under Alternative H, an alternative method of dredge and fill activity would occur in waters around the SBMT, which would not materially change the analysis of any IPF compared to the Proposed Action because the Onshore Project area is heavily developed with no bat habitat. Therefore, the overall impact level on bats would not change—**negligible**.

In context of reasonably foreseeable environmental trends, the cumulative impacts associated with Alternatives B, C, D, E, F, G, and H when each is combined with the impacts from ongoing and planned activities would be the same as for the Proposed Action—**negligible**.

As with the Proposed Action, construction, O&M, and decommissioning of the Preferred Action would have **negligible** impacts on bats, especially if conducted outside the active season, due to their low occurrence offshore.

3.5.10 Summary of Impacts of the Preferred Alternative

The Preferred Alternative is a combination of Alternatives C-1, D, F, G, and H. Therefore, the EW 1 submarine export cable route would traverse the Gravesend Anchorage Area (USCG Anchorage #25); EW 2 cable route options would avoid impacts within 500 meters of the sand borrow area offshore Long Island; the wind turbine layout would be optimized to maximize annual energy production and minimize wake loss while addressing the presence of glauconite deposits across the Lease Area; the EW 2 export cable route would use an above-water cable bridge to construct the onshore export cable crossing at Barnums Channel; and the construction of the EW 1 export cable landfall would use a method of dredge or fill activities (clamshell dredging with environmental bucket) that would reduce the discharge of dredged material compared to other dredging options considered in the Empire Wind PDE. Under the Preferred Alternative, the Lease Area would contain 138 WTGs, which is 9 WTGs (6 percent) fewer than the number of WTGs for the maximum-case scenario under Alternative A. The Preferred Alternative would result in fewer WTGs, and the potential for wider space between WTGs may allow greater opportunity for migrating tree bats (if present) to avoid WTGs. Changes to the export cable routes under the Preferred Alternative would not materially change the analyses of any IPF as compared to the Proposed Action.

As with the Proposed Action, construction, O&M, and decommissioning of the Preferred Alternative would have **negligible** impacts on bats, especially if conducted outside the active season, due to their low occurrence offshore. The most significant risks would be from operation of the offshore WTGs and potential onshore removal of habitat, which could lead to negligible long-term impacts in the form of mortality, although BOEM anticipates this to be rare.

3.5.11 Proposed Mitigation Measures

The mitigation measures listed in Table 3.5-3 are recommended for inclusion in the Preferred Alternative.

Table 3.5-3 Proposed Measures: Bats

Measure	Description	Effect
Adaptive mitigation for birds and bats	If the reported post-construction bird and bat monitoring results (generated as part of Empire's <i>Bird and Bat Monitoring Framework</i> (Appendix H, Attachment H-3) indicate bird and bat impacts deviate substantially from the impact analysis included in this EIS, then Empire must make recommendations for new mitigation measures or monitoring methods.	Adaptive management for bats would likely result in reduced potential impacts on bats on the OCS during operations. Should post-constructing monitoring show impacts on bats deviate substantially from the impact analysis in the EIS, measures would be implemented to address the specific impact reported.

Measure	Description	Effect
Annual Reporting	Annual Bird and Bat Mortality Reporting during construction and operation, and decommissioning. The Lessee must submit an annual report covering each calendar year, due by January 31 of the following year, documenting any dead (or injured) birds or bats found on vessels and structures during construction, operations, and decommissioning. The report must be submitted to BOEM (at renewable_reporting@boem.gov) and BSEE (at OSWSubmittals@bsee.gov) and USFWS. The report must contain the following information: the name of species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with Federal or research bands must be reported to the United States Geological Survey Bird Band Laboratory.	Annual bat mortality reporting can inform the Avian and Bat Post-Construction Monitoring Plan (see previous measure), which could lead to Empire recommending new mitigation measures or monitoring methods to reduce impacts on bats. In addition, mortality data can inform future BOEM offshore wind EIS analyses for proposed wind farms on the Atlantic OCS.
Reporting	Any occurrence of dead ESA birds or bats must be reported to BOEM, BSEE, and USFWS as soon as practicable (taking into account crew and vessel safety) after the sighting, and if practicable, carefully collect the dead specimen and preserve the material in the best possible state.	Annual bat mortality reporting can inform the Avian and Bat Post-Construction Monitoring Plan (see previous measure), which could lead to Empire recommending new mitigation measures or monitoring methods to reduce impacts on bats. In addition, mortality data can inform future BOEM offshore wind EIS analyses for proposed wind farms on the Atlantic OCS.
Adaptive Mitigation for Birds and Bats ¹	BOEM will require that Empire Wind develops and implements a Post-Construction Monitoring [PCM] plan based on the “Empire Offshore Wind Projects (EW 1 and EW 2): Proposed Bird and Bat Monitoring Framework” in coordination with USFWS and other relevant regulatory agencies. Annual monitoring reports will be used to determine the need for adjustments to monitoring approaches, consideration of new monitoring technologies, and/or additional periods of monitoring (see Appendix H, Table H-1 for more detail).	If the reported post-construction bat monitoring results (generated as part of Empire’s <i>Bird and Bat Monitoring Framework</i> [Appendix H, Attachment H-3]) indicate bat impacts deviate substantially from the impact analysis included in this EIS, then Empire must make recommendations for new mitigation measures or monitoring methods to reduce impacts.

Measure	Description	Effect
Reporting ¹	Empire Wind must provide an annual report to BOEM and USFWS documenting any dead (or injured) birds or bats found on vessels and structures during construction, operations, and decommissioning. The report must contain the following information: the name of species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with federal or research bands must be reported to the United States Geological Survey Bird Band Laboratory, available at https://www.pwrc.usgs.gov/bbl/ . Any occurrence of a dead ESA-listed bird or bat must be reported to BOEM, BSEE, and USFWS as soon as practicable (taking into account crew and vessel safety) after the sighting, and, if practicable, the dead specimen will be carefully collected and preserved in the best possible state.	Annual bat mortality reporting can inform the Avian and Bat Post-Construction Monitoring Plan (see previous measure), which could lead to Empire recommending new mitigation measures or monitoring methods to reduce impacts on bats. In addition, mortality data can inform future BOEM offshore wind EIS analyses for proposed wind farms on the Atlantic OCS.

¹ These two measures are a result of BOEM's ESA Section 7 consultation with USFWS and are listed in BOEM's BA for species under USFWS jurisdiction. They are similar to the first two measures that were developed for the EIS, but worded slightly differently; however, they are not materially different.

3.5.11.1. Effect of Measures Incorporated into the Preferred Alternative

The mitigation measures listed in Table 3.5-3 are recommended for inclusion in the Preferred Alternative. These measures would further define how the effectiveness and enforcement of APMs would be ensured and improve accountability for compliance with APMs by requiring monitoring, reporting, and adaptive management of potential bat impacts on the OCS. However, given bat use of the OCS is anticipated to be low, offshore wind activities are unlikely to appreciably contribute to impacts on bats regardless of measures intended to address potential offshore impacts on bats. In the onshore environment, conducting surveys and coordinating with BOEM, BSEE, and USFWS and implementing species- and habitat-avoidance measures would ensure impacts on bats and their habitats would be avoided and minimized to the extent practicable. Because these measures monitor the effectiveness of and compliance with APMs that are already analyzed as part of the Proposed Action and other action alternatives, implementation of these measures would not further reduce the impact level of the Preferred Alternative from what is described in Section 3.5.10, *Summary of Impacts of the Preferred Alternative*.

This page intentionally left blank.

3.7. Birds

This section discusses potential impacts on bird resources from the proposed Projects, alternatives, and ongoing and planned activities in the geographic analysis area for birds. The geographic analysis area for birds, as shown on Figure 3.7-1, includes the United States coastline from Maine to Florida; the offshore limit is 100 miles (161 kilometers) from the Atlantic shore and the onshore limit is 0.5 mile (0.8 kilometer) inland.

3.7.1 Description of the Affected Environment for Birds

This section discusses bird species that use onshore and offshore habitats, including both resident bird species that use the proposed Project area during all (or portions of) the year and migrating bird species with the potential to pass through the proposed Project area during fall or spring migration. Detailed information regarding habitats and bird species potentially present can be found in the COP Volume 2, Section 5.3, Appendix P, and Appendix Q (Empire 2023). Given the differences in life history characteristics and habitat use between offshore and onshore birds, the sections below provide a discussion of each group. This section also discusses bald and golden eagles. This section addresses federally listed threatened and endangered birds; BOEM prepared a BA for the USFWS analyzing the effects of the Projects on listed species per ESA Section 7 requirements (BOEM 2022). Results of ESA consultation with USFWS are presented in Section 3.7.5.3.

The Mid-Atlantic Coast plays an important role in the ecology of many bird species. The Atlantic Flyway is one of four major North American north-south migration routes for many species of seabirds, shorebirds, waterfowl, raptors, and songbirds. The Atlantic Flyway is along the eastern coast of North America, which includes several states and Canadian provinces that span the route from Canada to South America and the Caribbean. Coastal and marine environments along the Atlantic Flyway provide important habitat and food resources for hundreds of avian species at stopover sites, breeding locations, and wintering areas. Migrant terrestrial species may follow the coastline during migration or choose more direct flight routes over expanses of open water. Many marine birds also make annual migrations up and down the eastern seaboard (e.g., gannets, loons, and seaducks). Chapter 4.2.4 of the Atlantic OCS Proposed Geological and Geophysical Activities Programmatic EIS (BOEM 2014a) discusses the use of Atlantic Coast habitats by migrating birds.

Birds in the geographic analysis area are subject to pressure from ongoing activities, such as onshore construction, marine minerals extraction, port expansions, and installation of new structures in the OCS, but particularly from accidental releases; new cable, transmission line, and pipeline emplacement; interactions with fisheries and fishing gear; and climate change. More than one-third of bird species that occur in North America (37 percent, 432 species) are at risk of extinction unless significant conservation actions are taken (NABCI 2016). BOEM assumes that the North American Bird Conservation Initiative's (NABCI) 2016 estimate is true for the condition of birds in the geographic analysis area. This is likely representative of the conditions of birds within the geographic analysis area. The Northeastern United States is also home to more than one-third of the human population of the nation. As a result, species that live or migrate through the Atlantic Flyway have historically been, and will continue to be, subject to a variety of ongoing anthropogenic stressors, including hunting pressure (approximately 86,000 seaducks harvested annually [Roberts 2019]), commercial fisheries by-catch (approximately 2,600 seabirds are killed annually on the Atlantic [Hatch 2017; Sigourney et al. 2019]; recent estimates for long lines is 3,066 [Bi et al. 2021]), and climate change, which have the potential to have adverse impacts on bird species.

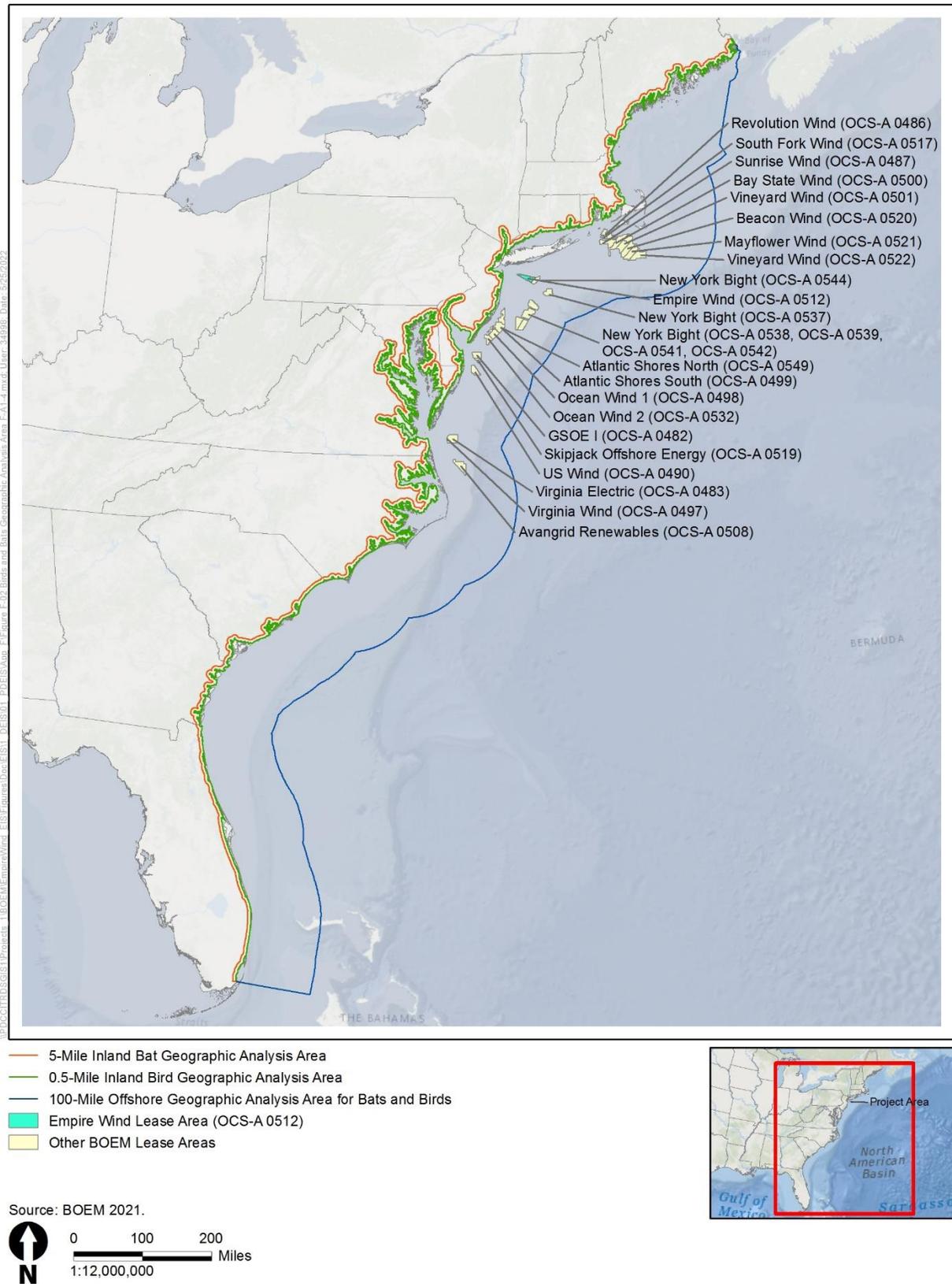


Figure 3.7-1 Birds Geographic Analysis Area

According to NABCI, more than half of the offshore Atlantic bird species (57 percent, 31 species) have been placed on the NABCI watch list as a result of small ranges, small and declining populations, and threats to required habitats. This watch list identified species of high conservation concern based upon high vulnerability to a variety of factors, including population size, breeding distribution, non-breeding distribution, threats to breeding, threats to non-breeding, and population trend (NABCI 2016). Globally, monitored offshore bird populations have declined by nearly 70 percent from 1950 to 2010, which may be representative of the overall population trend of seabirds (Paleczny et al. 2015) including those that forage, breed, and migrate over the Atlantic OCS. Overall, offshore bird populations are decreasing; however, considerable differences in population trajectories of offshore bird families have been documented.

Birds that nest in coastal marshes and other low-elevation habitats are vulnerable to sea-level rise and the increasing frequency of strong storms as a result of global climate change. According to NABCI, nearly 40 percent of the more than 100 bird species that rely on coastal habitats for breeding or for migration are on the NABCI watch list. Many of these coastal species have small population size or restricted distributions, making them especially vulnerable to habitat loss or degradation and other stressors (NABCI 2016). Models of vulnerability to climate change estimate that, throughout New York, 48 percent of New York's 280 bird species are vulnerable to climate change across all seasons (Audubon 2019), some of which occur in the geographic analysis area. A rapidly changing climate could lead to population declines if species are not able to adapt. In addition, the reshuffling of bird communities at a continental scale will bring together species that previously lived in isolation, leading to unpredictable interactions. Disruptions in food and nesting resources would further compound vulnerabilities to climate change. These ongoing impacts on birds would continue regardless of the offshore wind industry.

A broad group of avian species has been documented in or may pass through the Lease Area, including migrants (such as raptors and songbirds), coastal birds (such as shorebirds, waterfowl, and waders), and marine birds (such as seabirds and seaducks). The Lease Area is within the New York Bight, which is part of the larger Mid-Atlantic Bight. The Mid-Atlantic Bight supports a high diversity of marine birds and is an ecologically important area for birds due to its central location in a major migratory flyway. Approximately 61 bird species have been identified as occurring in the Offshore Project area through public databases and Project-associated baseline studies (see Table 2-9 in COP Appendix Q; Empire 2023). Of these 61 species, four are state-listed as threatened or endangered (black tern, least tern, common tern, roseate tern) and one is federally listed as endangered (roseate tern). Two additional federally and state-listed birds have the potential to occur in the Offshore Project area: the piping plover (state listed as endangered, federally listed as threatened) and red knot (state- and federally listed as threatened).

The Lease Area is within the Atlantic Flyway, which, as mentioned above, is one of four major North American north-south migration routes for many species of seabirds, shorebirds, waterfowl, raptors, and songbirds. Many marine birds also make annual migrations up and down the eastern seaboard (e.g., gannets, loons, and seaducks), taking them directly through the New York Bight region in spring and fall.

The New York Bight supports large populations of birds in summer, some of which breed in the area, such as gulls and terns. Other summer residents, such as shearwaters and storm-petrels, migrate from the Southern Hemisphere (where they breed during the austral summer). In the fall, many of the summer residents leave the area and migrate south to warmer regions, while species that breed farther north migrate south and spend winter in the Mid-Atlantic region. This results in a complex ecosystem where the community composition shifts regularly, and temporal and geographic patterns are highly variable (Empire 2023).

Table 3.7-1 briefly summarizes the bird presence in the Offshore Project area by bird group based on information in the *Avian Impact Assessment* conducted for the Projects (see COP Appendix Q; Empire

2023). The table breaks down birds into six groups—shorebirds, wading birds, raptors, songbirds, coastal waterbirds, and marine birds—that coincide with the *Avian Impact Assessment* bird groupings. Marine birds are further broken down by family group. The *Avian Impact Assessment* evaluates baseline conditions for birds in the onshore and offshore portions of the Projects by documenting which species are likely to occur in the Project area, based on the best available data. It then evaluates the risk of the impact of Project construction, operations, and decommissioning activities on those species likely to occur based on their habitat requirements, behavior, seasonal use of the Project area, and potential sensitivity to each Project activity. Additional Project-specific bird survey information, which is incorporated into the *Avian Impact Assessment*, can be found in the *Ornithological and Marine Fauna Aerial Survey* conducted for the Projects (COP Appendix P; Empire 2023).

Table 3.7-1 Bird Presence in the Offshore Project Area by Bird Group

Bird Group	Potential Bird Presence in Offshore Project Area
Shorebirds	Shorebirds (e.g., black-bellied plover, semipalmated plover) are typically coastal breeders and foragers and generally avoid straying out over deep waters during breeding. Of the shorebirds that range into and migrate through the Offshore Project area, only red phalarope and red-necked phalarope are generally considered marine species, meaning that they swim and forage in offshore marine waters. Red phalaropes are also known to regularly winter in Atlantic waters just south of the Offshore Project area. Primarily, exposure of shorebirds to the offshore infrastructure would be limited to the spring and fall migration periods
Wading Birds	Most long-legged wading birds, such as herons and egrets, breed and migrate in coastal and inland areas. Like the smaller shorebirds, wading birds are believed to avoid straying out over deep waters (Kushlan and Hafner 2000), but may traverse the Lease Area during spring and fall migration periods. The USFWS IPaC database does not indicate any wading birds in the Lease Area or adjacent waters that are identified as vulnerable or Birds of Conservation Concern, and digital aerial surveys and site-specific surveys conducted by Empire (see COP Appendix P) showed no wading birds within the Lease Area (see maps in COP Appendix Q).
Raptors	The degree to which raptors might occur offshore is dictated primarily by their morphology and flight strategy (i.e., flapping versus soaring), which influences species' ability or willingness to cross large expanses of open water where thermal formation is poor (Kerlinger 1985). Among raptors, falcons are the most likely to be encountered in offshore settings along the Atlantic flyway (Cochran 1985; DeSorbo et al. 2012, 2018). Merlins are the most abundant diurnal raptor observed at offshore islands during migration. Both have been observed offshore on vessels and offshore oil platforms considerable distances from shore. Therefore, these raptors are considered to be the most likely to pass through the Lease Area during migration.

Bird Group	Potential Bird Presence in Offshore Project Area
Songbirds	<p>Songbirds (e.g., warblers, sparrows) almost exclusively use terrestrial, freshwater, and coastal habitats and do not use the offshore marine system except during migration. Many North American breeding songbirds migrate to the tropical regions, many in flocks. On their migrations, neotropical migrants generally travel at night and at high altitudes where favorable winds can aid them along their trip. Songbirds regularly cross large bodies of water (Bruderer and Lietchi 1999; Gauthreaux and Belser 1999), and there is some evidence that species migrate over the northern Atlantic (Adams et al. 2015). Some birds may briefly fly over the water while others, like the blackpoll warbler, are known to migrate over vast expanses of ocean (Faaborg et al. 2010; DeLuca et al. 2015). Evidence for a variety of species suggests that overwater migration in the Atlantic is much more common in fall (than in spring), when the frequency of overwater flights increases perhaps due to consistent tailwinds (Morris et al. 1994; Hatch et al. 2013; Adams et al. 2015; DeLuca et al. 2015). Based on the <i>Avian Impact Assessment</i> for the Projects (COP Appendix Q), the exposure of songbirds to the Lease Area would be minimal to low and limited to the months of migration.</p>
Coastal Waterbirds	<p>Coastal waterbirds use terrestrial or coastal wetland habitats and rarely use the marine offshore environment. This group includes aquatic species not captured in other groupings, such as grebes and waterfowl, that are generally restricted to freshwater or use saltmarshes or beaches. Waterfowl comprise a broad group of geese and ducks, most of which spend much of the year in terrestrial or coastal wetland habitats. The diving ducks generally winter on open freshwater, as well as brackish or saltwater. Species that regularly winter on saltwater, including mergansers, scaup, and goldeneyes, usually restrict their distributions to shallow, very nearshore waters. Because most coastal waterbirds spend a majority of the year in freshwater aquatic systems and nearshore marine systems, there is little to no use of the Lease Area during any season. A subset of diving ducks has a strong affinity for saltwater, either year-round or outside of the breeding season; these species are known as seaducks. Seaducks are discussed below in the marine bird section.</p>
Marine Birds (by family group)	
Loons	<p>Common loons and red-throated loons are known to use the Atlantic OCS in winter. Analysis of satellite-tracked red-throated loons, captured and tagged in the Mid-Atlantic area, found their winter distributions to be largely inshore of the Mid-Atlantic WEAs, although they did overlap with the Lease Area during spring migration (Gray et al. 2016). The digital aerial surveys and MDAT models show lower use of the Lease Area by loons in the summer than in other seasons.</p>
Seaducks	<p>The seaducks (e.g., black scoter, surf scoter, common eider) use the Atlantic OCS heavily in winter. Most of these seaducks dive to forage on mussels and other benthic invertebrates, and generally winter in shallower inshore waters or out over large offshore shoals, where they can access benthic prey. Seaducks tracked with satellite transmitters remained largely inshore of the Lease Area, with exception of surf scoter and black scoter during spring migration (Spiegel et al. 2017). Based on the <i>Avian Impact Assessment</i> (COP Appendix Q), including digital aerial survey data and MDAT models, seaduck exposure to the Projects is expected to be minimal and would be primarily limited to migration or travel between wintering sites.</p>

Bird Group	Potential Bird Presence in Offshore Project Area
Petrel group	In the Atlantic, this group consists mostly of shearwaters (e.g., Cory's shearwater, great shearwater, sooty shearwater) and storm-petrels (e.g., leach's storm-petrel, Wilson's storm-petrel) that breed in the southern hemisphere and visit the northern hemisphere in vast numbers during the austral winter (boreal summer) and may pass through the Lease Area. These species use the Atlantic OCS region so heavily that, in terms of sheer numbers, they easily outnumber the locally breeding species and year-round residents at this time of year. Several of the species (e.g., Cory's shearwater, Wilson's storm-petrel) are found in high densities across the broader region, concentrating beyond the Atlantic OCS and in the Gulf of Maine as shown in the MDAT avian abundance models.
Gannets, Cormorants, and Pelicans	Northern gannets use the Atlantic OCS during winter and migration. They are opportunistic foragers, capable of long-distance oceanic movements, and may pass through the Lease Area regularly during the non-breeding period. The double-crested cormorant is the most likely species of cormorant exposed to the Lease Area, but regional MDAT abundance models show that cormorants are concentrated closer to shore and not commonly encountered well offshore (Curtice et al. 2016; Winship et al. 2018), and few cormorants were observed during digital aerial surveys. Brown pelicans are rare in the area, as only one was detected during project-specific surveys (COP Appendix P) and New Jersey is at the northern extent of its range; therefore, they are unlikely to pass through the Lease Area in any numbers.
Gulls, skuas, and jaegers	14 species of gulls, skuas, and jaegers were observed in digital aerial surveys in the Lease Area (COP Appendices P and Q). The regional MDAT abundance models show that these birds have wide distributions, ranging from near shore (gulls) to offshore (jaegers). Herring gulls and great black-backed gulls are resident in the region year-round, and are found farther offshore during the non-breeding season. The parasitic jaeger is often observed closer to shore during migration than the other species and great skuas may migrate along the Atlantic OCS outside the breeding season.
Terns	During Project-specific surveys (COP Appendix P), Black tern, least tern, common tern, Forster's tern, roseate tern, and royal tern have been observed in the Lease Area; least tern, common tern, and unidentified tern were identified with in the Lease Area in the spring. Terns generally restrict themselves to coastal waters during breeding, although they may pass through the Lease Area during migration. Roseate terns are federally listed.
Auks	Auk species present in the Project area are generally northern or Arctic-breeders that winter along the Atlantic OCS (e.g., common murre, dovekie, razorbill). The annual abundance and distribution of auks along the eastern seaboard in winter is erratic, and is dependent upon broad climatic conditions and the availability of prey. The MDAT abundance models show that during winter auks are generally concentrated offshore, along the shelf edge, and southwest of Nova Scotia.

Sources: Empire 2023; USFWS 2021a.

IPaC = Information for Planning and Consultation; MDAT = Marine-life Data and Analysis Team

Habitats within and in the vicinity of the EW 1 Onshore Project area are significantly altered by human development and are primarily used for industrial and commercial operations (see Figure 5.3-5 in COP Volume 2b, *Biological Resources*; Empire 2023). The EW 1 area and surrounding vicinity serve as a transportation and service corridor and associated infrastructure is a dominant feature. The SBMT is dominated by a paved lot and warehouse buildings, with over 95 percent impervious surfaces; vegetation is limited to volunteer invasives and a line of poplar trees on the north side of the 35th Street Pier

(NYCEDC 2023). Due to the mobility of birds, a variety of species have the potential to pass through the EW 1 Onshore Project area. However, due to the highly developed nature of the EW 1 Onshore Project area, the area does not provide important bird habitat for native species or species of conservation concern, with the exception of species that associate with coastal urbanized areas (e.g., pigeons, seagulls, European starlings). A bird survey conducted from August to October 2020 identified approximately 50 bird species in and around the SBMT, none of which were federally listed threatened or endangered species (NYCEDC 2023). A low number of four state special status birds were observed, including common tern (state-listed as threatened), osprey (state species of special concern), American black duck (high-priority species), and peregrine falcon (state-listed as endangered). Overall, the Onshore Project area has low value to these species due to the low resource levels, high levels of disturbance, and overall low-quality habitat for nesting, roosting, and foraging (NYCEDC 2023). The nearest Audubon Important Bird Area (IBA) is approximately 1.5 miles (2.4 kilometers) east of EW 1. This IBA (Prospect Park) supports a high diversity of migrant songbirds and is thought to be an important migratory stopover site for land birds (see Figure 5.3-5 in COP Volume 2b, *Biological Resources*; Empire 2023). The complete list of birds identified within 15 kilometers of the EW 1 onshore site is found in COP Appendix Q, Table 3-7 (Empire 2023).

Habitats within and in the vicinity of the EW 2 Onshore Project area are significantly altered by human development (see Figure 5.3-6 in COP Volume 2b, *Biological Resources*; Empire 2023). Natural habitat is minimal, as the landscape is highly characterized by residential and commercial development and only provides edge habitat for common urban birds. This area serves as a transportation and service corridor and associated infrastructure is a dominant feature. EW 2 Onshore Substation C is composed of several active commercial properties with approximately 70 percent of the site devoid of vegetation and includes commercial buildings, supporting ancillary appurtenances, roads, and gravel parking areas. The remaining 30 percent of the site consists of vegetated perimeters (some trees and shrubs) of parking lots and an approximately 1-acre area that has been routinely disturbed with land clearing and soil disturbance. The undeveloped areas of the EW 2 Onshore Substation C site may have the potential to provide some habitat for certain urban bird species, but this area is not expected to be important habitat for any species and is completely isolated by surrounding developments. The EW 2 Onshore Substation A site is previously developed and currently supports a recycling facility. There is some beach and dune habitat along shoreline that is developed for tourism and recreational use. Long Beach is sandy with no vegetation and could provide foraging habitat for common marine bird species (e.g., gulls), while Lido Beach includes vegetated dunes that provide nesting habitat to various coastal nesting species. The landfall sites are in a paved parking area site, directly adjacent to commercial areas and existing roadways. The EW 2 Onshore Project area is surrounded by the West Hempstead Bay/Jones Beach West IBA (a global IBA), which includes most of the beach areas and inland waterways around the EW 2 Onshore Project area (see Figure 3-2 in COP Appendix Q; Empire 2023). This IBA has over 60 recorded species known to occur, with known breeding of the piping plover and short-eared owl. Outside of the beach areas, the IBA does not include the islands of Long Beach and Island Park, however. Because the EW 2 Onshore Project area is highly developed, the birds most likely to be present in the EW 2 Onshore Project area are common coastal, urban (some introduced), and upland species. The birds most likely to be exposed to the Project activities at EW 2 Landfall A, EW 2 Landfall B, and EW 2 Landfall E sites include gulls, geese, dabbling ducks, and cormorants, while some coastal nesting species may be exposed at the EW 2 Landfall C site. Upland species are likely to include European starling, house sparrow, song sparrow, and mockingbird.

The complete list of birds identified within 15 kilometers of the EW 2 Onshore Project area is found in COP Appendix Q, Table 3-7 (Empire 2023) and includes species listed by the federal government as endangered, threatened, and birds of conservation concern and by the state of New York as endangered, threatened, or special concern. In the eBird database there are 23 species listed as high-priority Species of

Greatest Conservation Need (SGCN),¹ five of which are state-listed: piping plover (also federally listed), black tern, roseate tern (also federally listed), peregrine falcon, and short-eared owl. The two state-listed birds that utilize upland habitats (i.e., peregrine falcon and short-eared owl) are not likely to be present because available habitat, including the wooded parcel adjacent to the Oceanside POI, is in an urban developed area. It is possible that the coastal species (e.g., terns, warblers, sparrows) may pass through the beach areas at the export cable landfall site during migration (Empire 2023).

Bald eagles (*Haliaeetus leucocephalus*), which are listed as endangered (breeding) and threatened (non-breeding) in New Jersey and threatened in New York, are federally protected by the Bald and Golden Eagle Protection Act, 16 USC 668 et seq., as are golden eagles (*Aquila chrysaetos*). Bald eagles are broadly distributed across North America and generally nest and perch in areas associated with water (lakes, rivers, bays) in both freshwater and marine habitats, often remaining largely within roughly 1,640 feet of the shoreline (Buehler 2000). Bald eagles are present year-round in New Jersey and New York. In New Jersey, nesting is concentrated on the edge of Delaware Bay (NJDEP 2017); in New York, eagle territories are primarily inland, and in 2010 no territories were identified on Long Island (Nye 2010). In a study evaluating the space use of bald eagles captured in Chesapeake Bay, the coast of New Jersey was associated with moderate levels of use and the coast of New York had low to moderate levels of use (Mojica et al. 2016). The general morphology of bald eagles dissuades long-distance movements in offshore settings, as the species generally relies upon thermal formations, which develop poorly over the open ocean, during long-distance movements. As such, bald eagles are unlikely to fly through the Lease Area. Bald eagles were rarely observed in Mid-Atlantic offshore surveys (all observations were less than 3.7 miles [6 kilometers] from shore), and only one bald eagle was observed in the APEM² surveys; this individual was close to shore (see Figure 2-16 in COP Appendix Q) and none were documented in the Lease Area (Empire 2023).

Golden eagles are found throughout the United States, but mostly in the western half of the United States and are rare in the eastern states (Cornell University 2019). The species is now virtually extirpated as a breeding bird east of the Mississippi River (NYSDEC n.d.). Although sightings occur every year in New York, most are during migration and no active nests are known to occur (NYSDEC n.d.). In New Jersey, golden eagles are associated with forest habitats in the Delaware Bay, Piedmont Intercoastal Plain, Pinelands, and Skylands landscape regions (NJDEP 2018). The area of New Jersey closest to the Lease Area is within the Atlantic Coastal Landscape region, which is not associated with golden eagles (New Jersey Bureau of GIS 2019). Like with bald eagle, the general morphology of golden eagle dissuades long-distance movements in offshore settings (Kerlinger 1985), as the species generally relies upon thermal formations, which develop poorly over the open ocean, during long-distance movements. As such, golden eagles are unlikely to fly through the Lease Area.

Three species of birds listed as threatened or endangered under the ESA may occur in the Onshore and Offshore Project areas: the threatened piping plover (*Charadrius m. melodus*), endangered roseate tern (*Sterna d. dougallii*), and threatened *Rufa* subspecies of the red knot (*Calidris canutus rufa*) (USFWS 2021a; Empire 2023).

¹ High-priority SGCN species are wildlife species experiencing a population decline or have identified threats that may put them in jeopardy, and are in need of timely management intervention or are likely to reach critical population levels in New York (NYSDEC 2015).

² APEM is a European environmental consultant that specializes in aerial surveys.

3.7.2 Impact Level Definitions for Birds

Definitions of impact levels are provided in Table 3.7-2.

Table 3.7-2 Impact Level Definitions for Birds

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts would be so small as to be unmeasurable.
	Beneficial	Impacts would be so small as to be unmeasurable.
Minor	Adverse	Most impacts would be avoided; if impacts occur, the loss of one or few individuals or temporary alteration of habitat could represent a minor impact, depending on the time of year and number of individuals involved.
	Beneficial	Impacts would be localized to a small area but with some measurable effect on one or a few individuals or habitat.
Moderate	Adverse	Impacts would be unavoidable but would not result in population-level effects or threaten overall habitat function.
	Beneficial	Impacts would affect more than a few individuals in a broad area but not regionally, and would not result in population-level effects.
Major	Adverse	Impacts would result in severe, long-term habitat or population-level effects on species.
	Beneficial	Long-term beneficial population-level effects would occur.

3.7.3 Impacts of the No Action Alternative on Birds

When analyzing the impacts of the No Action Alternative on birds, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for birds. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with the other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*.

3.7.3.1 Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for birds described in Section 3.7.1, *Description of the Affected Environment for Birds*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on birds are generally associated with construction and climate change, and may also include interactions with commercial fisheries and anthropogenic light in the coastal environment. Onshore construction activities and associated impacts are expected to continue and have the potential to affect birds through temporary and permanent habitat removal and temporary noise impacts, which can cause avoidance behavior and displacement. Mortality of individual birds could occur but population-level effects would not be anticipated. Impacts of climate change such as increased storm severity and frequency, ocean acidification, altered migration patterns, increased disease frequency, and increased erosion and sediment deposition have the potential to result in long-term, potentially high-consequence risks to birds and could lead to changes in prey abundance and distribution, changes in nesting and foraging habitat abundance and distribution, and changes to migration patterns and timing.

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on birds include:

- Continued O&M of the Block Island project (five WTGs) installed in state waters;
- Continued O&M of the Coastal Virginia Offshore Wind project (two WTGs) installed in OCS-A 0497; and
- Ongoing construction of two offshore wind projects, the Vineyard Wind 1 project (62 WTGs and 1 OSS) in OCS-A 0501 and the South Fork project (12 WTGs and 1 OSS) in OCS-A 0517.

Ongoing O&M of the Block Island and Coastal Virginia Offshore Wind projects and ongoing construction of the Vineyard Wind 1 and South Fork projects would affect birds through the primary IPFs of accidental releases, lighting, cable emplacement and maintenance, noise, presence of structures, traffic (aircraft), and land disturbance. Ongoing offshore wind activities would have the same type of impacts from accidental releases, lighting, cable emplacement and maintenance, noise, presence of structures, traffic (aircraft), and land disturbance described in detail in Section 3.7.3.2 for planned offshore wind activities but the impacts would be of lower intensity.

3.7.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impact of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Other planned non-offshore wind activities that may affect birds include installation of new submarine cables and pipelines, increasing onshore construction, marine minerals extraction, port expansions, and installation of new structures on the OCS (see Section F.2 in Appendix F for a complete description of planned activities). These activities may result in short-term and permanent impacts on birds including disturbance, displacement, injury, mortality, habitat degradation, and habitat conversion. See Table F1-4 for a summary of potential impacts associated with planned non-offshore wind activities by IPF for birds.

BOEM expects planned offshore wind development activities to affect birds through the following primary IPFs.

Accidental releases: Accidental releases of fuel/fluids, other contaminants, and trash and debris could occur as a result of future offshore wind activities. The risk of any type of accidental release would be increased primarily during construction, but also during operations and decommissioning of offshore wind facilities. Ingestion of fuel and other hazardous contaminants has the potential to result in lethal and sublethal impacts on birds, including decreased hematological function, dehydration, drowning, hypothermia, starvation, and weight loss (Briggs et al. 1997; Haney et al. 2017; Paruk et al. 2016). Additionally, even small exposures that result in oiling of feathers can lead to sublethal effects that include changes in flight efficiencies and result in increased energy expenditure during daily and seasonal activities, including chick provisioning, commuting, courtship, foraging, long-distance migration, predator evasion, and territory defense (Maggini et al. 2017). Based on the volumes potentially involved (refer to Table F2-3 in Appendix F, *Planned Activities Scenario*), the likely amount of releases associated with future offshore wind development would fall within the range of accidental releases that already occur on an ongoing basis from non-offshore wind activities and would represent a negligible impact on birds.

Vessel compliance with USCG regulations would minimize trash or other debris; therefore, BOEM expects accidental trash releases from offshore wind vessels to be rare and localized in nature. In the unlikely event of a release, lethal and sublethal impacts on individuals could occur as a result of blockages caused by both hard and soft plastic debris (Roman et al. 2019). Given that accidental releases

are anticipated to be rare and localized, BOEM expects that accidental releases of trash and debris would not appreciably contribute to overall impacts on birds.

Lighting: Nighttime lighting associated with offshore wind structures and vessels (during construction, operations, and decommissioning) could represent a source of bird attraction, which can result in disorientation and increased collision and predation risks (Hüppop et al. 2006). Under the No Action Alternative, up to 2,803 WTGs and 66 OSS would have navigational and FAA hazard and aviation lighting that would be incrementally added beginning in 2023 and continuing through 2030. However, BOEM anticipates this impact to be significantly reduced due to the anticipated use of ADLS, which is a system that would activate WTG lighting only when an aircraft enters a predefined airspace. For example, the recently approved Vineyard 1 offshore wind project will implement ADLS and, based on historical air traffic data, WTG light activation under ADLS is estimated to occur 235 times per year, for a total illumination duration of less than 4 hours per year (illuminating less than 0.1 percent of the nighttime hours per year) (BOEM 2021a). Another recently approved offshore wind project—South Fork—will also implement ADLS as part of BOEM’s COP approval terms and conditions, and several offshore wind projects currently under BOEM consideration are proposing/considering ADLS (pending FAA and BOEM approval) (e.g., Atlantic Shores, Ocean Wind, Coastal Virginia Offshore Wind). As such, BOEM anticipates ADLS to significantly reduce the potential WTG lighting impacts on birds. In addition, and as discussed in more detail below in the *Presence of Structures* IPF, the abundance of bird species that overlap with the anticipated development of wind energy facilities on the Atlantic OCS is relatively small (Figure 3.7-2), and the relative seasonal exposure of bird populations is generally very low (Table 3.7-2). BOEM anticipates long-term but minor impacts on birds due to lighting of offshore structures.

Construction vessels are also a source of artificial lighting, which could attract birds and cause disorientation and collision or predation risk. However, the potential impact would be short term, lasting only the duration of construction and, as previously described, the abundance of bird species on the OCS that overlap with the anticipated wind development of wind energy facilities is relatively small. Therefore, BOEM anticipates vessel lighting would result in short-term and minor impacts on birds.

Cable emplacement and maintenance: Generally, emplacement of submarine cables would result in increased suspended sediments that may affect diving birds, result in displacement of foraging individuals or decreased foraging success, and have impacts on some prey species (e.g., benthic assemblages) (Cook and Burton 2010). The total area of seafloor disturbed by offshore export and interarray cables for offshore wind facilities is estimated to be 36,125 acres (146.2 km²). Impacts associated with cable emplacement would be short term and localized, and birds would be able to successfully forage in adjacent areas not affected by increased suspended sediments. Any dredging necessary prior to cable installation could contribute to additional impacts. Disturbed seafloor from construction of future offshore wind projects may affect some bird prey species; however, assuming future projects use installation procedures similar to those proposed in the Empire Wind COP, the duration and extent of impacts would be limited and short term, and benthic assemblages would recover from disturbance relatively quickly (as stated Section 3.6, *Benthic Resources*, and Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*). Given that impacts would be short term and generally localized to the emplacement corridor, no individual fitness or population-level effects on birds would be expected.

Noise: Anthropogenic noise on the OCS associated with future offshore wind development, including noise from aircraft, pile-driving activities, G&G surveys, offshore construction, and vessel traffic, has the potential to result in impacts on birds on the OCS. Additionally, onshore construction noise has the potential to result in impacts on birds. BOEM anticipates that these impacts would be localized and short term. Potential impacts could be greater if avoidance and displacement of birds occurs during seasonal migration periods.

Aircraft flying at low altitudes may cause birds to flush, resulting in increased energy expenditure. Disturbance to birds, if any, would be temporary and localized, with impacts dissipating once the aircraft has left the area. No individual or population-level effects would be expected.

Construction of up to 2,803 WTGs and 66 OSS would create noise and may temporarily affect diving birds. The greatest impact of noise is likely to be caused by pile-driving activities during construction. Noise transmitted through water has the potential to result in temporary displacement of diving birds in a limited space around each pile and can cause temporary stress and behavioral changes ranging from mild annoyance to escape behavior (BOEM 2014b, 2016). Additionally, noise impacts on prey species may affect bird foraging success. Similar to pile driving, G&G site characterization surveys for offshore wind facilities would create high-intensity impulsive noise around sites of investigation, leading to similar impacts on birds.

Onshore noise associated with intermittent construction of required offshore wind development infrastructure may also result in localized and short-term impacts, including avoidance and displacement, although no individual fitness or population-level effects would be expected to occur.

Noise associated with project vessels could disturb some individual diving birds, but they would likely acclimate to the noise or move away, potentially resulting in a short-term loss of habitat (BOEM 2012). However, brief, temporary responses, if any, would be expected to dissipate once the vessel has passed or the individual has moved away. No individual fitness or population-level effects would be expected.

Presence of structures: The presence of structures can lead to long-term beneficial and adverse impacts on birds. Beneficial impacts from the presence of structures could result for some bird species through a reduction in derelict fishing gear (by entanglement with foundations) and increased prey items, which could result in fish aggregation and associated increase in foraging opportunities. Adverse impacts could include migration disturbances, strikes with structures (e.g., WTGs, buoys), and displacement.

The primary threat to birds from future offshore wind development is the presence of WTGs that could cause collisions and displacement. The Atlantic Flyway is an important migratory pathway for as many as 164 species of waterbirds, and a similar number of land birds, with the greatest volume of birds using the Atlantic Flyway during annual migrations between wintering and breeding grounds (Watts 2010). Within the Atlantic Flyway along the North American Atlantic Coast, much of the bird activity is concentrated along the coastline (Watts 2010). Waterbirds use a corridor between the coast and several kilometers out onto the OCS, while land birds tend to use a wider corridor extending from the coastline to tens of kilometers inland (Watts 2010). While both groups may occur over land or water within the flyway and may extend considerable distances from shore, the highest diversity and density are centered on the shoreline.

Building on this information, Robinson Wilmott et al. (2013) evaluated the sensitivity of bird resources to collision and displacement due to future wind development on the Atlantic OCS and included the 164 species selected by Watts (2010) plus an additional 13 species, for a total of 177 species that may occur on the Atlantic OCS from Maine to Florida during all or some portion of the year. As discussed in Robinson Willmott et al. (2013) and consistent with Garthe and Hüppop (2004), Furness and Wade (2012), and Furness et al. (2013), species with high scores for sensitivity for collision include gulls, jaegers, and the northern gannet (*Morus bassanus*). In many cases, high collision sensitivity was driven by high occurrence on the OCS, low avoidance rates with high uncertainty, and time spent in the RSZ. It should be noted that, although Robinson Wilmott et al. (2013) use a comprehensive set of metrics in the study, may other environmental factors could influence bird vulnerability to offshore wind facilities (e.g., weather, lighting, area of RSZ).

Many of the species addressed in Robinson Willmott et al. (2013) that were identified as having low collision sensitivity include passerines that spend very little time on the Atlantic OCS during migration and typically fly above the RSZ. As described by Watts (2010), approximately 55 seabirds occur on the Atlantic OCS at a distance from shore where WTGs could be operating. However, generally the abundance of bird species that overlap with the anticipated development of wind energy facilities on the Atlantic OCS is relatively small (Figure 3.7-2). Of the 55 seabird species, 47 seabird species have sufficient survey data to calculate the modeled percentage of a species population by season that would overlap with the anticipated offshore wind development on the Atlantic OCS (Winship et al. 2018). Looking at all 47 birds across all four seasons, the relative seasonal exposure is generally very low, ranging from 0.0 to 5.2 percent of the seabird populations (Table 3.7-3). BOEM assumes that the 47 species (85 percent) with sufficient data to model the relative distribution and abundance on the Atlantic OCS are representative of the 55 species that may overlap with offshore wind development on the Atlantic OCS.

Offshore wind development would add up to 2,803 WTGs in the bird geographic analysis area (Table F2-1). In the contiguous United States, bird collisions with operating WTGs are believed to be relatively rare events, with an estimated 140,000 to 500,000 (mean = 320,000) birds killed annually from about 49,000 onshore wind turbines in 39 states (USFWS 2018). Bird collisions with turbines in the eastern United States have been estimated at 6.86 birds per turbine per year (USFWS 2018). Based on this mortality rate, an estimated 19,229 birds could be killed annually from the 2,803 WTGs that would be added for offshore wind development. This represents a worst-case scenario and does not consider mitigating factors, such as landscape and weather patterns, or bird species that are expected to occur. As already stated, bird presence on the OCS is low and abundance of bird species that overlap with the anticipated development of wind energy facilities on the Atlantic OCS is relatively small. Given that the relative density of birds in the OCS is low, relatively few birds are likely to encounter WTGs (see Figure 3.7-2).

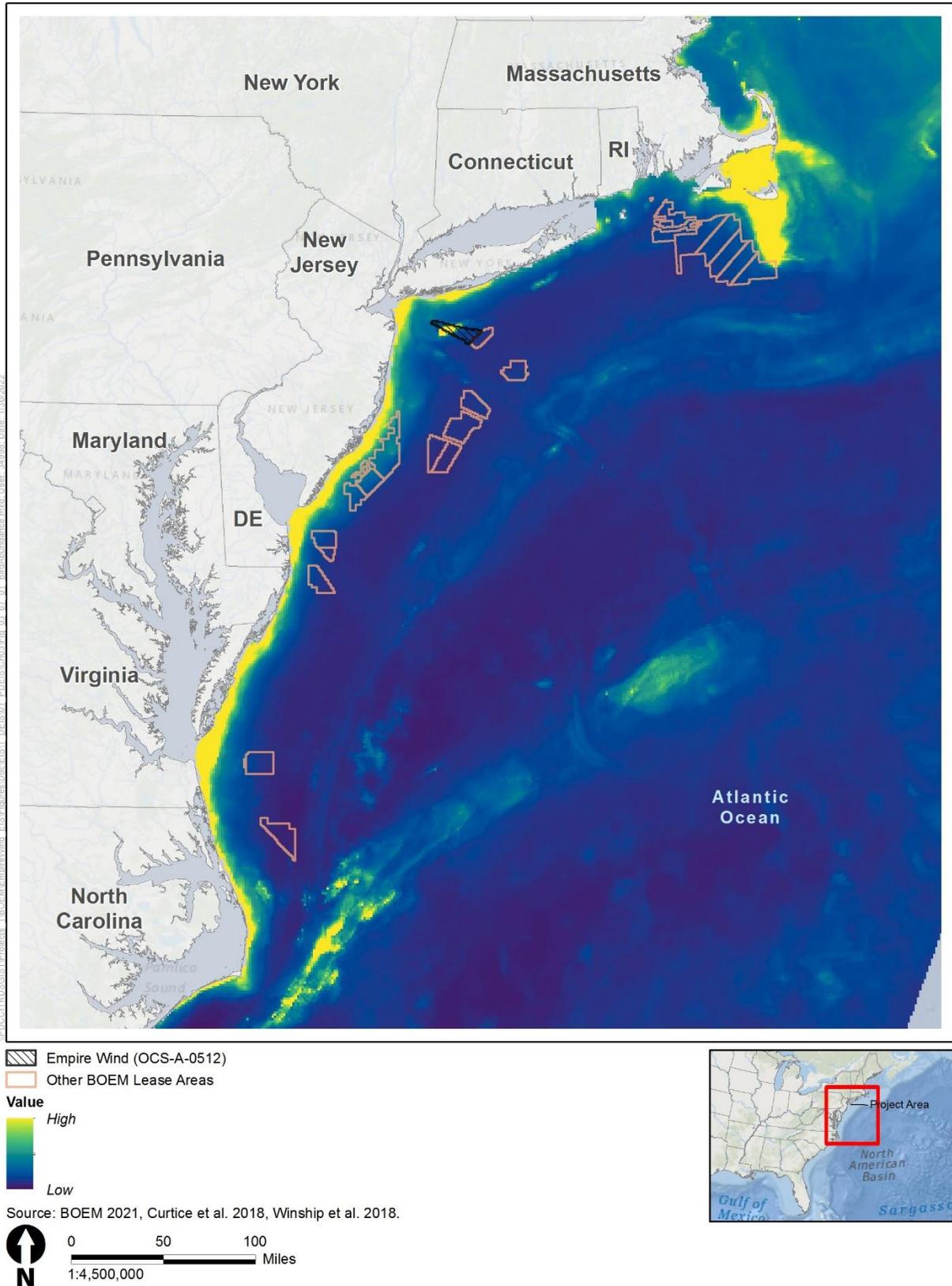


Figure 3.7-2 Total Avian Relative Abundance Distribution Map

Potential annual bird kills from WTGs would be relatively low compared to other causes of migratory bird deaths in the United States; feral cats are the primary cause of migratory bird deaths in the United States (2.4 billion per year), followed by collisions with building glass (599 million per year), collisions with vehicles (214.5 million per year), poison (72 million per year), collisions with electrical lines (25.5 million per year), collisions with communication towers (6.6 million per year), and electrocutions (5.6 million per year) (USFWS 2021b). Not all individuals that occur or migrate along the Atlantic Coast are expected to encounter the RSZ of one or more operating WTGs associated with future offshore wind development. Generally, only a small percentage of a species' seasonal population would potentially encounter operating WTGs (Table 3.7-3).

Table 3.7-3 Percentage of Atlantic Seabird Populations that Are Expected to Overlap with Anticipated Offshore Wind Energy Development on the Outer Continental Shelf by Season

Species	Spring	Summer	Fall	Winter
Artic Tern (<i>Sterna paradisaea</i>)	NA	0.2	NA	NA
Atlantic Puffin (<i>Fratercula arctica</i>) ¹	0.2	0.1	0.1	0.2
Audubon Shearwater (<i>Puffinus lherminieri</i>) ²	0.0	0.0	0.0	0.0
Black-capped Petrel (<i>Pterodroma hasitata</i>)	0.0	0.0	0.0	0.0
Black Guillemot (<i>Cephus grille</i>)	NA	0.3	NA	NA
Black-legged Kittiwake (<i>Rissa tridactyla</i>) ¹	0.7	NA	0.7	0.5
Black Scoter (<i>Melanitta americana</i>)	0.2	NA	0.4	0.5
Bonaparte's Gull (<i>Chroicocephalus philadelphia</i>)	0.5	NA	0.4	0.3
Brown Pelican (<i>Pelecanus occidentalis</i>)	0.1	0.0	0.0	0.0
Band-rumped Storm-Petrel (<i>Oceanodroma castro</i>)	NA	0.0	NA	NA
Bridled Tern (<i>Onychoprion anaethetus</i>)	NA	0.1	0.1	NA
Common Eider (<i>Somateria mollissima</i>) ¹	0.3	0.1	0.5	0.6
Common Loon (<i>Gavia immer</i>)	3.9	1.0	1.3	2.1
Common Murre (<i>Uria aalge</i>)	0.4	NA	NA	1.9
Common Tern (<i>Sterna hirundo</i>) ¹	2.1	3.0	0.5	NA
Cory's Shearwater (<i>Calonectris borealis</i>) ²	0.1	0.9	0.3	NA
Double-crested Cormorant (<i>Phalacrocorax auritus</i>)	0.7	0.6	0.5	0.4
Dovekie (<i>Alle alle</i>)	0.1	0.1	0.3	0.2
Great Black-backed Gull (<i>Larus marinus</i>) ¹	1.3	0.5	0.7	0.6
Great Shearwater (<i>Puffinus gravis</i>)	0.1	0.3	0.3	0.1
Great Skua (<i>Stercorarius skua</i>)	NA	NA	0.1	NA
Herring Gull (<i>Larus argentatus</i>) ¹	1.0	1.3	0.9	0.5
Horned Grebe (<i>Podiceps auritus</i>)	NA	NA	NA	0.3
Laughing Gull (<i>Leucophaeus atricilla</i>)	1.0	3.6	0.9	0.1
Leach's Storm-Petrel (<i>Oceanodroma leucorhoa</i>)	0.1	0.0	0.0	NA
Least Tern (<i>Sternula antillarum</i>)	NA	0.3	0.0	NA
Long-tailed Ducks (<i>Clangula hyemalis</i>)	0.6	0.0	0.4	0.5
Manx Shearwater (<i>Puffinus puffinus</i>) ¹	0.0	0.5	0.1	NA
Northern Fulmar (<i>Fulmarus glacialis</i>) ¹	0.1	0.2	0.1	0.2
Northern Gannet (<i>Morus bassanus</i>) ¹	1.5	0.4	1.4	1.4
Parasitic Jaeger (<i>Stercorarius parasiticus</i>)	0.4	0.5	0.4	NA

Species	Spring	Summer	Fall	Winter
Pomarine Jaeger (<i>Stercorarius pomarinus</i>)	0.1	0.3	0.2	NA
Razorbill (<i>Alca torda</i>) ¹	5.2	0.2	0.4	2.1
Ring-billed Gull (<i>Larus delawarensis</i>)	0.5	0.5	0.9	0.5
Red-breasted Merganser (<i>Mergus serrator</i>)	0.5	NA	NA	0.7
Red Phalarope (<i>Phalaropus fulicarius</i>)	0.4	0.4	0.2	NA
Red-necked Phalarope (<i>Phalaropus lobatus</i>)	0.3	0.3	0.2	NA
Roseate Tern (<i>Sterna dougallii</i>)	0.6	0.0	0.5	NA
Royal Tern (<i>Thalasseus maximus</i>)	0.0	0.2	0.1	NA
Red-throated Loon (<i>Gavia stellate</i>) ¹	1.6	NA	0.5	1.0
Sooty Shearwater (<i>Ardenna grisea</i>)	0.3	0.4	0.2	NA
Sooty Tern (<i>Onychoprion fuscatus</i>)	0.0	0.0	NA	NA
South Polar Skua (<i>Stercorarius maccormicki</i>)	NA	0.2	0.1	NA
Surf Scoter (<i>Melanitta perspicillata</i>)	1.2	NA	0.4	0.5
Thick-billed Murre (<i>Uria lomvia</i>)	0.1	NA	NA	0.1
Wilson's Storm-Petrel (<i>Oceanites oceanicus</i>)	0.2	0.9	0.2	NA
White-winged Scoter (<i>Melanitta deglandi</i>)	0.7	NA	0.2	1.3

Source: Winship et al. 2018.

¹ Species used in collision risk modeling.

² Birds of Conservation Concern

NA = not applicable

The addition of WTGs to the offshore environment may result in increased functional loss of habitat for those species with higher displacement sensitivity. Displacement and avoidance can cause birds to expend more energy and to forage in other areas. However, overall habitat loss due to displacement as a result of a single project is unlikely to affect population trends because of the relatively small size of the Project area in relation to the available foraging habitat (Fox and Petersen 2019). In addition, a recent study of long-term data collected in the North Sea found that despite the extensive observed displacement of loons in response to the development of 20 wind farms, there was no decline in the region's loon population (Vilela et al. 2021). Substantial foraging habitat for resident birds would remain available outside of the proposed offshore lease areas and no individual fitness or population-level impacts would be expected to occur.

Because most structures would be spaced 0.6 nm to 1 nm apart, ample space between WTGs should allow birds that are not flying above WTGs to fly through individual lease areas without changing course or to make minor course corrections to avoid operating WTGs. The effects of offshore wind farms on bird movement ultimately depend on the bird species, size of the offshore wind farm, spacing of the turbines, and extent of extra energy cost incurred by the displacement of flying birds (relative to normal flight costs pre-construction) and their ability to compensate for this degree of added energy expenditure. Little quantitative information is available on how offshore wind farms may act as a barrier to movement, but Madsen et al. (2012) modeled bird movement through offshore wind farms using bird (common eider) movement data collected at the Nysted offshore wind farm in the western Baltic Sea just south of Denmark. After running several hundred thousand simulations for different layouts/configurations for a 100-WTG offshore wind farm, Madsen et al. (2012) determined that the proportion of birds traveling between turbines increased as distance between turbines increased. With eight WTG columns at 200-meter (0.1-nm) spacing, no birds passed between the turbines. However, increasing inter-turbine distance to 500 meters (0.27 nm) increased the percentage of birds to more than 20 percent, while a spacing of 1,000 meters (0.54 nm) increased this further to 99 percent. The 0.6- to 1-nm spacing estimated for most

structures that will be proposed on the Atlantic OCS is greater than the distance at which 99 percent of the birds passed through in the model. As such, adverse impacts of additional energy expenditure due to minor course corrections or complete avoidance of offshore wind lease areas would not be expected to be biologically significant. BOEM anticipates that any additional flight distances would likely be relatively small for most migrating birds when compared with the overall migratory distances traveled, and no individual fitness or population-level effects would be expected to occur.

In the Northeast and Mid-Atlantic waters, there are 2,570 documented annual seabird fatalities through interaction with commercial fishing gear; of those, 84 percent are with gillnets involving shearwaters/fulmars and loons (Hatch 2017). Abandoned or lost fishing nets from commercial fishing may get tangled with foundations, reducing the chance that abandoned gear would cause additional harm to birds and other wildlife if left to drift until sinking or washing ashore. A reduction in derelict fishing gear (in this case by entanglement with foundations) has a beneficial impact on bird populations (Regular et al. 2013). The presence of structures may also increase recreational fishing (see Section 3.9) and thus expose individual birds to harm from fishing line and hooks.

The presence of new structures could result in increased prey items for some marine bird species. Offshore wind foundations could increase the mixing of surface waters and deepen the thermocline, possibly increasing pelagic productivity in local areas (English et al. 2017). Additionally, the new structures may create habitat for structure-oriented and hard-bottom species. This reef effect has been observed around WTGs, leading to local increases in biomass and diversity (Causon and Gill 2018). Recent studies have found increased biomass for benthic fish and invertebrates, and possibly for pelagic fish, marine mammals, and birds as well (Raoux et al. 2017; Pezy et al. 2018; Wang et al. 2019), indicating that offshore wind energy facilities could generate beneficial long-term impacts on local ecosystems, indicating that offshore wind energy facilities may increase foraging opportunities for individuals of some marine bird species, potentially contributing to beneficial impacts on local ecosystems. BOEM anticipates that the presence of structures may result in permanent beneficial impacts. Conversely, increased foraging opportunities could attract marine birds, potentially exposing those individuals to increased collision risk associated with operating WTGs.

Traffic (aircraft): General aviation traffic accounts for approximately two bird strikes per 100,000 flights (Dolbeer et al. 2019). Because aircraft flights associated with offshore wind development are expected to be minimal in comparison to baseline conditions, aircraft strikes with birds are highly unlikely to occur. As such, aircraft traffic would not be expected to appreciably contribute to overall impacts on birds.

Land disturbance: Onshore construction of offshore wind development infrastructure has the potential to result in some impacts due to habitat loss or fragmentation. However, onshore construction would be expected to account for only a very small increase in development relative to other ongoing development activities. Onshore construction would be expected to generally occur in previously disturbed habitats, and no individual fitness or population-level impacts on birds would be expected to occur. As such, onshore construction associated with future offshore wind development would not be expected to appreciably contribute to overall impacts on birds.

3.7.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, birds would continue to be affected by existing environmental trends and ongoing activities. BOEM expects ongoing activities to have continuing temporary and permanent impacts (disturbance, displacement, injury, mortality, habitat degradation, habitat conversion) on birds primarily through construction and climate change. Given that the abundance of bird species that overlap with ongoing wind energy facilities on the Atlantic OCS is relatively small, ongoing wind activities would not appreciably contribute to impacts on birds. Temporary

disturbance and permanent loss of habitat onshore may occur as a result of offshore wind development. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects within the geographic analysis area. The No Action Alternative would result in **minor** impacts on birds.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and birds would continue to be affected by natural and human-caused IPFs. Planned activities would contribute to the impacts on birds due to habitat loss from increased onshore construction and interactions with offshore developments.

BOEM anticipates that the impacts associated with offshore wind activities in the geographic analysis area would result in adverse impacts but could potentially include beneficial impacts because of the presence of structures. The majority of offshore structures in the geographic analysis area would be attributable to the offshore wind development. Migratory birds that use the offshore wind lease areas during all or parts of the year would either be exposed to new collision risk or experience long-term functional habitat loss due to behavioral avoidance and displacement from wind lease areas on the OCS. The offshore wind development would also be responsible for the majority of impacts related to new cable emplacement and pile-driving noise, but effects on birds resulting from these IPFs would be localized and temporary and would not be expected to be biologically significant. BOEM anticipates that the cumulative impacts of the No Action Alternative would have a **moderate** adverse impact on birds but could also include **moderate beneficial** impacts because of the presence of offshore structures.

3.7.4 Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on birds:

- The new EW 2 onshore substations, which could require the removal of trees and shrubs in or on the edge of the construction footprint;
- The number, size, and location of the WTGs;
- The routing variants within the selected onshore export cable system, which could require removal of trees and shrubs along the construction corridor; and
- The time of year during which construction occurs.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- WTG number, size, and location: the level of hazard related to WTGs is proportional to the number of WTGs installed; fewer WTGs would present less hazard to birds.
- Onshore export cable routes and substations footprint: the route chosen (including variants within the general route) and substation footprint would determine the amount of habitat affected.
- Season of construction: The activity and distribution of birds exhibit distinct seasonal changes. For instance, summer and fall months (generally May through October) constitute the most active season for birds in the Project area, and the months on either side coincide with major migration events. Therefore, construction during months in which birds are not present, not breeding, or less active would have a lesser impact on birds than construction during more active times.

3.7.5 Impacts of the Proposed Action on Birds

The sections below summarize the potential impacts of the Proposed Action on birds during the various phases of the proposed Projects. Routine activities would include construction, O&M, and decommissioning of the proposed Projects, as described in Chapter 2, *Alternatives Including the Proposed Action*. The most impactful IPF is expected to be the presence of structures, which could lead to adverse impacts including injury and mortality or elicit an avoidance response.

Accidental releases: Some potential exists for mortality, decreased fitness, and health effects due to the accidental release of fuel, hazardous materials, and trash and debris from vessels associated with the Proposed Action. Vessels associated with the Proposed Action may potentially generate operational waste, including bilge and ballast water, sanitary and domestic wastes, and trash and debris. All vessels associated with the Proposed Action would comply with USCG requirements for the prevention and control of oil and fuel spills. Proper vessel regulations and operating procedures would minimize effects on offshore bird species resulting from the release of debris, fuel, hazardous materials, or waste (BOEM 2012). Empire has prepared and would implement an OSRP (APM 80), which would minimize the potential for spills and identify procedures in the event of a spill (see COP Appendix F). These releases, if any, would occur infrequently at discrete locations and vary widely in space and time; as such, BOEM expects localized and short-term impacts on birds.

Lighting: Under the Proposed Action, up to 147 WTGs and two OSS would be lit with USCG navigational and FAA hazard lighting; these lights have some potential to attract birds and result in increased collision risk (Hüppop et al. 2006). In accordance with BOEM lighting guidelines (2021b) and as outlined in the COP (Volume 1, Section 3.5.2; Empire 2023), all WTGs in excess of 699 feet about ground level would be lit with two synchronized red flashing obstruction lights (with medium-intensity FAA model L-864 and light-emitting diode color between 800 and 900 nanometers) placed on the back of the nacelle on opposite sides, and up to three FAA model L-810 red flashing lights at mid-mast level, adding up to 870 new red flashing lights to the offshore environment where none currently exist. However, red flashing aviation obstruction lights are commonly used at land-based wind facilities without any observed increase in avian mortality compared with unlit turbine towers (Kerlinger et al. 2010; Orr et al. 2013).

Marine navigation lighting would consist of multiple types of flashing yellow lights on corner WTGs/significant peripheral structures, outer boundary WTGs, and interior WTGs. Empire has committed to using an FAA-approved ADLS (APM 84), which is a lighting system that would only activate WTG lighting when aircraft enter a predefined airspace. For the Proposed Action, based on historical air traffic data, obstruction light activation under ADLS was estimated to occur 30 hours per month over the course of 1 year, which equals just 7.5 percent of the time that full-time obstruction lights would be active (COP Volume 2, Section 8.6, and Appendix B; Empire 2023). To further reduce impacts on birds, Empire would limit, where practicable, lighting (not required by FAA and USCG) during offshore construction to reduce attraction of birds (APM 76 and APM 78). As such, BOEM expects impacts, if any, to be long term but negligible from WTG and OSS lighting. Vessel lights during construction, O&M, and decommissioning would have short-term but minimal effects and would be limited to vessels transiting to and from construction areas.

Cable emplacement and maintenance: The Proposed Action would disturb up to 1,895 acres (7.6 km²) of seafloor associated with the installation of array cable and export cable (EW 1 and EW 2), which would result in turbidity effects that have the potential to reduce marine bird foraging success or have temporary and localized impacts on marine bird prey species. To evaluate the impacts of submarine export and interarray cable installation, a conservative analytical sediment transport model was developed using publicly available data to quantify potential maximum plume dispersion and sediment concentrations and potential maximum sediment deposition thicknesses (see COP Volume 3, Appendix J

for details). In areas that consist predominantly of gravels and sands, the analysis indicates a limited extent of increased sediment concentrations, as the larger grain size sediments immediately deposit in the trench (Empire 2023). In locations that are dominated by fine sand, silts, or clays, these sediments can be released into the water column, temporarily increase total suspended solids near the trench, and cause sediment deposition outside of the trench. These impacts are expected to be temporary, with sediments settling quickly to the seabed and potential plumes limited to right above the seabed and not within the water column.

During jet plow activities, silts and clays are anticipated to remain suspended for 4 hours and deposit no farther than 492 feet from the trench, with most of the deposition near the trench. Mass flow excavations were found to have a similar disturbance to sediment, with deposition from the trench no farther than 246 feet. Results from the analysis were also consistent with other sediment transport models completed for wind farm installation projects in the Mid-Atlantic region. Data collections and modeling studies of plowing, trenching, and dredging projects showed that displacement of sediments is low, and they typically dissipated to background levels very close to the site (Empire 2023). Individual birds would be expected to successfully forage in nearby areas not affected by increased sedimentation during cable emplacement, and only non-measurable impacts, if any, on individuals or populations would be expected given the localized and temporary nature of the potential impacts.

Noise: The expected impacts of aircraft (e.g., helicopters), G&G survey, and pile-driving noise associated with the Proposed Action would not increase the impacts of noise beyond those described under the No Action Alternative. Effects on offshore bird species could occur during the construction phase of the Proposed Action because of equipment noise (including pile-driving noise). The pile-driving noise impacts would be temporary (5 hours per pile) and would cease after piles are installed. Vessel and construction noise could temporarily disturb offshore bird species, but they would likely acclimate to the noise or move away, potentially resulting in a temporary loss of habitat (BOEM 2012). BOEM anticipates the temporary impacts, if any, related to construction and installation of the offshore components would be negligible.

Normal operation of the substations would generate continuous noise, but BOEM expects negligible long-term impacts when considered in the context of the other commercial and industrial noises near the proposed substations.

Presence of structures: The various types of impacts on birds that could result from the presence of structures, such as fish aggregation and associated increase in foraging opportunities, entanglement and fishing gear loss or damage, migration disturbances, and WTG strikes and displacement, are described in detail in Section 3.7.3.2, *Cumulative Impacts of the No Action Alternative*. The impacts of the Proposed Action as a result of presence of structures would be long term but minor and may include some beneficial impacts. Due to the anticipated use of flashing red tower lights, restricted time period of exposure during migration, and small number of migrants that could cross the Lease Area, BOEM determined that the Proposed Action would not likely adversely affect roseate terns, piping plovers, and red knots.

Within the Atlantic Flyway along the North American Atlantic Coast, much of the bird activity is concentrated along the coastline (Watts 2010). Waterbirds use a corridor between the coast and several kilometers out onto the OCS, while land birds tend to use a wider corridor extending from the coastline to tens of kilometers inland (Watts 2010). However, operation of the Proposed Action would result in impacts on some individuals of offshore bird species and possibly some individuals of coastal and inland bird species during spring and fall migration. These impacts could arise through direct mortality from collisions with WTGs or through behavioral avoidance and habitat loss (Drewitt and Langston 2006; Fox et al. 2006; Goodale and Millman 2016).

The predicted occurrence of bird populations that have a higher sensitivity to collision (as defined by Robinson Willmott et al. 2013) is relatively low across the OCS during all seasons of the year (Figure 3.7-3), suggesting that bird fatalities in the overall OCS due to collision are likely to be low. The Marine-life Data and Analysis Team models predict an area of high bird abundance, however, in the northwestern portion of the Lease Area, but this is believed to be due to the high predicted winter use of just one species, common murre, and not that of all birds. Furthermore, more recent offshore high-definition digital surveys (2016–2019) of the Lease Area conducted by NYSERDA and Empire did not detect any common murres (see COP Appendix Q, Tables 2-16 and 2-36; Empire 2023). Therefore, regardless of the high predicted abundance shown on Figure 3.7-2, Figure 3.7-3, and Figure 3.7-4, the predicted occurrence of overall bird populations in the Lease Area is still relatively low.

When WTGs are present, many birds would avoid the WTG site altogether, especially the species that ranked “high” in vulnerability to displacement by offshore wind energy development (Robinson Willmott et al. 2013). In addition, many birds would likely adjust their flight paths to avoid WTGs by flying above, below, or between them (e.g., Desholm and Kahlert 2005; Plonczkier and Simms 2012; Skov et al. 2018) and others may take extra precautions to avoid WTGs when the WTGs are moving (Johnston et al. 2014). Several species have very high avoidance rates; for example, the northern gannet, black-legged kittiwake, herring gull, and great black-backed gull have measured avoidance rates of at least 99.6 percent (Skov et al. 2018). Vattenfall (a European energy company) recently studied bird movements within an offshore wind farm situated 3–4.9 kilometers off the coast of Aberdeen, Scotland (Vattenfall 2023). The purpose of the study was to improve the understanding of seabird flight behavior inside an offshore wind farm with a focus on the bird breeding period and post-breeding period when densities are highest. The study was robust in that seabirds were tracked inside the array with video cameras and radar tracks, which allowed for measuring avoidance movements (meso- and micro-avoidance³) with high confidence and at the species level. Detailed statistical analyses of the seabird flight data were enabled both by the large sample sizes and by the high temporal resolution in the combined radar track and video camera data. Meso-avoidance behavior showed that species avoided the RSZ by flying in between the turbines, with very few avoiding by changing their flight altitude in order to fly either below or above the rotors. The most frequently recorded adjustment under micro-avoidance behavior was birds flying along the plane of the rotor; other adjustments included crossing the rotor either obliquely or perpendicularly, and some birds crossed the rotor-swept area without making any adjustments to the spinning rotors. The study concluded that, together with the recorded high levels of micro-avoidance in all species (more than 0.96), it is now evident that seabirds will be exposed to very low risks of collision in offshore wind farms during daylight hours. This was substantiated by the fact that no collisions or even narrow escapes were recorded in over 10,000 bird videos during the 2 years of monitoring covering the April–October period. The study’s calculated micro-avoidance rate (more than 0.96) is similar to that calculated by Skov et al. (2018). As previously stated in Section 3.7.3.2, displacement and avoidance can cause birds to expend more energy and to forage in other areas. However, overall habitat loss due to displacement as a result of a single project is unlikely to affect population trends because of the relatively small size of the Project area in relation to the available foraging habitat (e.g., Fox and Petersen 2019).

Empire performed an exposure and relative vulnerability assessment to estimate the collision and displacement risk of various offshore bird species encountering the Lease Area (COP Appendix Q, Avian Impact Assessment; Empire 2023). Most species were identified as having “minimal” to “low” overall exposure risk. With the exception of migratory falcons and songbirds, coastal birds are considered to have minimal exposure (occurrence) to the Lease Area because it is far enough offshore as to be beyond the range of most breeding terrestrial or coastal bird species. Falcons, primarily peregrine falcons, may be

³ Micro-avoidance is flight behavior within and in the immediate vicinity of individual wind turbine rotor swept areas (i.e., last-second action to avoid collision); meso-avoidance is flight behavior within and in the immediate vicinity of the wind farm (i.e., anticipatory/impulsive evasion of rows of turbines in a wind farm).

exposed to the Lease Area during migration. However, uncertainty exists about what proportion of migrating peregrine falcons might be attracted to offshore wind energy projects for perching, roosting, and foraging, and the extent to which individuals might avoid WTGs or collide with them.

To minimize the introduction of perching structures to the offshore environment, Empire has committed to installing bird deterrent devices, where appropriate, on offshore, above-water structures (APM 77).

Some migratory songbirds may also be exposed to the Lease Area during migration periods, but population-level impacts are unlikely because exposure to the Lease Area is expected to be minimal to low and limited in duration. All marine birds were identified as having minimal to low exposure except terns (not including the roseate tern), which received a medium exposure assessment. Terns would be most exposed during spring migration. Generally, terns are thought to fly below the RSZ, but do have some vulnerability to collision when they are not avoiding WTGs.

Loons also initially received a medium exposure score during the summer, but this was reduced to minimum to low because the exposure score was driven by a low sample size in the summer when most individual are breeding on inland lakes. Local density estimates showed very low to no density during the summer. For these reasons, overall loon exposure is considered minimal to low. Loons are documented to avoid wind farms, but displacement from the Lease Area is unlikely to affect population trends because of the relatively small size of the Lease Area in relation to available foraging habitat. As previously mentioned, while the Marine-life Data and Analysis Team models predict high winter use of the Lease Area by common murre, exposure of all auk species combined at a population level is considered to be minimal to low when the Marine-life Data and Analysis Team models and APEM surveys are assessed together. Generally, auks are not considered vulnerable to collision, as they primarily fly much lower than the RSZ.

During migration, many bird species, including songbirds, likely fly at heights well above or below the RSZ (98 feet to 951 feet [30 to 290 meters] above highest astronomical tide) (COP Appendix Q; Empire 2023). As shown in Robinson Willmott et al. (2013), species with low sensitivity scores include many passerines that only cross the Atlantic OCS briefly during migration and typically fly well above the RSZ. It is generally assumed that inclement weather and reduced visibility cause changes to migration altitudes (Ainley et al. 2015) and could potentially lead to large-scale mortality events. However, this has not been shown to be the case in studies of offshore wind facilities in Europe, with overseas migration completely, or nearly so, ceasing during inclement weather (Fox et al. 2006; Pettersson 2005; Hüppop et al. 2006), and with migrating birds avoiding flying through fog and low clouds (Panuccio et al. 2019).

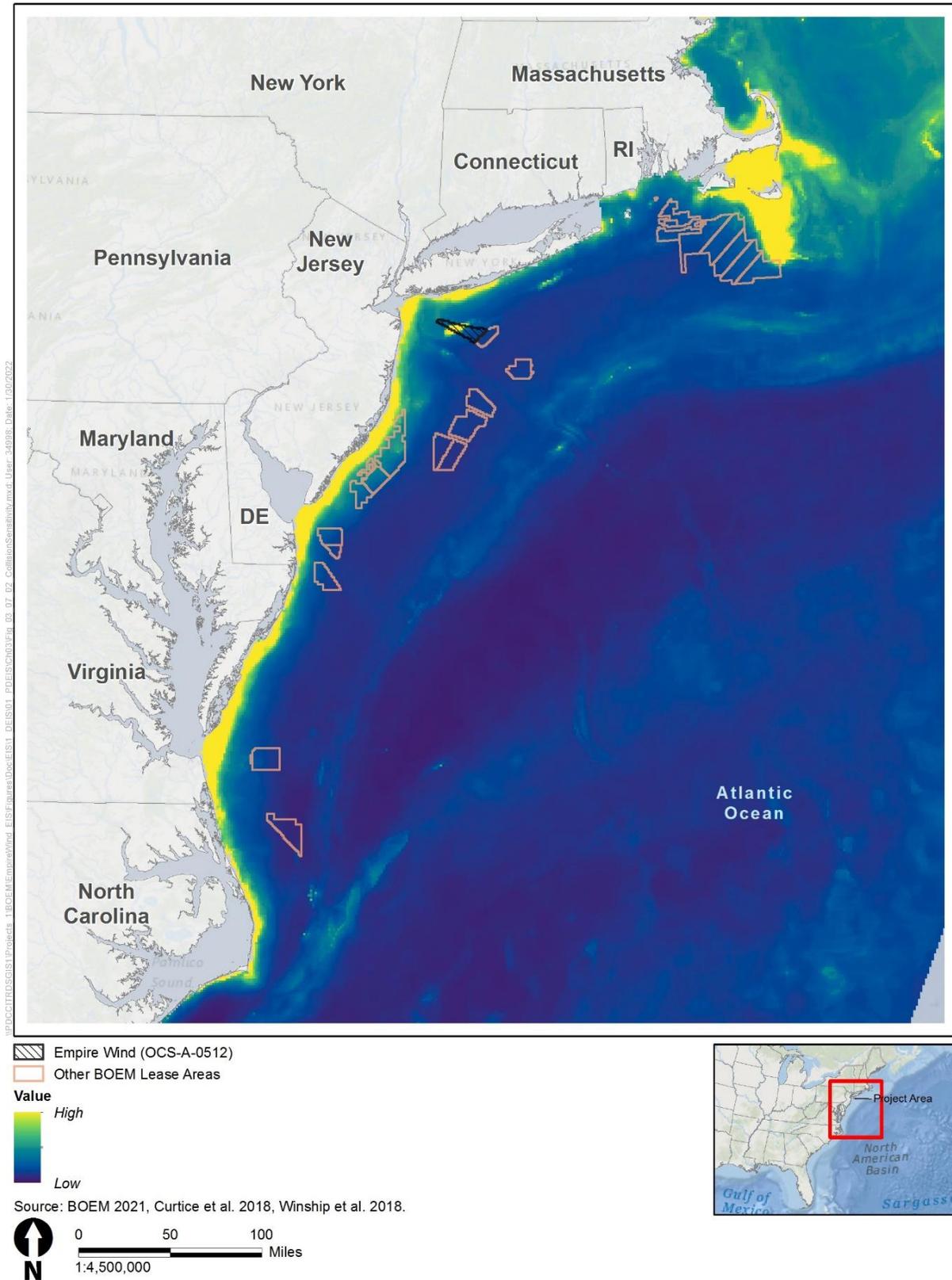


Figure 3.7-3 Total Avian Relative Abundance Distribution Map for the Higher Collision Sensitivity Species Group

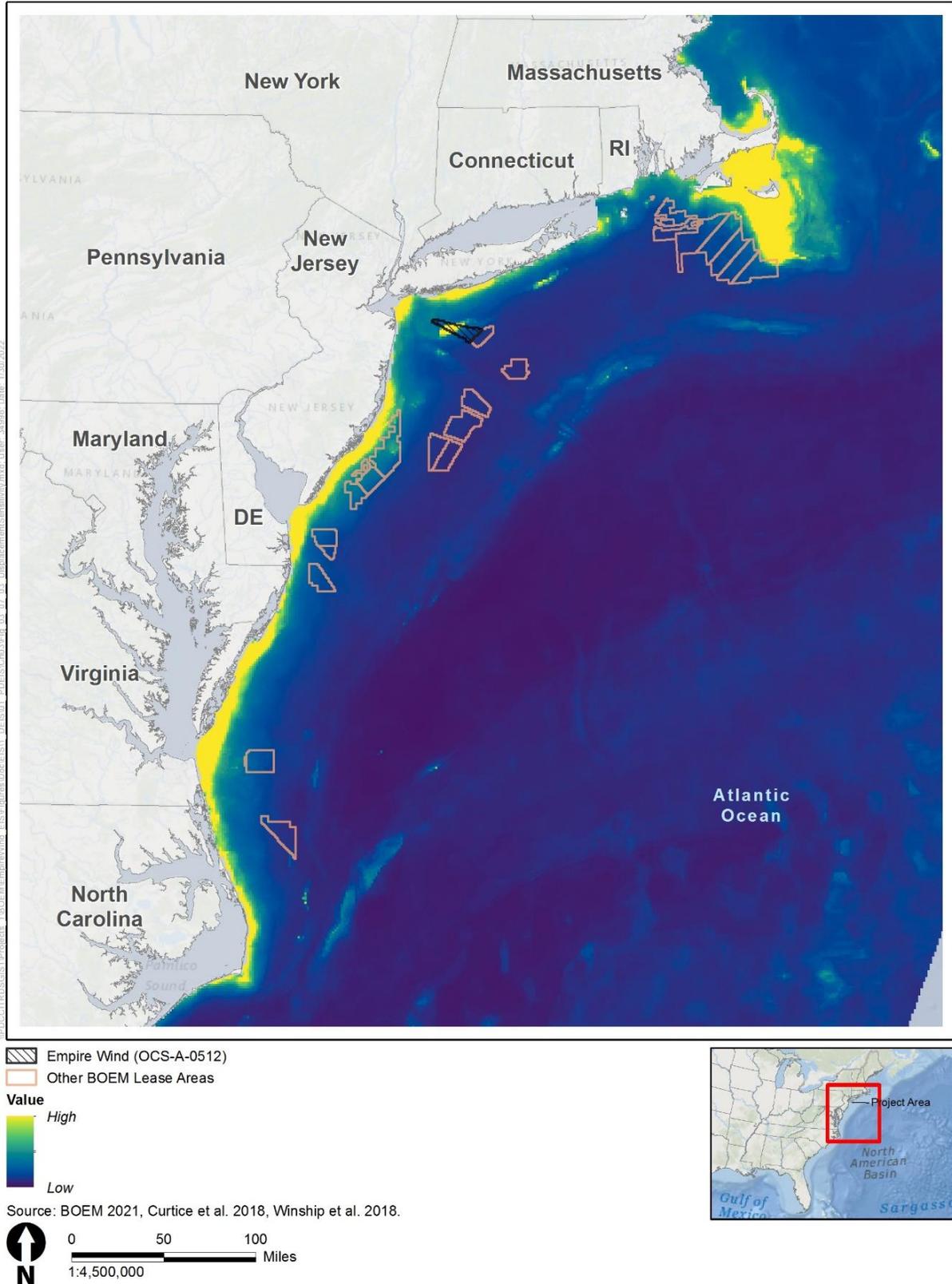


Figure 3.7-4 Total Avian Relative Abundance Distribution Map for the Higher Displacement Sensitivity Species Group

Many of these passerine species, while detected on the OCS during migration as part of BOEM's Acoustic/Thermographic Offshore Monitoring project (Robinson Willmott and Forcey 2014), were documented in relatively low numbers. Most of the activity (including blackpoll warblers) was during windspeeds less than 10 kilometers per hour—below the turbine cut-in speed (see Figure 109 in Robinson Willmott and Forcey 2014)—and thus minimizing risk to migrating passerines from spinning turbine blades. Most carcasses of small migratory songbirds found at land-based wind energy facilities in the Northeast were within 2 meters of the turbine towers, suggesting that they are colliding with towers rather than moving turbine blades (Choi et al. 2020). Although it is possible that migrating passerines, including flocks, could collide with offshore structures (including vessels), migrating passerines are also occasionally found dead on boats, presumably from exhaustion (e.g., Stabile et al. 2017). Equinor documented dead or injured birds found on vessels during G&G surveys for the Lease Area since 2018, and observed 0 birds in 2018, 37 in 2019, 19 in 2020, and 7 in 2021 (Equinor 2019, 2021). The majority of birds found in 2019 (month of May) were white-throated sparrows. In 2020 (mid-October to mid-November) about half of the birds found were pine siskins, with the remaining consisting of one or more swamp sparrow, purple finch, dark-eyed junco, northern parula, American robin, ruby-crowned kinglet, red-breasted nuthatch, and common redpoll. In 2021 (one day each in February, May, and August), observed birds included one or more white-throated sparrow, pine siskin, gray catbird, and herring gull. Empire has committed to implementing a monitoring program to answer specific questions, including identifying key bird species of interest and, when possible, contributing to the understanding of long-term, project-specific impacts and larger-scale efforts to understand cumulative impacts on birds (APM 82). In addition, Empire has committed to implementing a *Bird and Bat Monitoring Framework* that outlines an approach to post-construction bird monitoring that supports advancement of the understanding of bird interactions with offshore wind farms (Appendix H, Attachment H-3).

Some marine bird species might avoid the Lease Area during its operation, leading to an effective loss of habitat. For example, loons (Dierschke et al. 2016; Drewitt and Langston 2006; Lindeboom et al. 2011; Percival 2010; Petersen et al. 2006), grebes (Dierschke et al. 2016; Leopold et al. 2011; Leopold et al. 2013), seabirds (Drewitt and Langston 2006; Petersen et al. 2006), and northern gannets (Drewitt and Langston 2006; Lindeboom et al. 2011; Petersen et al. 2006) typically avoid offshore wind developments. The proposed Projects would no longer provide foraging opportunities to those species with high displacement sensitivity, but suitable foraging habitat exists in the immediate vicinity of the proposed Projects and throughout the region. However, as depicted on Figure 3.7-4, modeled use of the Lease Area by bird species with high displacement sensitivity is low (see explanation above for the high abundance rating in part of the Lease Area related to common murre). A complete list of species included in the higher displacement sensitivity group can be found in Robinson Willmott et al. (2013). Because the Lease Area is not likely to contain important foraging habitat for the species susceptible to displacement, BOEM expects this loss of habitat to be insignificant. Population-level, long-term impacts resulting from habitat loss would likely be negligible.

The expected impacts of the Proposed Action would increase incrementally beyond those described under the No Action Alternative. The structures associated with the Proposed Action and the consequential impacts would be long term and would remain at least until decommissioning of the proposed Projects is complete.

Generally, onshore operation is not expected to pose any significant IPFs (i.e., hazards) to birds because activities would disturb little if any habitat, and the onshore export cables would be below ground. The EW 1 and EW 2 onshore Project components would be within highly disturbed areas with little or no natural habitats.

Traffic (aircraft): The expected impacts of aircraft traffic associated with the Proposed Action would not increase the impacts of this IPF beyond those described under the No Action Alternative.

Land disturbance: The expected impacts of onshore construction associated with the Proposed Action would not increase the impacts of this IPF beyond those described under the No Action Alternative. Empire would implement trenchless technology (e.g., HDD) for the EW 2 offshore export cable landing to go under beaches, which would avoid beach habitat for nesting shorebirds (COP Volume 2b, Section 5.1.1.2; Empire 2023); as such, temporary impacts on birds, particularly nesting shorebirds, resulting from the landfall location would be negligible. Collisions between birds and vehicles or construction equipment have some limited potential to cause mortality. However, these temporary impacts, if any, would be negligible, as most individuals would avoid noisy construction areas (Bayne et al. 2008; Goodwin and Shriver 2010; McLaughlin and Kunc 2013).

Impacts on bird habitat from onshore construction activities would be limited. The EW 1 Onshore Project area (which also includes the O&M facility) lacks natural bird habitat (i.e., significantly altered by human development and primarily used for industrial and commercial operations) and does not support native species or species of conservation concern; some species that associate with coastal urbanized areas (e.g., pigeons, seagulls) occur in the geographic analysis area. Therefore, impacts on birds from construction and operations of EW 1 onshore components and the O&M facility would be negligible, as no natural habitat would be affected.

While habitats in the EW 2 Onshore Project area have also been significantly altered by human development, there are some small areas of tree and shrub habitat that could be affected, depending on the substation and onshore cable route; however, these more natural areas are isolated and surrounded by developed and urbanized areas. During construction, the onshore export and interconnection cables and onshore substations for EW 2 would require varying acreage of tree removal, which would be a long-term impact lasting until decommissioning and restoration. To minimize disturbance, the majority of the proposed onshore export and interconnection cable routes would be sited in already disturbed areas (e.g., existing roadways) to the extent practicable (APM 74).

Construction of onshore export cable segment IP-C would require vegetation removal in three isolated areas between Long Beach Road and Daly Boulevard (6.44 acres herbaceous, 1.99 acres forest/wooded vegetation, and 0.41 acre scrub/shrub). Construction of EW 2 Onshore Substation C would require the removal of approximately 0.55 acre of tree/shrub habitat along the existing railroad corridor. Clearing and grading during construction within temporary workspaces would result in short-term loss of forage and cover for birds within the area. Construction of Onshore Substation C would result in long-term impacts on habitat from construction of the permanent substation facilities and short-term impacts for temporary construction workspaces. Any remnant habitat within the permanent substation site would be converted to developed land with landscaping for the duration of the Projects' operational lifetime. Landscaped areas would provide some habitat for species acclimated to human activity. Tree and shrub removal for onshore export cable installation would likely result in a maintained right-of-way of herbaceous/low shrub vegetation, which would be a short-term impact for herbaceous/low shrub vegetation and a long-term impact for tree removal. Empire would implement measures to avoid and minimize bird impacts, including revegetating disturbed areas (APM 83). Given the nature of the existing conditions of the Onshore Project area (i.e., developed and highly urbanized with little or no natural habitat), the temporary nature of construction, and Empire's commitment to measures to avoid and reduce bird impacts, the impacts on birds are not expected to be measurable.

3.7.5.1. Impact of the Connected Action

As described in Chapter 2, infrastructure improvements have been proposed at SBMT that include in-water activities (i.e., dredging and dredged material management, replacement and strengthening of existing bulkheads, installation of new pile-supported and floating platforms, installation of new fenders), as well as some upland activities (building construction and paving). As previously stated in Section 3.7.1, habitats within and in the vicinity of the EW 1 Onshore Project area are significantly altered by

human development and are primarily used for industrial and commercial operations. The EW 1 area and surrounding vicinity serve as a transportation and service corridor and associated infrastructure is a dominant feature. Due to the mobility of birds, a variety of species have the potential to pass through the EW 1 Onshore Project area. However, due to the highly developed nature of the EW 1 Onshore Project area, the SBMT does not provide important bird habitat. BOEM expects the activities associated with the connected action to affect birds primarily through the noise, accidental releases, and land disturbance IPFs. Other IPFs considered under the Proposed Action do not apply (e.g., cable emplacement and maintenance, traffic [aircraft]), and because the surrounding area consists of existing structures and other infrastructure, the presence of structures IPF would not pose a substantial risk to birds.

Noise: The expected impacts of noise associated with the connected action's activities could affect any birds that may be in the vicinity of the SBMT. However, similar to under the Proposed Action, construction noise would be temporary and localized and would not be anticipated to be significantly different than the noise levels in the surrounding urban environment. If pile driving is necessary during construction, the noise would be temporary and would cease after piles are installed. Similarly, dredging vessels and other construction noise could temporarily disturb and displace bird species, but they are likely already acclimated to noise in an urban environment and would be able to move away from the noise. Normal operation at the SBMT would generate continuous noise, but BOEM expects negligible long-term impacts when considered in the context of the other commercial and industrial noises in the EW 1 Onshore Project area. BOEM anticipates noise impacts associated with the connected action to be negligible.

Accidental releases: Onshore construction activities would require heavy equipment use, and potential spills could occur as a result of an inadvertent release from the machinery or during refueling activities. Some potential exists for bird impacts (e.g., injury from exposure) due to the accidental release of fuel, hazardous materials, and trash and debris from vessels associated with dredging and construction equipment in the aquatic and terrestrial environment around SBMT. BOEM assumes an SPCC plan would be developed and implemented to avoid, minimize, and contain spills. Accidental releases, if any, would occur infrequently at discrete locations and vary widely in space and time; as such, BOEM expects localized and short-term impacts on birds. In addition, all dredging equipment/use of watercraft and in-water work would comply with federal, state, and local permitting (e.g., CWA Section 404 and 401) requirements for prevention and control of petrochemical spills, including oil and fuel. Normal operation at the SBMT could result in accidental releases, but BOEM expects negligible impacts due to federal, state, and local requirements to contain and clean up releases. Therefore, BOEM anticipates accidental releases associated with the connected action to be negligible.

Land disturbance: Improvement activities at the SBMT would remove all existing structures and approximately 40 percent of the currently paved area. After additional excavation for installation of subsurface piles, utilities, and building structures, only minor grade changes are anticipated. The site would be repaved and new structures installed. Impacts on upland vegetation would be limited to removal of approximately 0.05 acre of volunteer invasive vegetation throughout the SBMT site and three poplar trees along the north side of the 35th Street Pier to replace a bulkhead, with each tree being approximately 4 inches in diameter at breast height. The removal of this vegetation is not anticipated to affect birds because it is low-quality habitat and not considered significant or important to birds. Therefore, BOEM anticipates land disturbance associated with the connected action to be negligible.

3.7.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind activities, other planned offshore wind activities, and the connected action at SBMT. Ongoing and planned non-offshore wind activities related to installation of new submarine cables and pipelines, onshore development (including a planned

substation and underground loop-in/loop-out lines for the Oceanside POI), marine minerals extraction, port expansions, and installation of new structures on the OCS would contribute to impacts on birds through the primary IPFs of accidental releases, lighting, cable emplacement and maintenance, presence of structures, traffic (aircraft), and land disturbance. Construction related to the connected action at SBMT and for the planned Hampton Road Substation and loop-in/loop-out lines for the Oceanside POI could affect birds through the removal a few small trees, by generating temporary and localized noise, and with potential accidental releases of fuels and hazardous materials. The construction, O&M, and decommissioning of both onshore and offshore infrastructure for offshore wind activities across the geographic analysis area would also contribute to the primary IPFs of accidental releases, lighting, cable emplacement and maintenance, presence of structures, traffic (aircraft), and land disturbance. Given that the abundance of bird species that overlap with wind energy facilities on the Atlantic OCS is relatively small, offshore wind activities would not appreciably contribute to impacts on bird populations. Temporary disturbance and permanent loss of habitat onshore may occur as a result of offshore wind development. However, habitat removal is anticipated to be minimal, and any impacts resulting from habitat loss or disturbance would not be expected to result in individual fitness or population-level effects within the geographic analysis area. Ongoing and planned offshore wind activities in combination with the Proposed Action would result in an estimated 3,031 WTGs, of which the Proposed Action would contribute 147 or about 5 percent, and would include up to more than 37,353 acres (155.4 km²) of seafloor disturbed from the offshore export cable and interarray cables.

The cumulative impacts on birds would likely be moderate because, although bird abundance on the OCS is low, there could be unavoidable impacts offshore and onshore; however, BOEM does not anticipate the impacts to result in population-level effects or threaten overall habitat function. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the cumulative accidental releases, lighting, cable emplacement and maintenance, presence of structures, traffic (aircraft), and land disturbance impacts on birds.

3.7.5.3. Conclusions

Impacts of the Proposed Action. Activities associated with the construction, installation, O&M, and eventual decommissioning of the Proposed Action would have **minor** impacts on birds, depending on the location, timing, and species affected by an activity. The primary impacts of the Proposed Action affecting birds are habitat loss and collision-induced mortality from rotating WTGs and long-term habitat loss and conversion from onshore construction. The Proposed Action would also potentially result in **minor beneficial** impacts associated with foraging opportunities for some marine birds. The primary impacts of the connected action are related to noise, accidental releases, and land disturbance, which could affect birds in the EW 1 Onshore Project area. However, given the developed nature of the EW 1 Onshore Project area, birds are likely acclimated to activities similar to those related to the connected action; therefore, BOEM anticipates impacts of the connected action would be **negligible**.

BOEM prepared a BA assessing the potential effects on federally listed species (BOEM 2022). Consultation with USFWS pursuant to Section 7 of the ESA was concluded June 22, 2023. In USFWS's transmittal letter for the Biological Opinion, USFWS concurred with BOEM's determination of not likely to adversely affect for the roseate tern. USFWS also concurred with BOEM's determination of not likely to adversely affect for piping plover and rufa red knot for Project impacts unrelated to collisions with WTGs (USFWS 2023). USFWS conservation measures, other Project measures, and nondiscretionary terms and conditions included in the Biological Opinion to minimize or compensate for Project effects related to collision risk or to address significant data gaps in avian and bat use of offshore areas, collision modeling, and compensatory mitigation are presented in Table H-1 (Appendix H). With the adoption of these measures it is the USFWS's Opinion that operation of the EW 1 and EW 2 offshore wind energy projects is not likely to jeopardize the continued existence of the Atlantic Coast piping plover or the rufa red knot (USFWS 2023).

Cumulative Impacts of the Proposed Action. BOEM anticipates that the cumulative impacts on birds in the geographic analysis area would be **moderate**, as well as **moderate beneficial**. In context of other reasonably foreseeable environmental trends in the area, the incremental impacts contributed by the Proposed Action to the cumulative impacts on birds would be undetectable. The Proposed Action would contribute to the cumulative impacts primarily through the permanent impacts from the presence of structures and long-term impacts from habitat loss related to the EW 2 Onshore Station C site and cable route that would cross three isolated habitat areas.

3.7.6 Impacts of Alternatives B, E, and F on Birds

Impacts of Alternatives B, E, and F. Alternatives B and E would alter the turbine array layout compared to the Proposed Action; however, each of these alternatives would allow for installation of up to 147 WTGs as defined in Empire's PDE. Under Alternative F, a maximum of 138 WTGs could be constructed compared to up to 147 WTGs under the Proposed Action (reduction of 9 WTGs). While the WTGs may move to a different position in the Lease Area under Alternatives B and E, and the number of WTGs would be slightly reduced under Alternative F, impacts on birds would not materially change compared to those of the Proposed Action. All other offshore and onshore Project components of Alternatives B, E, and F would be the same as under the Proposed Action.

Cumulative Impacts of Alternatives B, E, and F. The cumulative impacts on birds would be moderate and moderate beneficial for the same reasons described for the Proposed Action. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B, E, and F to the cumulative impacts on birds would be the same as those described under the Proposed Action.

3.7.6.1. Conclusions

Impacts of Alternatives B, E, and F. As discussed above, the expected **minor** impacts and potential **minor beneficial** impacts associated with the Proposed Action would not change under Alternative B, E, or F.

Cumulative Impacts of Alternatives B, E, and F. The cumulative impacts on birds would be moderate and moderate beneficial for the same reasons described for the Proposed Action. Therefore, cumulative impacts of Alternatives B, E, and F would be **moderate** and **moderate beneficial**.

3.7.7 Impacts of Alternative C, D, and G on Birds

Impacts of Alternatives C, D, and G. The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Projects under Alternative C, D, or G would be the same those described under the Proposed Action. Submarine and onshore cable route options around the Gravesend Anchorage (Alternative C-1) and the Ambrose Navigation Channel (Alternative C-2), to avoid the sand borrow area (Alternative D), or to use a cable bridge to cross Barnums Channel (Alternative G) are already covered under the Proposed Action as part of the PDE approach and narrowing the submarine and onshore cable route options under Alternative C, D, or G would not materially change the analyses of any IPF. All other offshore and onshore Project components would be the same as under the Proposed Action.

Cumulative Impacts of Alternatives C, D, and G. The cumulative impacts on birds would be moderate and moderate beneficial for the same reasons described for the Proposed Action. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B, E, and F to the cumulative impacts on birds would be the same as those described under the Proposed Action.

3.7.7.1. Conclusions

Impacts of Alternatives C, D, and G. As discussed above, the expected **minor** impacts and potential **minor beneficial** impacts associated with the Proposed Action would not change under Alternative C, D, or G.

Cumulative Impacts of Alternatives C, D, and G. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative C, D, or G to cumulative impacts on birds would be undetectable. Because the impacts of the Proposed Action would not change under Alternative C, D, or G, BOEM anticipates that the cumulative impacts of Alternatives C, D, and G would be the same as described for the Proposed Action. Therefore, cumulative impacts of Alternatives B, E, and F would be **moderate** and **moderate beneficial**.

3.7.8 Impacts of Alternative H on Birds

Impacts of Alternative H. The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Projects under Alternative H would be the same those described under the Proposed Action. An alternate method of dredge and fill activity at the SBMT would not materially change the analysis of any IPF, as the Onshore Project area is heavily developed with little or no bird habitat. BOEM does not anticipate that any change in dredge and fill activity would affect undisturbed or natural areas. All other offshore and onshore Project components of Alternative H would be the same as under the Proposed Action.

Cumulative Impacts of Alternative H. The cumulative impacts on birds would be moderate and moderate beneficial for the same reasons described for the Proposed Action. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative H to the cumulative impacts on birds would be the same as those described under the Proposed Action.

3.7.8.1. Conclusions

Impacts of Alternative H. As discussed above, the expected **minor** impacts and potential **minor beneficial** impacts associated with the Proposed Action would not change under Alternative H.

Cumulative Impacts of Alternative H. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative H to the cumulative impacts on birds would be undetectable. Because the impacts of the Proposed Action would not change under Alternative H, BOEM anticipates that the cumulative impacts of Alternative H would be the same as described for the Proposed Action. Therefore, cumulative impacts of Alternative H would be **moderate** and **moderate beneficial**.

3.7.9 Comparison of Alternatives

Alternatives B and E would alter the turbine array layout compared to the Proposed Action; however, each of these alternatives would allow for installation of up to 147 WTGs as defined in Empire's PDE. Under Alternative F, a maximum of 138 WTGs could be constructed compared to up to 147 WTGs under the Proposed Action (reduction of 9 WTGs). Alternatives B and E would have the same number of WTGs as the Proposed Action, which would result in the same impacts on species with high collision sensitivity and high displacement sensitivity. Alternative F would have nine fewer WTGs compared to the Proposed Action, which would somewhat reduce the potential for collision and displacement; however, the overall impact level would not change—**minor** with **minor beneficial** impacts.

Alternative C, D, or G would not materially change the analysis compared to the Proposed Action because the cable route options that would be constructed under these alternatives are already covered

under the Proposed Action as part of the PDE approach. Therefore, the overall impact level would not change—**minor** with **minor beneficial** impacts.

Under Alternative H, an alternative method of dredge and fill activity would occur in waters around the SBMT, which would not materially change the analysis of any IPF compared to the Proposed Action because the Onshore Project area is heavily developed with little or no bird habitat. Therefore, the overall impact level would not change—**minor** with **minor beneficial** impacts.

In context of reasonably foreseeable environmental trends, BOEM anticipates that the cumulative impact of Alternatives B, C, D, E, F, G, and H in combination with ongoing and planned activities would result in **moderate** and **moderate beneficial** impacts on birds in the geographic analysis area.

As with the Proposed Action (Alternative A), activities associated with the construction, installation, O&M, and eventual decommissioning of the Preferred Alternative would have **minor** impacts on birds, depending on the location, timing, and species affected by an activity.

3.7.10 Summary of Impacts of the Preferred Alternative

The Preferred Alternative is a combination of Alternatives C-1, D, F, G, and H. Therefore, the EW 1 submarine export cable route would traverse the Gravesend Anchorage Area (USCG Anchorage #25); EW 2 cable route options would avoid impacts within 500 meters of the sand borrow area offshore Long Island; the wind turbine layout would be optimized to maximize annual energy production and minimize wake loss while addressing the presence of glauconite deposits across the Lease Area; the EW 2 export cable route would use an above-water cable bridge to construct the onshore export cable crossing at Barnums Channel; and the construction of the EW 1 export cable landfall would use a method of dredge or fill activities (clamshell dredging with environmental bucket) that would reduce the discharge of dredged material compared to other dredging options considered in the Empire Wind PDE.

Under the Preferred Alternative, the Lease Area would contain 138 WTGs, which is 9 WTGs (6 percent) fewer than the number of WTGs for the maximum-case scenario under Alternative A. Fewer WTGs may slightly reduce collision risk in the Lease Area; consequently, the Preferred Alternative could be less likely to affect birds than Alternative A. Changes to the export cable routes under the Preferred Alternative would not materially change the analyses of any IPF as compared to Alternative A. As with the Proposed Action (Alternative A), activities associated with the construction, installation, O&M, and eventual decommissioning of the Preferred Alternative would have **minor** impacts on birds, depending on the location, timing, and species affected by an activity. The primary impacts of the Preferred Alternative affecting birds are habitat loss and collision-induced mortality from rotating WTGs and long-term habitat loss and conversion from onshore construction. The Preferred Alternative would also potentially result in **minor beneficial** impacts associated with foraging opportunities for some marine birds.

3.7.11 Proposed Mitigation Measures

The mitigation measures listed in Table 3.7-4 are recommended for inclusion in the Preferred Alternative.

Table 3.7-4 Proposed Measures: Birds

Measure	Description	Effect
Adaptive mitigation for birds and bats	If the reported post-construction bird and bat monitoring results (generated as part of Empire's <i>Bird and Bat Monitoring Framework</i> (Appendix H, Attachment H-3) indicate bird and bat impacts deviate substantially from the impact analysis included in this EIS, then Empire must make recommendations for new mitigation measures or monitoring methods.	Adaptive management for birds would likely result in reduced potential impacts on birds on the OCS during operations. Should post-construction monitoring show impacts on birds deviate substantially from the impact analysis in the EIS, measures would be implemented to address the specific impact reported.
Annual Reporting	Annual Bird and Bat Mortality Reporting during construction and operation, and decommissioning. The Lessee must submit an annual report covering each calendar year, due by January 31 of the following year, documenting any dead (or injured) birds or bats found on vessels and structures during construction, operations, and decommissioning. The report must be submitted to BOEM (at renewable_reporting@boem.gov) and BSEE (at OSWSubmittals@bsee.gov) and USFWS. The report must contain the following information: the name of species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with Federal or research bands must be reported to the United States Geological Survey Bird Band Laboratory.	Annual bird mortality reporting can inform the Avian and Bat Post-Construction Monitoring Plan (see previous measure), which could lead to Empire recommending new mitigation measures or monitoring methods to reduce impacts on birds. In addition, mortality data can inform future BOEM offshore wind EIS analyses for proposed wind farms on the Atlantic OCS.
Reporting	Any occurrence of dead ESA birds or bats must be reported to BOEM, BSEE, and USFWS as soon as practicable (taking into account crew and vessel safety) after the sighting, and if practicable, carefully collect the dead specimen and preserve the material in the best possible state.	Annual bird mortality reporting can inform the Avian and Bat Post-Construction Monitoring Plan (see previous measure), which could lead to Empire recommending new mitigation measures or monitoring methods to reduce impacts on birds. In addition, mortality data can inform future BOEM offshore wind EIS analyses for proposed wind farms on the Atlantic OCS.
Bird Deterrent ¹	To minimize attracting birds to operating turbines, Empire Wind must install bird perching-deterrent devices on all WTGs and OSSs. The location of bird-deterrent devices must be proposed by Empire Wind based on best management practices applicable to the appropriate operation and safe installation of the devices. Empire Wind must confirm the locations of bird perching-deterrent devices as part of the documentation it must submit with the FDR.	While bird presence on the OCS is anticipated to be low, potential collision impacts with offshore WTGs and OSS could be reduced by requiring installation of bird perching deterrent devices to minimize bird attraction to operating WTGs and on the OSS.

Measure	Description	Effect
Light Impact Reduction ¹	Empire Wind must light each WTG and OSS in a manner that is visible by mariners in a 360-degree arc around the WTG and OSS. To minimize the potential of attracting migratory birds, the top of each light shall be shielded to minimize upward illumination (Conditional on USCG approval).	While the presence of birds on the OCS is anticipated to be low, shielding of light downward could minimize the potential for light attraction and collision.
Light Impact Reduction ¹	Empire Wind must use an FAA-approved vendor for the Aircraft Detection Lighting System (ADLS), which will activate the FAA hazard lighting only when an aircraft is in the vicinity of the wind facility to reduce visual impacts at night. Empire Wind must confirm the use of an FAA-approved vendor for ADLS on WTGs and OSSs in the FDR.	While the presence of birds on the OCS is anticipated to be low, implementation of ADLS would reduce bird attraction and potential collisions with offshore WTGs and OSS, given the limited amount of time that lights would actually be illuminated.
Adaptive Mitigation for Birds and Bats ¹	BOEM will require that Empire Wind develops and implements a Post-Construction Monitoring [PCM] plan based on the “Empire Offshore Wind Projects (EW 1 and EW 2): Proposed Bird and Bat Monitoring Framework” in coordination with USFWS and other relevant regulatory agencies. Annual monitoring reports will be used to determine the need for adjustments to monitoring approaches, consideration of new monitoring technologies, and/or additional periods of monitoring (see Appendix H, Table H-1 for more detail).	If the reported post-construction bird monitoring results (generated as part of Empire’s <i>Bird and Bat Monitoring Framework</i> [Appendix H, Attachment H-3]) indicate bird impacts deviate substantially from the impact analysis included in this EIS, then Empire must make recommendations for new mitigation measures or monitoring methods to reduce impacts.
Reporting ¹	Empire Wind must provide an annual report to BOEM and USFWS documenting any dead (or injured) birds or bats found on vessels and structures during construction, operations, and decommissioning. The report must contain the following information: the name of species, date found, location, a picture to confirm species identity (if possible), and any other relevant information. Carcasses with federal or research bands must be reported to the United States Geological Survey Bird Band Laboratory, available at https://www.pwrc.usgs.gov/bbl/ . Any occurrence of a dead ESA-listed bird or bat must be reported to BOEM, BSEE, and USFWS as soon as practicable (taking into account crew and vessel safety) after the sighting, and, if practicable, the dead specimen will be carefully collected and preserved in the best possible state.	Annual bird mortality reporting can inform the Avian and Bat Post-Construction Monitoring Plan (see previous measure), which could lead to Empire recommending new mitigation measures or monitoring methods to reduce impacts on birds. In addition, mortality data can inform future BOEM offshore wind EIS analyses for proposed wind farms on the Atlantic OCS.

Measure	Description	Effect
USFWS Biological Opinion Conservation and Other Project Measures	Conservation Measures for activities under BOEM's jurisdiction were provided related to the design and spacing of WTGs, offshore lighting, ongoing support for and regular utilization of a Collision Risk Model, monitoring and data collection as part of implementation of an Avian and Bat Post-Construction Monitoring Plan, incidental mortality reporting, and compensatory mitigation for collisions of listed birds.	These conservation measures would reduce potential for collision risk to listed birds posed by operation of the WTGs. These measures also include an ongoing, long-term commitment to reduce the uncertainty associated with the estimated rates of collision mortality for each of the two listed bird species. Implementation of these conservation measures would provide incremental reductions in impacts on birds, improve accountability, and reduce uncertainty associated with estimated rates of collision mortality, but would not alter the overall impact determination.

¹ These measures are a result of BOEM's ESA Section 7 consultation with USFWS and are listed in BOEM's BA for species under USFWS jurisdiction. The last two are similar to the first two measures in the table that were developed for the EIS, but worded slightly differently; however, they are not materially different.
FDR = Facility Design Report

3.7.11.1. Effect of Measures Incorporated into the Preferred Alternative

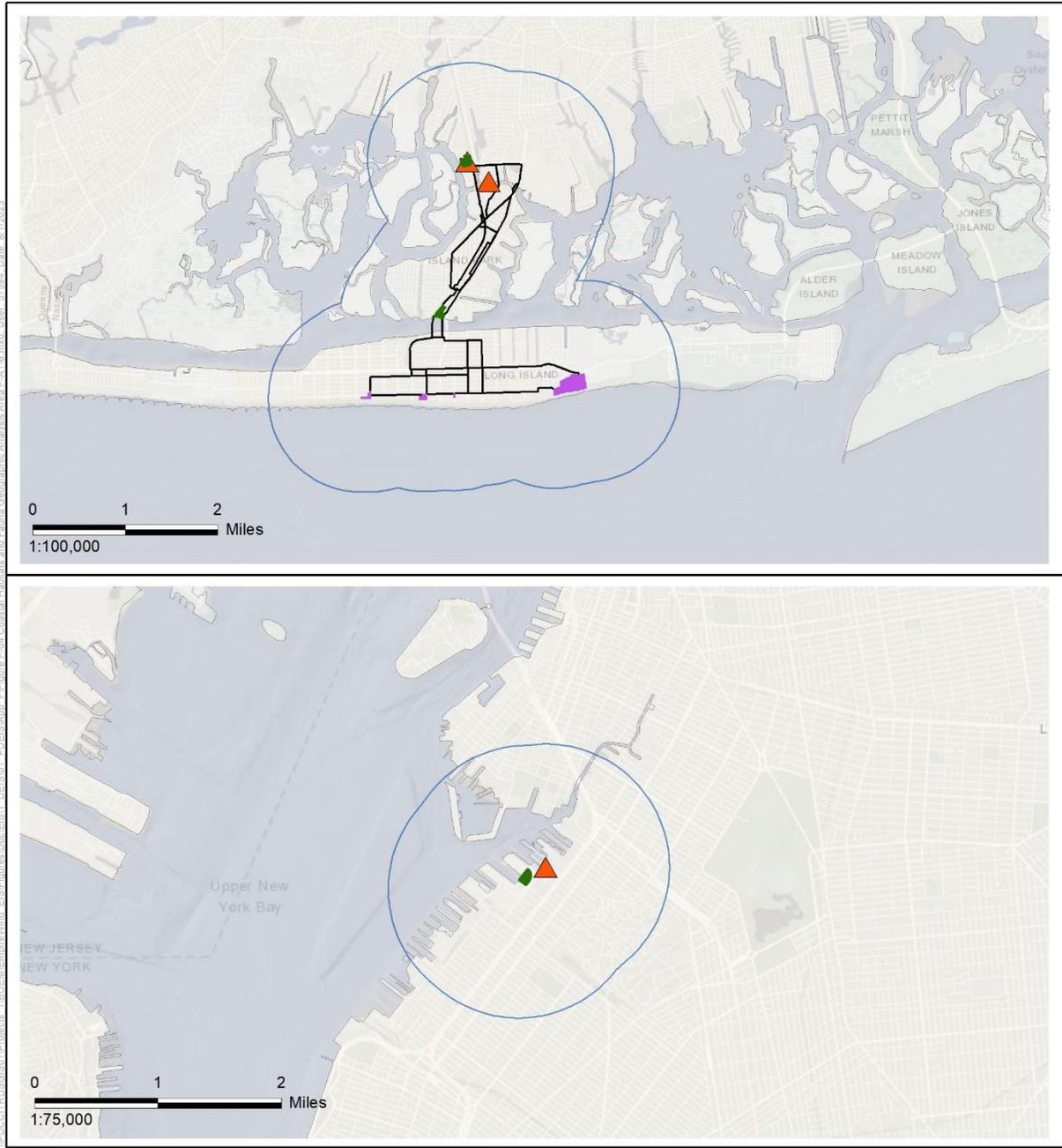
The mitigation measures listed in Table 3.7-4 are recommended for inclusion in the Preferred Alternative. These measures would further define how the effectiveness and enforcement of APMs would be ensured and improve accountability for compliance with APMs by requiring monitoring, reporting, and adaptive management of potential bird impacts on the OCS. In addition, implementation of collision and light reduction measures on the offshore Project components would ensure interactions between birds and the offshore wind infrastructure would be minimized. However, given bird use of the OCS is anticipated to be low, offshore wind activities are unlikely to appreciably contribute to impacts on birds regardless of measures intended to address potential offshore bird impacts. In the onshore environment, conducting surveys and coordinating with BOEM, BSEE, and USFWS and implementing species- and habitat-avoidance measures would ensure impacts on birds and their habitats would be avoided and minimized to the extent practicable. These measures would provide for incremental reductions in impacts on birds, improve accountability, and reduce uncertainty associated with estimated rates of collision mortality, but would not reduce the overall impact level determination for the Preferred Alternative from what is described in Section 3.7.10, *Summary of Impacts of the Preferred Alternative*.

3.8. Coastal Habitat and Fauna

This section discusses potential impacts on coastal habitat and fauna resources from the proposed Projects, alternatives, and ongoing and planned activities in the coastal habitat and fauna geographic analysis area. Coastal habitat includes flora and fauna within state waters (which extend 3 nm from the shoreline) inland to the mainland, including the foreshore, backshore, dunes, and interdunal areas. The coastal habitat and fauna geographic analysis area, as shown on Figure 3.8-1, includes the area within a 1.0-mile (1.6-kilometer) buffer of the Onshore Project area that includes the export cable landfalls, onshore export cable routes, the onshore substations, the connection from the onshore substations to the POI, and the O&M facility. This section analyzes the affected environment and environmental consequences of the Proposed Action and alternatives on coastal flora and fauna, including special-status species. The affected environment and environmental consequences of Project activities that are within the geographic analysis area and extend into state waters (i.e., HDD for cable landfalls and cable laying within 1 mile [1.6 kilometers] of cable landfalls) are presented in Sections 3.6, *Benthic Resources*; 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*; 3.15, *Marine Mammals*; 3.19, *Sea Turtles*; and 3.21, *Water Quality*. Additional information on birds, bats, and wetlands is presented in Section 3.7, *Birds*, Section 3.5, *Bats*, and Section 3.22, *Wetlands*, respectively.

3.8.1 Description of the Affected Environment for Coastal Habitat and Fauna

The geographic analysis area is within urbanized landscapes in the New York metropolitan area, and the onshore export and interconnection cables, onshore substations, and O&M facility are primarily along or within existing roadway corridors. Vegetation almost entirely consists of landscape plants, including trees, shrubs, other ornamental plants, and maintained grass. This includes landscaped areas along roadways, within roadway medians, and in local parks and cemeteries (e.g., Green-Wood Cemetery). Wildlife is expected to be limited to those species adapted to living in urban environments, such as gulls, pigeons, squirrels, and other small rodents or other commensal wildlife. Areas that contain larger expanses of open space and natural land cover, such as parks and riparian areas associated with existing waterbodies, are expected to have higher densities of common wildlife species. However, due to the urban nature of these terrestrial areas, wildlife species expected to occur will be limited to those adapted to living in association with human-influenced landscapes, disturbance, and noise. Shorebirds may forage on the public beaches adjacent to the export cable landfall locations, and marsh islands at the periphery of the geographic analysis area may serve as foraging or nesting habitat. Invasive plant species commonly associated with disturbed and urban areas occur, often at high densities, throughout the Onshore Project area. Due to the high level of development, impervious surfaces, and other such areas that are devoid of vegetation within the onshore export and interconnection cable construction corridors, onshore substations, and O&M facility, invasive plant species are concentrated within and adjacent to disturbed wetlands and streams as well as along vegetated edges of public roadways (Empire 2023).



I:\PROJECTS\GIS\Projects_1\BOEM\EmpireWind_EIS\FaunaDec\ES11_DEIS\Map_Figures\Fig 3.8 Coastal Habitat and Fauna Geographic Analysis Area E-A1.6.mxd; User: BTB04; Date: 8/1/2023

- Coastal Habitat and Fauna Geographic Analysis Area
- Potential Onshore Substation Parcel
- Cable Landfall Site
- Point of Interconnection



Source: BOEM 2021, Empire 2023.



Figure 3.8-1 Coastal Habitat and Fauna Geographic Analysis Area

EW 1

The SBMT is a commercial shipping terminal dominated by a paved lot and warehouse buildings, with over 95 percent impervious surfaces; vegetation is limited to volunteer invasives and a line of poplar trees on the north side of the 35th Street Pier (NYCEDC 2023). From the EW 1 landfall at SBMT, where the onshore substation would also be located, the interconnection cable route would travel northeast along an existing public roadway to the Gowanus POI. The O&M facility would be located on SBMT, directly to the south of the EW 1 onshore substation. The Gowanus POI consists of a paved lot that already contains electrical transmission infrastructure and is devoid of any vegetation. Based on the 2016 National Land Cover Database and aerial imagery, the onshore substation parcel is primarily situated within developed lands (see COP Volume 2, Figure 5.1-3; Empire 2023).

As the EW 1 interconnection cable route and onshore substation would be within an urban landscape and an area mostly devoid of vegetation, wildlife expected to occur would be limited to scavengers and those adapted to living in association with human disturbance and noise, including gulls, pigeons, and small rodents. Other seabird species and migratory birds could occur along the route; however, due to the lack, and already-fragmented nature, of natural habitat, these are not expected to occur at high densities (Empire 2023).

One plant listed as threatened under the ESA may occur in the EW 1 geographic analysis area: seabeach amaranth (*Amaranthus pumilus*) (USFWS 2022; Empire 2023). However, the primary habitat associated with the species—foredunes, non-eroding beaches, and overwash flats at the end of islands—does not exist in the EW 1 geographic analysis area. Sites visits conducted in August to October 2020 for the SBMT Improvement Project included vegetation surveys at the SBMT and seabeach amaranth and associated habitat was not observed (NYCEDC 2023). Three bird species and one mammal listed as threatened or endangered under the ESA may also occur or potentially occur in the geographic analysis area; these species are addressed in Section 3.7, *Birds*, and Section 3.5, *Bats*. The Empire Wind BA (BOEM 2022) provides a detailed discussion of ESA-listed species and potential impacts of the Projects on these species.

The EW 1 Onshore Project area is not within New York State Significant Coastal Fish and Wildlife Habitats. Natural Heritage Database inquiries were submitted to the NYSDEC Division of Fish and Wildlife, and results indicated that the peregrine falcon (*Falco peregrinus*) may be present in the vicinity of the EW 1 submarine export cable route, as there is a documented breeding occurrence on the Verrazzano-Narrows Bridge (see COP Appendix N; Empire 2023); however, the bridge is outside of the geographic analysis area.

EW 2

Overall, EW 2 would be situated within developed lands of variable development intensity, with vegetation primarily limited to the area within and adjacent to Onshore Substation C, as well as strips along transportation corridors (i.e., roads and rail) and maintained lawn. Four export cable landfall options (Landfalls A, B, C, and E) are currently under review for EW 2. Proposed Landfalls consist of a bare vacant parcel used for parking (Landfall A), existing paved parking lots devoid of vegetation (Landfalls B and C), and a previously disturbed vacant lot (Landfall E). Barrier beaches are present between the landfall locations and the shoreline. Long Beach (Landfalls A, B, and E) is sandy with no vegetation while Lido Beach (Landfall C) includes vegetated dunes. A total of six onshore export cable route segments are under review to traverse the island of Long Beach from the export cable landfall options to the Reynolds Channel crossing. These routes would travel along existing roads in areas dominated by high-intensity development (see COP Volume 2, Figure 5.1-4; Empire 2023). After crossing the Reynolds Channel into Island Park, a total of five cable routes under review would traverse Island Park to Onshore Substation A. These routes would travel along existing roads in areas dominated

by high- and medium-intensity development (see COP Volume 2, Figure 5.1-5; Empire 2023); there are three isolated vegetated areas (e.g., herbaceous, forest/wooded vegetation, and scrub/shrub) along onshore export cable segment IP-C between Long Beach Road and Daly Boulevard. Onshore Substation A would be on a developed parcel with no natural vegetation (see COP Volume 2, Table 5.1-2 and Figure 5.1-5; Empire 2023). EW 2 Onshore Substation C would be on the north side of Reynolds Channel along an existing railroad corridor and, if selected, would eliminate the need for the five cable routes under review that would traverse Island Park to Onshore Substation A. The EW Onshore Substation C site is composed of several active commercial properties with approximately 70 percent of the site devoid of vegetation and includes commercial buildings, supporting ancillary appurtenances, roads, and gravel parking areas. The remaining 30 percent of the site consists of vegetated perimeters (some trees and shrubs) of parking lots and an approximately 1-acre area that has been routinely disturbed with land clearing and soil disturbance.

Considering the high percentage of development within the onshore export cable route corridor, this portion of EW 2 would be suitable for species common to urban environments comprising sparsely vegetated and highly fragmented habitat. Gulls, pigeons, and seabird species may occur as transients in low densities, with seabird species increasing in relative density closer to the landfall. Species occurring along the beach may include foraging individuals or transient migrants; however, the beach is highly developed and routinely raked and therefore contains poor-quality breeding habitat. Areas in the northern portion of the onshore export cable route corridor in the vicinity of onshore export cable segments IP-C and IP-G north and west of Long Beach Road and south of Daly Boulevard are composed primarily of scrub/shrub habitats that may provide foraging and nesting habitat for wildlife species (Empire 2023). The undeveloped areas of the EW 2 Onshore Substation C site may have the potential to provide some habitat for certain urban bird species, but this area is not expected to be important habitat for any species and is completely isolated by surrounding developments.

One plant listed under the ESA may occur in the EW 2 geographic analysis area: seabeach amaranth (threatened) (USFWS 2022). As previously mentioned, seabeach amaranth habitat generally consists of foredunes, non-eroding beaches, and overwash flats at the ends of islands. Individuals or populations of seabeach amaranth have been identified as potentially occurring within Project components at Lido Beach (see COP Volume 2, Table 5.1-3; Empire 2023). BOEM notes that COP Section 5.1.1.2 and Table 5.1-3 indicate a second federally listed plant potentially present in the geographic analysis area: sandplain gerardia (endangered). However, the ESA species information in the COP is based on an Information for Planning and Consultation query from June 2021, and the species no longer occurs or potentially occurs in the geographic analysis area based on BOEM's more recent Information for Planning and Consultation queries in preparation for this EIS and the Empire Wind BA. Three bird species and one mammal listed as threatened or endangered under the ESA may also occur or potentially occur in the geographic analysis area; these species are addressed in Section 3.7, *Birds*, and Section 3.5, *Bats*. The Empire Wind BA provides a detailed discussion of ESA-listed species and potential impacts of the Projects on these species (BOEM 2022).

Natural Heritage Database inquiries were submitted to NYSDEC, Division of Fish and Wildlife, and results indicated that nine threatened, endangered, or species of conservation concern have been documented in the vicinity of EW 2, including seven bird species and two plant species (seabeach amaranth and sandplain gerardia) (see COP Appendix N; Empire 2023). Three significant communities were also identified as potentially occurring within the tidal channels in the vicinity of onshore export cable segments IP-C and IP-G north and west of Long Beach Road and south of Daly Boulevard and two significant natural communities, both comprising sensitive beach habitats, were identified at Landfall C and the temporary work area associated with the landfall site. A small area of the Landfall C parcel overlaps with the western tip of the state designated Nassau Beach Significant Coastal Fish and Wildlife Habitat site (New York State 2008). A review of the New York State Wildlife Action Plan found that the

geographic analysis area is most closely associated with six habitat types defined in the State Wildlife Action Plan: (1) brackish intertidal mesohabitat, (2) marine intertidal mesohabitat, (3) brackish subtidal shallow mesohabitat, (4) coastal grassland/shrubland, (5) maintained grasses and mixed cover, and (6) urban/suburban (NYSDEC 2015). These habitat types are associated with 116 SGCN,¹ of which 59 are birds, 2 are bats, and 24 are aquatic species (e.g., fish, crabs, clams). Examples of non-avian (i.e., birds and bats) SGCN that may be found in the Project area include diamondback terrapin, three-banded lady beetle, smooth greensnake, northern copperhead, black-bordered lemon moth, Jersey jair underwing, and Rambur’s forktail. However, as previously stated, natural habitat is limited along the cable routes due to the developed nature of the Onshore Project area.

3.8.2 Impact Level Definitions for Coastal Habitat and Fauna

Definitions of impact levels are provided in Table 3.8-1. There are no beneficial impacts on coastal habitat and fauna.

Table 3.8-1 Impact Level Definitions for Coastal Habitat and Fauna

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on species or habitat would be so small as to be unmeasurable.
Minor	Adverse	Most impacts on species would be avoided; if impacts occur, they may result in the loss of a few individuals. Impacts on sensitive habitats would be avoided; impacts that do occur are temporary or short term in nature.
Moderate	Adverse	Impacts on species would be unavoidable but would not result in population-level effects. Impacts on habitat may be short term, long term, or permanent and may include impacts on sensitive habitats but would not result in population-level effects on species that rely on them.
Major	Adverse	Impacts would affect the viability of the population and would not be fully recoverable. Impacts on habitats would result in population-level impacts on species that rely on them.

3.8.3 Impacts of the No Action Alternative on Coastal Habitat and Fauna

When analyzing the impacts of the No Action Alternative on coastal habitat and fauna, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for coastal habitat and fauna. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind activities, as described in Appendix F, *Planned Activities Scenario*.

3.8.3.1 Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for coastal habitats and fauna described in Section 3.8.1, *Description of the Affected Environment for Coastal Habitat and Fauna*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on coastal habitats and fauna include onshore residential, commercial, and industrial

¹ SGCN species are wildlife species experiencing a population decline (or some level of population decline) or have identified threats that may put them in jeopardy, are in need of timely management intervention or are likely to reach critical population levels in New York, or need conservation actions to maintain stable populations levels or sustain recovery (NYSDEC 2015).

development and climate change. Onshore construction activities and associated impacts are expected to continue at current trends and have the potential to affect coastal habitats and fauna. Onshore construction activities and associated impacts are expected to continue and have the potential to affect coastal habitat and fauna through temporary and permanent loss of coastal habitat and temporary noise impacts, which can cause avoidance behavior and displacement. Injury or mortality of individual animals could occur, but population-level effects would not be expected. Climate change would contribute to impacts on coastal habitats and fauna through global warming, sea level rise, and resulting modifications to habitat and ecology. Climate change is altering the seasonal timing and patterns of species distributions and ecological relationships, likely causing permanent impacts of unknown intensity (Friggens et al. 2018). Climate change and associated sea level rise results in dieback of coastal habitats caused by rising groundwater tables and increased saltwater inundation from storm surges and exceptionally high tides (USDA n.d.). Climate change may also affect coastal habitats through increases in instances and severity of droughts and range expansion of invasive species. Warmer temperatures will cause plants to flower earlier, will not provide needed periods of cold weather, and will likely result in declines in reproductive success of plant and pollinator species. Increased temperatures could lead to changes in mating, nesting, reproductive, and foraging behaviors of species. The effects of climate change on animals will likely include loss of habitat, population declines, increased risk of extinction, decreased reproductive productivity, and changes in species distribution (NJDEP 2020).

There are no ongoing offshore wind activities within the geographic analysis area for coastal habitat and fauna.

3.8.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with the other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Other planned non-offshore wind activities that may affect coastal habitat and fauna primarily include onshore development activities (see Appendix F, Section F.2.13 for descriptions) These activities may result in short-term and permanent impacts on coastal habitat and fauna, including habitat degradation, removal, and conversion; and disturbance, displacement, injury, and mortality of individual wildlife species.

Planned offshore wind activities could contribute to individual displacement, injury, mortality, and habitat loss or modification via noise, land disturbance, vehicle collisions, and climate change if there is overlap with the geographic analysis area. Activities from these projects would be temporary, and some fauna would likely return to disturbed areas following completion of construction, depending on the amount of land disturbance. BOEM is not aware of any planned offshore wind activities other than the Proposed Action that would overlap the geographic analysis area for coastal habitat and fauna. However, if any planned offshore wind activities are identified and occur within the highly urbanized landscape of the geographic analysis area, impacts would be similar to those under the Proposed Action, and any adverse impacts on coastal habitats and fauna under the No Action Alternative would be minimal. While planned offshore wind activities may result in minimal onshore habitat impacts, offshore wind energy is expected to have a cumulative positive impact by helping to counteract climate change.

BOEM expects planned offshore wind activities to affect coastal habitat and fauna through the following primary IPFs.

Noise: Onshore construction noise associated with any planned offshore wind activities could result in temporary and highly localized impacts at the landing site, along the onshore export cable route, and at the onshore substation location. Impacts, if any, would be limited to behavioral avoidance of construction

activity and noise. Displaced wildlife could use adjacent habitat and would likely repopulate these areas once construction ceases. Construction would likely occur in the highly developed and urbanized landscape areas of the New York metropolitan area where wildlife is already habituated to human activity and noise. Therefore, no individual fitness or population-level effects on wildlife would be expected.

Land disturbance: BOEM anticipates that any planned offshore wind activities would require minimal disturbance of undisturbed lands and habitats given the extent of the highly developed areas and urbanized landscapes of the geographic analysis area. Some clearing of vegetation may be required for constructing the landfall, widening a transmission right-of-way, or clearing the substation footprint, but construction would be expected to generally occur in previously disturbed areas and areas generally fragmented or disconnected from other natural habitats. Use of construction and maintenance equipment could result in collisions with wildlife. However, it is anticipated that wildlife collisions would be rare because wildlife presence is expected to be limited due to the urban environment and because most individuals are expected to avoid construction areas or have the mobility to avoid construction equipment. Therefore, no individual fitness or population-level impacts on wildlife would be expected to occur during land disturbance activities, and onshore construction associated with planned offshore wind development would not be expected to appreciably contribute to cumulative impacts on wildlife.

3.8.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, coastal habitats and fauna would continue to be affected by existing environmental trends and ongoing activities. BOEM expects ongoing activities to have continuing temporary and permanent impacts (disturbance, displacement, injury, mortality, and habitat conversion) on coastal habitats and fauna primarily through onshore construction and climate change. BOEM anticipates that the potential impacts of ongoing construction activities on coastal habitats and fauna would be minor, but impacts from climate change could be moderate. Therefore, the No Action Alternative would result in **moderate** impacts on coastal habitats, primarily driven by climate change.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and coastal habitat and fauna would continue to be affected by natural and human-caused IPFs. Planned activities would contribute to the impacts on coastal habitat and fauna through construction-related activities that affect habitat, vegetation, and wildlife. Currently, there are no planned offshore wind activities proposed in the geographic analysis area. If any were to occur, they would have some potential to result in temporary disturbance and permanent loss of onshore habitat. However, habitat removal is anticipated to be minimal due to the developed and urbanized landscape of the geographic analysis area, and any impacts resulting from habitat loss or disturbance would not be expected to result in population-level effects within the geographic analysis area. BOEM anticipates the No Action Alternative would result in **moderate** impacts on coastal habitat and fauna, primarily driven by ongoing construction activities and climate change.

3.8.4 Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on coastal habitat and fauna:

- The onshore export cable routes, including routing variants, and extent of ground disturbance, which could require the removal of vegetation; and

- The EW 2 onshore substations, which could require the removal of trees and shrubs in or on the edge of the construction footprint for Onshore Substation C.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- Onshore export cable routes, substation footprints, and staging areas (e.g., pipe stringing staging for HDD): The route chosen (including variations of the general route) and substation and staging area footprints would determine the amount of habitat affected.

3.8.5 Impacts of the Proposed Action on Coastal Habitat and Fauna

The sections below summarize the potential impacts of the Proposed Action on coastal habitat and fauna and special-status species during the various phases of the Projects. Routine activities would include construction, O&M, and decommissioning of the Projects, as described in Chapter 2, *Alternatives Including the Proposed Action*.

Noise: Construction noise could lead to temporary and highly localized disturbance and displacement of wildlife. Displaced individuals would likely return to the affected areas once the noise has ended. It is possible that individuals could experience repeated stress events if they returned to the site at night, when construction has paused, only for construction to drive them away again in the morning. BOEM expects these impacts to be limited and temporary in nature. Normal operation of the substation would generate continuous noise, but BOEM expects minimal associated impacts in the context of existing noises near the proposed substations that are generated from the highly developed and urbanized landscape around the substation sites. The impacts on coastal habitats and fauna of noise from the Proposed Action would add to the impacts of other anthropogenic noise. Terrestrial fauna may habituate to noise so that it has little to no effect on their behavior or biology (Kight and Swaddle 2011). Considering that most of the onshore area where the onshore Project components would be constructed consists of the highly developed and urbanized landscape of the New York metropolitan area, terrestrial fauna in this area are likely to be already subject and habituated to anthropogenic noise. The impacts on coastal habitats and fauna from noise from the Proposed Action are anticipated to be minimal, and no individual fitness or population-level effects on wildlife would be expected.

Land disturbance: The expected impacts of onshore construction associated with the Proposed Action would not increase the impacts of this IPF beyond those described under the No Action Alternative. The EW 1 geographic analysis area (which also includes the O&M facility) is mostly devoid of natural habitat (i.e., is significantly altered by human development and primarily used for industrial and commercial operations) and would support species that associate with coastal urbanized areas (e.g., pigeons, seagulls, rodents). Therefore, impacts on wildlife from construction and operation of EW 1 onshore components and the O&M facility would be negligible, as no natural habitat would be affected.

Empire would implement trenchless technology (e.g., HDD or direct pipe) for the EW 2 offshore export cable landing to go under beaches and dunes, which would avoid beach and dune habitat (COP Volume 2b, Section 5.1.1.2; Empire 2023) and the state-designated Nassau Beach Significant Coastal Fish and Wildlife Habitat site; as such, temporary impacts on wildlife resulting from the landfall location would be minor. While habitats in the EW 2 geographic analysis area have also been significantly altered by human development, there are some small areas of tree and shrub habitat that could be affected, depending on the substation and onshore cable route selected; however, these more natural areas are isolated and surrounded by developed and urbanized areas.

To minimize disturbance, the majority of the proposed onshore export and interconnection cable routes would be sited in already-disturbed areas (e.g., existing roadways) to the extent practicable. Construction

of EW 2 onshore export cable segment IP-C would require vegetation removal in three isolated areas between Long Beach Road and Daly Boulevard (6.44 acres herbaceous, 1.99 acres forest/wooded vegetation, and 0.41 acre scrub/shrub). Construction of EW 2 Onshore Substation C would require the removal of approximately 0.55 acre of tree/shrub habitat along the existing railroad corridor. Removal of trees would be a long-term impact while removal of scrub/shrub habitat would be short term.

Clearing and grading during construction within temporary workspaces would result in temporary loss of forage and cover for wildlife within the area. Construction of Onshore Substation C would result in short-term and permanent impacts on habitat from construction of the permanent substation facilities and use of temporary construction workspace. Any remnant habitat within the permanent substation site would be converted to developed land with landscaping for the duration of the Projects' operational lifetime. Landscaped areas would provide some habitat for species acclimated to human activity, which are the primary species types in the area given the surrounding developed and urbanized landscape. Any tree and shrub removal for onshore export cable installation would likely result in a maintained right-of-way of herbaceous/low shrub vegetation.

Empire would implement measures to avoid and minimize habitat impacts, including revegetating disturbed areas (Appendix H, Attachment H-2, APM 49), implementing an invasive species control plan and invasive species survey (APM 48 and APM 56), siting in previously disturbed areas (APM 57), implementing erosion and sediment control plans (APMs 45,46, 50, 51), and conducting site-specific mitigation (APM 53). Given the nature of the existing conditions of the Onshore Project areas (i.e., developed and highly urbanized with little or no natural habitat), Empire's commitment to measures to avoid and reduce habitat impacts, and the temporary nature of construction, the impacts on wildlife and habitat are expected to be minor.

3.8.5.1. Impact of the Connected Action

As described in Chapter 2, infrastructure improvements have been proposed at SBMT to provide the necessary structural capacity, berthing facilities, and water depths to operate as an offshore wind hub for several proposed offshore wind projects, including the Proposed Action. These improvements include in-water activities (i.e., dredging and dredged material management, replacement and strengthening of existing bulkheads, installation of new pile-supported and floating platforms, installation of new fenders), as well as some upland activities (building construction and paving). BOEM expects the connected action to affect coastal flora and fauna through the noise and land disturbance IPFs.

Noise: The expected impacts of noise associated with the connected action's activities alone could affect any wildlife that may be in the vicinity of the SBMT. However, similar to under the Proposed Action, construction noise would be temporary and localized and would not be anticipated to be significantly different than the noise levels in the surrounding urban environment. If pile driving is necessary during construction, the noise would be temporary and would cease after piles are installed. Similarly, dredging vessels and other construction noise could temporarily disturb wildlife, but wildlife that may be in the area are likely already acclimated to noise in an urban environment and would be able to move away from the noise. Normal operation at the SBMT would generate continuous noise, but BOEM expects negligible long-term impacts when considered in the context of the other commercial and industrial noises in the EW 1 Onshore Project area. BOEM anticipates noise impacts associated with the connected action to be negligible.

Land disturbance: Improvement activities at the SBMT would remove all existing structures and approximately 40 percent of the currently paved area. After additional excavation for installation of subsurface piles, utilities, and building structures, only minor grade changes are anticipated. The site would be repaved and new structures installed. Impacts on upland vegetation would be limited to removal of approximately 0.05 acre of volunteer invasive vegetation throughout the SBMT site and three poplar

trees along the north side of the 35th Street Pier to replace a bulkhead, with each tree being approximately 4 inches in diameter at breast height. The removal of this vegetation is not anticipated to affect wildlife because it is low-quality habitat. Therefore, BOEM anticipates land disturbance associated with the connected action to be negligible.

3.8.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind activities, other planned offshore wind activities, and the connected action at SBMT. Ongoing and planned non-offshore wind activities related to onshore development activities (including a planned substation and underground loop-in/loop-out lines for the Oceanside POI) would contribute to impacts on coastal habitat and fauna through the primary IPFs of noise and land disturbance. Construction related to the connected action at SBMT and for the planned Hampton Road Substation and loop-in/loop-out lines for the Oceanside POI could affect coastal habitat and fauna through the removal of a few small trees and by generating temporary and localized noise. The construction, O&M, and decommissioning of onshore infrastructure for offshore wind activities in the geographic analysis area would also contribute to the primary IPFs of noise and land disturbance. Temporary disturbance and permanent loss of habitat onshore may occur as a result of offshore wind development. BOEM is not aware of any planned offshore wind activities other than the Proposed Action that would overlap the geographic analysis area for coastal habitat and fauna. However, if habitat removal is anticipated, it would be minimal and any related impacts would not be expected to result in individual fitness or population-level effects in the geographic analysis area.

The cumulative impact on coastal habitat and fauna would likely be moderate, mostly driven by climate change. The onshore cable routes and substation location are within highly developed areas and within the urbanized landscapes in the New York metropolitan area, where limited natural habitat and habitat connectivity are present. In context of reasonably foreseeable environmental trends, the Proposed Action would contribute an undetectable increment to the cumulative noise and land disturbance impacts on coastal habitat and fauna.

3.8.5.3. Conclusions

Impacts of the Proposed Action. In summary, activities associated with the construction, installation, O&M, and eventual decommissioning of the Proposed Action would have **minor** impacts on coastal habitats and fauna due to the developed and urbanized landscape that dominates the geographic analysis area. The primary impacts of the Proposed Action affecting habitats and wildlife would be long-term habitat loss and conversion from onshore construction at Onshore Substation C and onshore export cable segment IP-C. The primary impacts of the connected action would be related to noise and land disturbance, which could affect wildlife in the EW 1 Onshore Project area. However, given the developed nature of the EW 1 Onshore area, wildlife are likely acclimated to activities similar to those related to the connected action; therefore, BOEM anticipates impacts of the connected action would be **negligible**.

BOEM prepared a BA assessing the potential effects on federally listed species (BOEM 2022). Consultation with USFWS pursuant to Section 7 of the ESA was concluded June 22, 2023. In USFWS's transmittal letter for the Biological Opinion, USFWS concurred with BOEM's determination of not likely to adversely affect for the northern long-eared bat (*Myotis septentrionalis*; endangered), tri-colored bat (*Perimyotis subflavus*; proposed endangered), roseate tern (*Sterna dougallii dougallii*; endangered), monarch butterfly (*Danaus plexippus*; proposed), and seabeach amaranth (*Amaranthus pumilus*; threatened) (USFWS 2023).

Cumulative Impacts of the Proposed Action. BOEM anticipates that the cumulative impacts on coastal habitat and fauna in the geographic analysis area would be **moderate**. In context of other reasonably

foreseeable environmental trends in the area, the incremental impacts contributed by the Proposed Action to the cumulative impacts on coastal habitat and fauna would be undetectable. The Proposed Action would contribute to cumulative impacts primarily through the permanent impacts on habitat associated with the long-term impacts from habitat loss related to the EW 2 Onshore Station C site and cable route that would cross three isolated habitat areas.

3.8.6 Impacts of Alternatives B, E, and F on Coastal Habitat and Fauna

Impacts of Alternatives B, E, and F. Alternatives B, E, and F would alter the turbine array layout compared to the Proposed Action. Alternative F would have 54 WTGs in EW 1 and 84 WTGs in EW 2 (totaling 138 WTGs) compared to up to 147 WTGs for the Proposed Action. Coastal habitat and fauna impacts under Alternatives B, E, and F would be the same as those of the Proposed Action because these alternatives would differ only with respect to the WTG offshore component (WTGs in different positions in the Lease Area), and the WTGs would be outside of the geographic analysis area. Therefore, the impacts resulting from individual IPFs associated with onshore construction and installation, O&M, and decommissioning under Alternatives B, E, and F on coastal habitat and fauna would be the same as those of the Proposed Action.

Cumulative Impacts of Alternatives B, E, and F. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B, E, and F to the cumulative impacts on coastal habitat and fauna would be undetectable. The cumulative impacts on coastal habitat and fauna would be moderate for the same reasons described for the Proposed Action.

3.8.6.1. Conclusions

Impacts of Alternatives B, E, and F. As discussed above, the expected **minor** impacts associated with the Proposed Action would not change under Alternative B, E, or F because the alternatives would only differ in offshore WTG components, which would be outside of the geographic analysis area.

Cumulative Impacts of Alternatives B, E, and F. Because the impacts of the Proposed Action would not change under Alternative B, E, or F, BOEM anticipates that the cumulative impacts of Alternatives B, E, and F would be the same as described for the Proposed Action. Therefore, cumulative impacts of Alternatives B, E, and F would be **moderate**.

3.8.7 Impacts of Alternative C, D, and G on Coastal Habitat and Fauna

Impacts of Alternatives C, D, and G. The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Projects under Alternative C, D, or G would be the same as those described under the Proposed Action. Submarine and onshore cable route options around the Gravesend Anchorage (Alternative C-1) and the Ambrose Navigation Channel (Alternative C-2), to avoid the sand borrow area by at least 500 meters (Alternative D), or to use a cable bridge to cross Barnums Channel (Alternative G) are already covered under the Proposed Action as part of the PDE approach, and narrowing the submarine and onshore cable route options under Alternative C, D, or G would not materially change the analyses of any IPF. All other offshore and onshore Project components would be the same as under the Proposed Action.

Cumulative Impacts of Alternatives, C, D, and G. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative C, D, or G to the cumulative impacts on coastal habitat and fauna would be undetectable. The cumulative impacts on coastal habitat and fauna would be moderate for the same reasons described for the Proposed Action.

3.8.7.1. Conclusions

Impacts of Alternatives C, D, and G. As discussed above, the expected **minor** impacts associated with the Proposed Action would not change under Alternative C, D, or G.

Cumulative Impacts of Alternatives C, D, and G. Because the impacts of the Proposed Action would not change under Alternative C, D, or G, BOEM anticipates that the cumulative impacts of Alternatives C, D, and G would be the same as described for the Proposed Action. Therefore, cumulative impacts of Alternatives C, D, and G would be **moderate**.

3.8.8 Impacts of Alternative H on Coastal Habitat and Fauna

Impacts of Alternative H. The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Projects under Alternative H would be the same those described under the Proposed Action. An alternate method of dredge and fill activity at the SBMT to reduce the discharge of dredged material would not materially change the analysis of any IPF, as the Onshore Project area is highly developed with a lack of natural habitats. BOEM does not anticipate any change in dredge and fill activity would affect undisturbed or natural areas. All other offshore and onshore Project components of Alternative H would be the same as under the Proposed Action.

Cumulative Impacts of Alternative H. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative H to the cumulative impacts on coastal habitat and fauna would be undetectable. The cumulative impacts on coastal habitat and fauna would be moderate for the same reasons described for the Proposed Action.

3.8.8.1. Conclusions

Impacts of Alternative H. As discussed above, the expected **minor** impacts associated with the Proposed Action would not change under Alternative H.

Cumulative Impacts of Alternative H. Because the impacts of the Proposed Action would not change under Alternative H, BOEM anticipates that the cumulative impacts of Alternative H would be the same as described for the Proposed Action. Therefore, cumulative impacts of Alternative H would be **moderate**.

3.8.9 Comparison of Alternatives

Because Alternatives B, C, D, E, and F involve modifications only to offshore components, and because Alternative G is already covered under the Proposed Action as part of the PDE approach, impacts on coastal habitat and fauna from those alternatives would be the same as those under the Proposed Action—**minor**.

Under Alternative H, an alternative method of dredge and fill activity would occur in waters around the SBMT, which would not materially change the analysis of any IPF compared to the Proposed Action because the Onshore Project area is highly developed with little or no habitat. Therefore, the overall impact level would not change—**minor**.

In context of reasonably foreseeable environmental trends, the cumulative impact of Alternatives B, C, D, E, F, G, and H in combination with ongoing and planned activities would be the same as that of the Proposed Action for individual IPFs—**minor**. Considering all the IPFs together, BOEM anticipates that the contribution of Alternative B, C, D, E, F, G, or H to the impacts from ongoing and planned activities would result in **moderate** cumulative impacts on coastal habitats and fauna in the geographic analysis

area. Ongoing and planned activities contributing to impacts on coastal habitats and fauna in the geographic analysis area include climate change and habitat impacts.

3.8.10 Summary of Impacts of the Preferred Alternative

The Preferred Alternative is a combination of Alternatives C-1, D, F, G, and H. Therefore, the EW 1 submarine export cable route would traverse the Gravesend Anchorage Area (USCG Anchorage #25) (Alternative C-1); EW 2 cable route options would avoid impacts within 500 meters of the sand borrow area offshore Long Island (Alternative D); the wind turbine layout would be optimized to maximize annual energy production and minimize wake loss while addressing the presence of glauconite deposits across the Lease Area (Alternative F); the EW 2 export cable route would use an above-water cable bridge to construct the onshore export cable crossing at Barnums Channel (Alternative G); and the construction of the EW 1 export cable landfall would use a method of dredge or fill activities (clamshell dredging with environmental bucket) that would reduce the discharge of dredged material compared to other dredging options considered in the Empire Wind PDE (Alternative H). As described above, modifications to the export cable routes, wind turbine layout, and dredging are not expected to change the impacts on coastal habitats or fauna as compared to the Proposed Action. Impacts associated with modifications to the cable routes in Alternatives C-1, D, and G are already covered under the Proposed Action as part of the PDE approach, and changes to the wind turbine layout in Alternative F would not affect areas where coastal habitat and fauna are present. Additionally, due to the highly developed nature of the Onshore Project area and lack of natural habitats, the alternative method of dredge and fill activity proposed as part of Alternative H is not anticipated to result in changes to impacts on coastal habitat or fauna.

Overall, impacts due to construction, O&M, and decommissioning of the Preferred Alternative are expected to be the same as those of Alternative A and be **minor** for coastal habitats and fauna due to the developed and urbanized landscape that dominates the geographic analysis area.

3.8.11 Proposed Mitigation Measures

No measures to mitigate impacts on coastal habitat and fauna have been proposed for analysis.

This page intentionally left blank.

3.11. Demographics, Employment, and Economics

This section discusses potential impacts on demographic, employment, and economic conditions from the Projects, alternatives, and ongoing and planned activities in the geographic analysis area for demographics, employment, and economics (shown on Figure 3.11-1). The demographics, employment and economics geographic analysis area includes the counties and municipalities where proposed onshore infrastructure and potential port cities are located: Kings, Nassau, and Albany Counties, including Town of Hempstead, City of Long Beach, and Village of Island Park in New York State and Nueces and San Patricio Counties in Texas (a port in the Corpus Christi, Texas area could be a starting point for transporting the OSS topsides for EW 1 and EW 2). Tables I-7 through I-24 in Appendix I provide detailed demographic and employment information for these areas, including information from the 2020 census (U.S. Census Bureau 2020). Data for New York State is also provided for reference. This section also considers the other counties that may be affected by visual or recreation and tourism impacts, which may have impacts on property values or recreation and tourism economies (i.e., Manhattan, Queens, and Suffolk in New York State and Monmouth and Ocean Counties in New Jersey). For these counties and states, data on the economic value of the recreation and tourism industries are provided in Table I-21 in Appendix I.

3.11.1 Description of the Affected Environment for Demographics, Employment, and Economics

Kings, Nassau, and Albany Counties

New York has always been one of the top tourism destinations in the world. The industry is mainly centered around the New York City region (including Brooklyn). The Long Island region is the second largest tourism region. As a result, the tourism industry is a key component and driver of these local economies (COP Volume 2e, Section 8.3; Empire 2023).

Kings County

The population of Kings County increased by 11.0 percent from 2000 to 2020, compared to 6.5 percent in New York State overall. The population of Kings County is younger than in the other affected New York counties and New York State as a whole, with 23.0 percent aged 0–17 and 26.6 percent aged 18–34 (U.S. Census Bureau 2019a).

In 2021, the annual unemployment rate in Kings County was approximately 10.1 percent, and the overall New York State unemployment rate was 6.9 percent (U.S. Bureau of Labor Statistics 2021a, 2021b). In 2015–2019, the unemployment rate in Kings County was relatively high (6.2 percent) compared to the other affected areas and New York State as a whole (5.5 percent) (U.S. Census Bureau 2019a). In 2020, the Kings County gross domestic product (GDP) totaled approximately \$86.2 billion (U.S. BEA 2021).

Kings County (i.e., Brooklyn) is notable for the importance of coastal tourism and recreation to its economy and a relatively high proportion of seasonal housing compared with the other affected counties and municipalities in the geographic analysis area (aside from the City of Long Beach). In 2018, Kings County had 3,759 establishments, 33,229 employees, \$899.2 million in total wages, and \$1.8 billion in GDP resulting from tourism and recreation (National Ocean Economics Program 2018). In Kings County, nearly 1 percent of housing units are seasonally occupied (similar to Nassau County), compared to approximately 4 percent in New York State overall (U.S. Census Bureau 2019a).

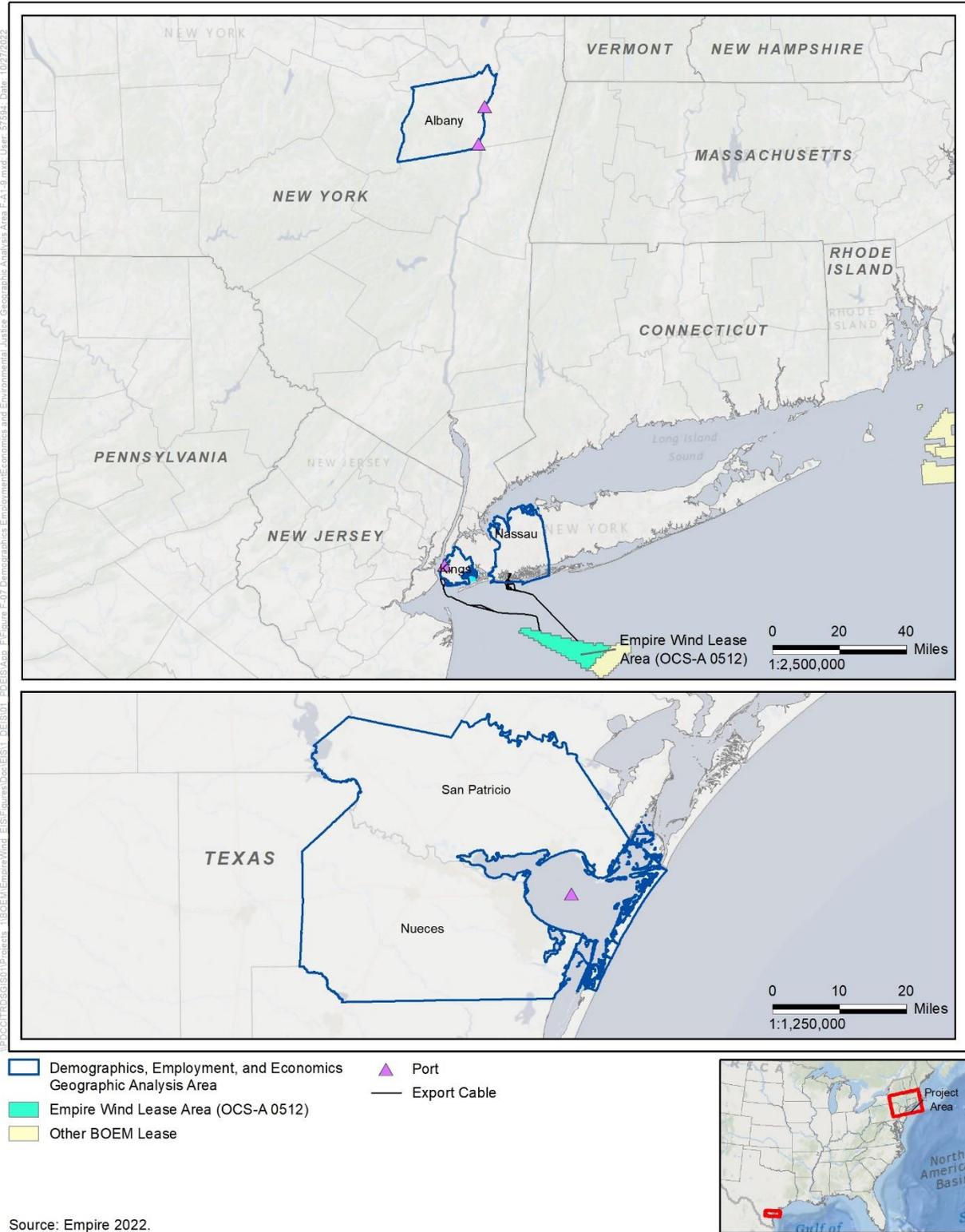


Figure 3.11-1 Demographics, Employment, and Economics Geographic Analysis Area

The industries that would be most affected by the Proposed Action include recreation and tourism, retail, and construction. A review of the industries that employ workers in Kings County (Table I-14 in Appendix I) reveals that Brooklyn has one of the lowest proportion of jobs in the entertainment, recreation, accommodation, and food services sectors (7.3 percent), aside from the City of Albany (4.3 percent) and Albany County (7 percent). Meanwhile, New York State overall has 9.9 percent of its jobs in the recreation and tourism-related sectors, and the City of Long Beach has the highest at 16.9 percent. In terms of other industries that may be affected by the Proposed Action, Kings County has a modest proportion of retail trade jobs (8.8 percent), compared to 9.3 percent in New York State overall, and 3.9 percent of jobs are in construction (compared to 4.1 percent in New York State as a whole) (U.S. Census Bureau 2019b). The largest proportion of jobs in Brooklyn is in Health Care and Social Assistance (31.4 percent), followed by Education Services (11.6 percent).

NOAA tracks economic activity dependent upon the ocean in its “Ocean Economy” data, which generally include commercial fishing and seafood processing, marine construction, commercial shipping and cargo-handling facilities, ship and boat building, marine minerals, harbor and port authorities, passenger transportation, boat dealers, and coastal tourism and recreation, among others. Tables I-17 and I-18 in Appendix I report data on the Ocean Economy as a whole in terms of GDP and employment, respectively. In Kings County, tourism and recreation accounted for 87.8 percent of the overall Ocean Economy GDP (NOAA 2018) (see Table I-17 in Appendix I). This category includes recreational and charter fishing, as well as commercial ferry services.

The “living resource” sector of the Ocean Economy includes commercial fishing, aquaculture, seafood processing, and seafood markets. Although the number employed or self-employed in this sector in Kings County is small compared to recreation and tourism, Brooklyn has a higher proportion of these jobs (3.9 percent) compared to Nassau County (2.5 percent), of all the Ocean Economy sectors.

Nassau County

The population of Nassau County increased by 4.6 percent from 2000 to 2020, compared to 11.0 percent growth in Kings County, and 6.5 percent in New York State overall. The population of Nassau County is slightly older than in the other affected New York counties and New York State as a whole, with 40.5 percent aged 35–64 and 17.5 percent aged over 65 (U.S. Census Bureau 2019a). Nassau County also has the oldest median age (42) compared to the other affected New York counties (35–40) and New York State overall (39).

In 2021, the annual unemployment rate in Nassau County was 4.5 percent, compared to the overall State of New York average of 6.9 percent (U.S. Bureau of Labor Statistics 2021a, 2021b). In 2015–2019, the unemployment rate in Nassau County was relatively low (3.9 percent) compared to the other affected areas and New York State as a whole (5.5 percent) (U.S. Census Bureau 2019a). In 2020, Nassau County had approximately \$83.0 billion in GDP (U.S. BEA 2021). In 2018, Nassau County had 1,396 establishments, 17,392 employees, \$421.9 million in total wages, and \$794.1 million in GDP resulting from tourism and recreation (National Ocean Economics Program 2018). In Nassau County, nearly 1 percent of housing units are seasonally occupied (similar to Kings County), compared to approximately 4 percent in New York State overall (U.S. Census Bureau 2019a).

A review of the industries that employ workers in Nassau County (Table I-14 in Appendix I) reveals that Nassau County has 9.5 percent of its jobs in the entertainment, recreation, accommodation, and food services sectors compared with 9.9 percent in New York State overall. In terms of other industries that may be affected, Nassau County has a relatively high proportion of retail trade jobs (12.0 percent compared to 9.3 percent in New York State overall), and 4.9 percent of jobs are in construction (compared to 4.1 percent in New York State as a whole) (U.S. Census Bureau 2019b).

In 2018, tourism and recreation (including recreational and charter fishing, and commercial ferry services) in Nassau County accounted for 74.6 percent of the overall Ocean Economy GDP, compared to 87.8 percent in Brooklyn (NOAA 2018) (see Table I-17 Appendix I).

The “living resource” sector of the Ocean Economy, which includes commercial fishing, aquaculture, seafood processing, and seafood markets, includes 2.5 percent of the Ocean Economy jobs in Nassau, compared to 3.9 percent in Brooklyn.

Albany County

The population of Albany County increased by 6.9 percent from 2000 to 2020, which was similar to the population increase in New York State overall (6.5 percent). The age of the population of Albany County is comparable to New York State as a whole, with a median age of 38 compared to 39 in New York State overall.

In 2021, the annual unemployment rate for Albany County was relatively low at 4.4 percent (U.S. Bureau of Labor Statistics 2021a). In 2015–2019, the unemployment rate in Albany County (4.5 percent) was slightly lower than the rate for New York State overall (5.5 percent) (U.S. Census Bureau 2019a). The Albany County GDP totaled approximately \$28.2 billion in GDP in 2020 (U.S. BEA 2021). Data on the economic value of the tourism and recreation sector for Albany County are not available from the National Ocean Economics Program for 2018 (likely because Albany is a watershed county, not a coastal county). Albany County has one of the largest percentages of seasonal housing units (1.3 percent) of the affected areas, compared to approximately 1 percent in Brooklyn and Nassau and 4 percent in New York State overall (U.S. Census Bureau 2019a).

A review of the industries that employ workers in Albany County (Table I-14 in Appendix I) reveals that Albany County has 7.0 percent of its jobs in the entertainment, recreation, accommodation, and food services sectors, which is the second lowest proportion of all the affected areas in New York State (with the lowest being in the City of Albany). In terms of other industries that may be affected, Albany County has a relatively modest proportion of retail trade jobs (8.2 percent) compared to 8.8 percent in Brooklyn, 12.0 percent in Nassau County, and 9.3 percent in New York State overall. In Albany County, 3.2 percent of jobs are in construction, which is the second lowest of any affected area in New York State (with the lowest again being the City of Albany) (U.S. Census Bureau 2019b). The sectors with the highest proportion of jobs include Public Administration (21.7 percent) and Health Care and Social Assistance (16.2 percent).

In Albany County, tourism and recreation data are not available from the National Ocean Economics Program for 2018. The Ocean Economy GDP is just 0.1 percent of the total county GDP (NOAA 2018). Marine Transportation is the only sector of the Ocean Economy for which employment data are available for Albany County in 2018 (594 employees) (NOAA 2018).

City of Albany, Albany County

The proposed port in Albany County is the Port of Albany in the City of Albany. The population of the City of Albany increased by 3.7 percent from 2000 to 2020, which was lower than in Albany County (6.9 percent) and New York State overall (6.5 percent). The median age of the population of the City of Albany (31 years) is lower than in any other affected area, likely due to the presence of colleges and universities. Correspondingly, the percentage of population aged 18–34 is higher in the City of Albany than in the other affected areas (37.9 percent) compared with 27.8 percent in Albany County and 24 percent in New York State overall.

In 2015–2019, the unemployment rate in the City of Albany was the highest (7.1 percent) of other affected areas (5.5 percent in New York State overall) (U.S. Census Bureau 2019a).

As in Albany County, the industries in the City of Albany with the largest proportion of jobs are Public Administration (37.9 percent) followed by Health Care and Social Assistance (19.3 percent).

The City of Albany has the lowest percentage of its jobs in the entertainment, recreation, accommodation, and food services sectors (4.3 percent) compared with the other affected areas, next to Albany County (7.0 percent). Correspondingly, the City of Albany also has the lowest percentages of seasonal homes (0.3 percent), aside from the Village of Island Park, which does not contain any seasonal homes.

Town of Hempstead, City of Long Beach, and Village of Island Park, Nassau County

The affected municipalities within Nassau County include the Town of Hempstead, City of Long Beach, and Village of Island Park. Of these areas, the City of Long Beach has the most notable recreation and tourism economy, with 16.9 percent of its jobs in the entertainment, recreation, accommodation, and food services sectors (compared with 10.6 percent in the Town of Hempstead and 11.9 percent in Island Park). Long Beach also has the highest percentage of seasonal homes (approximately 6 percent) compared with any other affected area in New York State (including less than 1 percent in the Town of Hempstead and 0 percent in Island Park).

Nueces and San Patricio Counties, Texas

Nueces County, Texas

In 2020, the population of Nueces County totaled 353,178 people, an increase of 12.6 percent from 2000. The age distribution of the population of Nueces County is comparable to that of San Patricio County, with the largest share of residents falling into the 35–64 age bracket and the median age being 36 years old.

In 2021, the annual unemployment rate in Nueces County (6.7 percent) was lower than in the neighboring San Patricio County (8.6 percent), but greater than the state average (5.7 percent) (U.S. Bureau of Labor Statistics 2021a, 2021b). In 2015–2019, the unemployment rate in Nueces County (5.7 percent) was similar to the rate for New York State overall (5.5 percent) and slightly higher than in neighboring San Patricio County (5.1 percent) (U.S. Census Bureau 2019a). In 2020, Nueces County had a GDP of approximately \$18.9 billion (U.S. BEA 2021). In 2018, the National Ocean Economics Program totaled \$1.5 billion in GDP across all ocean sectors in Nueces County. In 2018, Nueces County had 13,488 employees and \$574.6 million in GDP resulting from tourism and recreation (National Ocean Economics Program 2018). Nueces County has the third largest percentage of seasonal housing units (3.2 percent) of the affected areas, next to San Patricio County (3.7 percent) (U.S. Census Bureau 2019a).

A review of the industries that employ workers in Nueces County (Table I-14 in Appendix I) reveals that the county has roughly 13 percent of its jobs in the entertainment, recreation, accommodation, and food services sectors. In terms of other industries that may be affected, Nueces County has a relatively modest proportion of retail trade jobs (9.8 percent). The other sectors with the highest proportion of jobs include Health Care and Social Assistance (20.8 percent) and Construction (11.1 percent) (U.S. Census Bureau 2019b).

In addition to the tourism and recreation sector, Nueces County employs individuals in offshore mineral extraction (2,453 employees) and marine transportation (558 employees). The Ocean Economy GDP is approximately 7.5 percent of the total GDP in Nueces County (NOAA 2018) (see Table I-17 in Appendix I).

San Patricio County, Texas

In 2020, the total population of San Patricio County was 68,755 individuals, a 6.1-percent increase from 2010, although the population experienced a slight decline between 2000 and 2010 (-3.5 percent). The age distribution of residents in San Patricio County is similar to that of Nueces County, with the largest share being aged 35–64. The median age of the county’s population is 36 years.

As mentioned above, in 2021, the San Patricio County annual unemployment rate was relatively high, at 8.6 percent (U.S. Bureau of Labor Statistics 2021a). In 2015–2019, the unemployment rate in San Patricio County was 5.1 percent, which was the same as the rate for Texas overall, and just lower than the rate for New York State overall (5.5 percent) (U.S. Census Bureau 2019a). The GDP in San Patricio County was notably lower than in the neighboring Nueces County, with approximately \$2.6 billion in 2020 compared to \$18.9 billion (U.S. BEA 2021).

The Ocean Economy GDP totaled \$588.6 million across all ocean sectors in San Patricio County. In 2018, San Patricio County employed 1,766 individuals in the tourism and recreation sector, which totaled \$60.4 million in GDP (National Ocean Economics Program 2018). San Patricio County has the second largest percentage of seasonal housing units among affected areas for the proposed Projects (3.7 percent) (U.S. Census Bureau 2019a).

A review of the industries that employ workers in San Patricio County (Table I-14 in Appendix I) reveals that San Patricio County has 12.5 percent of its jobs in the entertainment, recreation, accommodation, and food services sectors compared to 12.8 percent in Nueces County. In terms of other industries that may be affected, San Patricio County has a relatively high proportion of retail trade jobs (10.6 percent compared to 9.8 percent in Nueces County), and 31.2 percent of jobs are in construction (compared to 11.1 percent in Nueces County) (U.S. Census Bureau 2019b).

In San Patricio County, tourism and recreation accounted for 10.3 percent of the overall Ocean Economy GDP, compared to 37.6 percent in Nueces County (NOAA 2018) (see Table I-17 in Appendix I). However, the Ocean Economy GDP makes up 24.7 percent of San Patricio County’s total county GDP, the largest share of all affected areas (NOAA 2018) (see Table I-17 in Appendix I).

Other Counties in Visual/Recreation and Tourism Affected Areas

Recreation and tourism play a major role in New York’s and New Jersey’s environments and economies. Visitors from all over the world travel to the area to partake in a variety of onshore and marine recreational activities. Marine recreational activities include wildlife viewing tours, scuba diving, and recreational fishing and boating. Popular onshore recreational activities include beach going, surfing, golfing, and scenic viewing. In 2017, New York State reported that tourists directly spent \$67.6 billion in the state, a record high for the state. In New Jersey, visitors directly spent over \$45 million in the state (COP Volume 2e, Section 8.3; Empire 2023).

New York, Queens, and Suffolk Counties, New York

In 2020, the New York State GDP was approximately \$1.42 trillion (U.S. BEA 2021). The New York County GDP totaled approximately \$610.4 billion, compared to \$82.3 billion in Queens and \$84.8 billion in Suffolk County. In 2018, Manhattan had 9,621 establishments, 217,305 employees, \$9,207.3 million in total wages, and \$22.2 billion in GDP resulting from tourism and recreation—greater than in any other affected area in New York State (National Ocean Economics Program 2018). In 2018, in Suffolk County there were 2,741 establishments, 36,385 employees, \$921.1 million in total wages, and \$1.9 billion in GDP; and in Queens there were 1,299 establishments, 11,581 employees, \$277.4 million in total wages, and \$510.0 million in GDP resulting from tourism and recreation. In New York State overall, there were

22,270 establishments, 359,194 employees, \$12.6 billion in total wages, and \$29.0 billion in GDP resulting from tourism and recreation in 2018.

Monmouth and Ocean Counties, New Jersey

In 2020, the GDP for the State of New Jersey was approximately \$535.8 billion (U.S. BEA 2021). In 2021, the annual New Jersey unemployment rate was approximately 6.3 percent, which was higher than that of Monmouth (4.9 percent) and Ocean (5.3 percent) Counties (U.S. Bureau of Labor Statistics 2021a, 2021b). The Monmouth County GDP in 2020 was approximately \$32.0 billion compared to \$19.0 billion in Ocean County (U.S. BEA 2021).

As discussed above, recreation and tourism plays a major role in New Jersey’s economy. New Jersey overall had 7,949 establishments, 96,261 employees, \$2.2 billion in total wages, and \$4.3 billion in GDP resulting from tourism and recreation in 2018. Within New Jersey, Monmouth County has a stronger tourism and recreation economy compared with Ocean County (see Table I-21 in Appendix I). In 2018, Monmouth County had 1,324 establishments, 17,767 employees, \$369.0 million in total wages, and \$704.7 million in GDP resulting from tourism and recreation, compared with 1,155 establishments, 14,049 employees, \$288.2 million in total wages, and \$569.5 million in GDP in Ocean County.

Trends under the No Action Alternative

Over the Projects’ proposed lifetime, BOEM does not anticipate major changes to the distribution of economic sectors in the geographic analysis area. The affected counties would continue to rely economically on coastal tourism and recreation. The geographic analysis area may experience substantial increased economic activity associated with offshore wind activities, as discussed in the next section.

3.11.2 Impact Level Definitions for Demographics, Employment, and Economics

Definitions of impact levels are provided in Table 3.11-1.

Table 3.11-1 Impact Level Definitions for Demographics, Employment, and Economics

Impact Level	Impact Type	Definition
Negligible	Adverse	No impacts would occur, or impacts would be so small as to be unmeasurable.
	Beneficial	Either no effect or no measurable benefit.
Minor	Adverse	Impacts would not disrupt the normal or routine functions of the affected activity or geographic place.
	Beneficial	Small but measurable benefit on demographics, employment, or economic activity.
Moderate	Adverse	The affected activity or geographic place would have to adjust somewhat to account for disruptions due to impacts of the Projects.
	Beneficial	Notable and measurable benefit on demographics, employment, or economic activity.
Major	Adverse	The affected activity or geographic place would experience disruptions to a degree beyond what is normally acceptable.
	Beneficial	Large local or notable regional benefit to the economy as a whole.

3.11.3 Impacts of the No Action Alternative on Demographics, Employment, and Economics

When analyzing the impacts of the No Action Alternative on demographics, employment, and economics, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for demographics, employment, and economics. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with the other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*.

3.11.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for demographics, employment, and economics described in Section 3.11.1, *Description of the Affected Environment for Demographics, Employment, and Economics*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities within the geographic analysis area that contribute to impacts on demographics, employment, and economics include growth in onshore development; ongoing installation or upgrades of piers, bridges, pilings, and seawalls or submarine cables and pipelines; ongoing commercial shipping; continued port upgrades and maintenance; and ongoing effects from climate change (e.g., damage to property and coastal infrastructure) (see Section F.2 in Appendix F for a complete description of ongoing activities). These ongoing activities contribute to numerous IPFs including energy generation/security, which has implications for employment and state and regional energy markets; noise, which can affect residential and other sensitive populations; port utilization, which can affect jobs, populations, and economies; marine traffic, which can affect commercial fishing/shipping and recreation and tourism economies; land disturbance/onshore construction, which supports local population growth, employment, and economies; and climate change, which has adverse implications for demographics and economic health of coastal communities, due in part to the costs of resultant damage to property and infrastructure, fisheries and other natural resources, increased disease frequency, and sedimentation, among other factors. See Table F1-9 for a summary of potential impacts associated with ongoing non-offshore wind activities by IPF for demographics, employment, and economics.

There are no ongoing offshore wind activities within the geographic analysis area for demographics, employment, and economics.

3.11.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impact of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Offshore wind could become a new industry for the Atlantic states and the nation. Several recent reports provide national estimates of employment and economic activity. These studies acknowledge that offshore wind component manufacturing and installation capacity exists primarily outside the United States; however, domestic capacity is anticipated to increase. This EIS uses available data, analysis, and projections to make reasoned conclusions on potential economic and employment impacts within the geographic analysis area. The EIS provides no analysis or conclusions about impacts outside the geographic analysis area (i.e., regional, national, or worldwide).

The BVG (2017) study estimated that during the initial implementation of offshore wind projects along the U.S. northeast coast, a base level of 35 percent of jobs, with a high probability of up to 55 percent of jobs, would be sourced from within the United States. The proportion of jobs filled within the United

States would increase as the offshore wind energy industry grows, due to growth of a supply chain and supporting industries along the East Coast, as well as a growing number of local O&M jobs for established wind facilities. By 2030 and continuing through 2056, approximately 65 to 75 percent of jobs associated with offshore wind are projected to be within the United States. Overseas manufacturers of components and specialized ships based overseas that are contracted for installation of foundations and WTGs would fill jobs outside of the United States (BVG 2017). As an example of the mix of local, national, and foreign job creation, for the five-turbine Block Island Wind Farm, turbine blade manufacturing occurred in Denmark, generator and nacelle manufacturing occurred in France, tower component manufacturing occurred in Spain, and foundation manufacturing occurred in Louisiana (Gould and Cresswell 2017).

The American Wind Energy Association (AWEA) estimates that the offshore wind industry will invest \$80 to \$106 billion in U.S. offshore wind development by 2030, including \$28 to \$57 billion invested within the United States, depending on installation levels and supply chain growth (other investment would occur in countries manufacturing or assembling wind energy components for U.S.-based projects) (AWEA 2020). Economic and employment impacts would occur nationwide, but would be most concentrated in Atlantic coastal states that host offshore wind development. The AWEA report lists over \$1.3 billion in announced domestic investments in wind energy manufacturing facilities, ports, and vessel construction in Atlantic states (AWEA 2020). The AWEA report analyzes a base scenario and a high scenario for offshore wind direct impacts, turbine and supply chain impacts, and induced impacts. The base scenario assumes 20 GW of offshore wind power by 2030 and domestic content increasing to 30 percent in 2025 and 50 percent in 2030. The high scenario assumes 30 GW of offshore wind power by 2030 and domestic content increasing to 40 percent in 2025 and 60 percent in 2030. Under the base scenario, offshore wind energy development would support \$14.2 billion in economic output and \$7 billion in value added by 2030. Under the high scenario, offshore wind energy development would support \$25.4 billion in economic output and \$12.5 billion in value added by 2030. The AWEA analysis does not specify where supply chain growth would occur in the U.S.

The AWEA estimates are consistent with the University of Delaware (2019) projections, which estimate that deployment of 18.6 GW of planned and contracted offshore wind energy projects through 2030 would require capital expenditures of \$68.2 billion over the next 10 years (University of Delaware 2019). The study notes that, while the offshore wind supply chain is global and the expenditures would be directed to both domestic and foreign sources, a growing number of U.S. suppliers are preparing to enter the industry. Compared to the \$14.2 to \$25.4 billion in offshore wind economic output (AWEA 2020), the 2019 annual GDP for states with offshore wind projects (Connecticut, Massachusetts, Rhode Island, New York, New Jersey, Delaware, Maryland, Virginia, and North Carolina) ranged from \$63.5 billion in Rhode Island to \$1.73 trillion in New York (U.S. BEA 2020), and totaled nearly \$5.0 trillion. The \$14.2 to \$25.4 billion in offshore wind industry output would represent 0.3 to 0.5 percent of the combined GDP of these states.

The AWEA study estimates offshore wind would support 45,500 (base scenario) to 82,500 (high scenario) jobs—full-time equivalent (FTE) jobs at a given point in time—in the year 2030 nationwide, including direct, supply chain, and induced jobs. Most offshore wind jobs are created during the temporary construction phase. About 60 percent of jobs would be short term (development and construction) and 40 percent would be long term (O&M). A 2020 study commissioned by the Responsible Offshore Development Alliance estimated that offshore wind projects through 2030 would generate 55,989 to 86,138 job-years (an FTE job lasting 1 year) for construction and 5,003 to 6,994 long-term jobs for O&M (Georgetown Economic Services 2020). These estimates are generally consistent with the AWEA study in total jobs supported, although the Georgetown Economic Services study concludes that a greater proportion of jobs would be in the construction phase. As with the AWEA estimates of economic output, the Responsible Offshore Development Alliance study assumed that offshore wind

energy jobs would be focused in states hosting offshore wind projects, but would also be generated in other states where manufacturing and other supply chain activities occur.

In 2019, employment in New York and New Jersey combined was 13.6 million (U.S. Census Bureau 2019b). Because projected offshore wind jobs could be anywhere in the United States, the extent of impacts on the geographic analysis area cannot be clearly foreseen; however, a substantial portion of the workforce for planned New York and New Jersey offshore wind projects would likely be drawn from, or would relocate to, areas within commuting distance of ports that would be used for offshore wind staging, construction, and operations.

Some local economic activity has already begun in preparation for the anticipated offshore wind industry. For example, New York is one of several states working together with industry to develop a regional offshore wind training infrastructure to support a growing U.S. offshore wind industry. The establishment of a New York State Advisory Council on Offshore Wind Economics and Workforce Development as well as public investments will support the development of an offshore wind workforce. In 2020, the \$20 million New York State Offshore Wind Training Institute was launched through State University of New York's Farmingdale State College and Stony Brook University campuses. These academic centers on Long Island are developing a plan for deploying the public funds and have issued the first solicitation for \$3 million to support organizations focusing on early training and skills development for disadvantaged communities. The developers of New York's Sunrise Wind project have invested \$10 million in a National Offshore Wind Training Center at Suffolk County Community College on Long Island. The training center will train and certify workers through the nation's first Global Wind Organization Training Center for offshore wind, also on Long Island. In addition, the Center of Excellence for Offshore Energy at State University of New York's Maritime College was launched with a grant from New York State; the center is working to develop classroom and online training programs (NYSERDA 2021).

In addition to the regional economic impact of a growing offshore wind industry, BOEM expects planned offshore wind activities to affect demographics, employment, and economics through the following primary IPFs.

Energy generation/security: Once built, over the long term, planned offshore wind could produce energy at long-term fixed costs. These projects could provide reliable prices once built compared to the volatility of fossil fuel prices. Offshore wind could significantly increase the proportion of energy from renewable sources not subject to fossil fuel costs, with a potential for 9,000 MW of power (30.7 trillion British thermal units, compared to 933.1 trillion British thermal units currently provided by all power generation sources in New York) from offshore wind development for New York (U.S. Energy Information Administration 2019). The economic impacts of offshore wind activities (including associated energy storage and capacity projects) on energy generation and energy security could be long term, minor, and beneficial.

Lighting: The aviation warning lighting required for offshore WTGs would be visible from some beaches and coastlines and could have effects on economic activity in certain locations; for example, if the lighting influences visitors and residents in selecting coastal locations to visit or reside in, respectively. At night, required aviation obstruction lighting on the WTGs would consist of red lights on the nacelle flashing 30 times per minute, as well as mid-tower red lights flashing at the same frequency. No readily available studies characterize the impacts of nighttime offshore lighting on economic activity. Studies cited in Section 3.18, *Recreation and Tourism*, suggest that WTGs visible from more than 15 miles (24.1 kilometers) away would have negligible effects on businesses dependent on recreation and tourism activity. The vast majority of the WTG positions envisioned offshore of the geographic analysis area would be more than 15 miles (24.1 kilometers) from coastal locations with views of the WTGs, so impacts are anticipated to be negligible. As a result, lighting on WTGs would have a continuous, long-

term negligible impact on demographics, employment, and economics, due to the distant and variable views of nighttime lighting from coastal businesses.

ADLS is an emerging technology that, if implemented, would only activate aviation warning lighting on WTGs when aircraft enter a predefined airspace. Depending on exact location and layout, ADLS would likely result in similar limits on the frequency of WTG aviation warning lighting use on offshore wind facilities. Implementation of ADLS could thus reduce the amount of time that WTG lighting is visible, thereby making WTG lighting visible only sporadically, rather than continuously, at night. This would reduce the time when WTG lighting is visible.

Nighttime construction and maintenance of offshore wind projects would require lighting for vessels in transit and at offshore construction work areas. Concurrent construction of planned offshore wind projects in the New York and New Jersey region between 2023 and 2030 (Appendix F, Table F2-1) would all potentially contribute to nighttime vessel lights. Vessel lighting would enable commercial shipping and commercial fishing operations to safely navigate around the vessels and work areas and would be visible from coastal locations, primarily while the vessels are in transit. Vessel lighting is not anticipated to affect the volume of business at visitor-oriented businesses or other businesses. Vessel lighting would be visible from coastal businesses, especially near the ports used to support offshore wind construction, but would be anticipated to have negligible impacts on demographics, employment, and economics.

Noise: Noise from G&G survey activities, O&M, pile driving, trenching, and vessels could result in temporary impacts on employment and economics via the impacts on marine businesses, including commercial fishing, for-hire recreational fishing, and recreational sightseeing, among others. Noise (especially from G&G surveys and pile driving) would also affect fish populations, with effects on commercial and for-hire fishing (see Section 3.9, *Commercial Fisheries and For-Hire Recreational Fishing*).

Population-level impacts on marine mammals would have impacts on employment and economic activity as a result of the impact on marine sightseeing businesses, such as whale watching tours, that benefit from the visible presence of marine mammals in the waters offshore from the geographic analysis area. As stated in Section 3.15, *Marine Mammals*, noise impacts associated with future offshore wind development could contribute to impacts on individual marine mammals. If construction activities from multiple projects occur in close spatial and temporal proximity, population-level impacts are possible; however, as noted in Section 3.15, BMPs can minimize exposure of individual mammals to harmful impacts and avoid population-level effects.

Offshore wind-related construction noise from pile driving, cable laying and trenching, and vessels are anticipated to have an impact on tour boat and for-hire fishing businesses, potentially making the affected areas temporarily unattractive for visitor-oriented businesses. Impacts would be localized and temporary.

Overall, offshore wind-generated noise could result in visitor-oriented services avoiding areas of noise and impacts on marine life important for fishing and sightseeing. Section 3.9 provides detail on potential economic impacts on commercial and for-hire fishing businesses. Both types of impacts would be localized and short term, occurring during surveying and construction, with no noticeable impacts during operations and only periodic, short-term impacts during maintenance. Noise impacts during surveys and construction would be more widespread when multiple offshore wind projects are under construction at the same time in the marine area off the coast of the geographic analysis area. As indicated in Appendix F, Table F2-1, the New York and New Jersey Lease Areas could have 1,205 WTGs installed between 2023 and 2030.

Onshore construction noise could temporarily inconvenience visitors, workers, and residents, possibly resulting in a short-term reduction of economic activity for businesses near installation sites for onshore

cables, substations, or port improvements. Because the location of onshore improvements is not known and cannot be determined until specific projects are proposed, the magnitude of noise associated with onshore construction and the number of businesses and homes affected cannot be determined. Impacts on demographics, employment, and economics from noise would be intermittent, short term, and negligible, similar to those of other onshore utility construction activity.

Port utilization: Planned offshore wind development would support use and expansion of ports and supporting industries in New York and New Jersey, including the ports indicated as possibly supporting construction of the proposed Projects. The major ports in the United States are seeing increased vessel visits, as vessel size also increases. Ports are also going through continual upgrades and maintenance. The New Jersey Wind Port is being developed and the Port of Paulsboro and SBMT are being upgraded specifically to support the construction of offshore wind energy facilities.

Port utilization would require a trained workforce for the offshore wind industry including additional shore-based and marine workers that would contribute to beneficial local and regional economic activity. Where existing ports are improved and channels are dredged for use in support of offshore wind, the improvements would also be beneficial to other port activity. Port utilization in the geographic analysis area associated with offshore wind would occur primarily during development and construction of projects offshore of New York and New Jersey, which are anticipated to occur primarily between 2023 and 2030. Ongoing maintenance and operational support would sustain port activity and employment at a lower level once construction is complete.

The port investment and usage generated by offshore wind would have long-term, beneficial impacts on employment and economic activity by providing employment opportunities and supporting marine service industries such as marine construction, ship construction and servicing, and related manufacturing. The most intensive beneficial impacts would occur during construction of offshore wind projects near the geographic analysis area between 2023 and 2030. The beneficial impact of offshore wind O&M services and improved port facilities would provide sustained, long-term employment and economic activity.

Offshore wind activities and associated port investment and usage would have long-term, moderate beneficial impacts on employment and economic activity by providing employment and industries such as marine construction, ship construction and servicing, and related manufacturing. If offshore wind construction results in competition for scarce berthing space and port service, port usage could potentially have short- to medium-term adverse impacts on commercial shipping (see Section 3.9).

Presence of structures: The structures required for planned offshore wind, including the 1,205 WTGs planned offshore New York and New Jersey (Appendix F, Table F2-1), could affect marine-based businesses. Commercial fishing operators, marine recreational businesses, and shore-based supporting services (such as seafood processing) could experience both short-term impacts during construction and long-term impacts from the presence of structures (see Section 3.9).

Although the likelihood of recreational vessels visiting offshore foundations would vary based on relative proximity to shore, increasing offshore wind development could change recreational fishing patterns within the larger socioeconomic geographic analysis area, as the tourist industry learns to make use of the structures. Businesses that would benefit from fish aggregation and reef effects—such as those that cater to highly migratory species and offshore fishing recreationists—may grow. The attraction of anglers to offshore wind structures is not anticipated to result in a volume of new recreational fishing large enough to replace or displace commercial fishing businesses by recreational fishing businesses.

In summary, as a result of fish aggregation and reef effects associated with the presence of offshore wind structures, there would be long-term impacts on commercial fishing operations and support businesses

such as seafood processing. The fishing industry is expected to be able to adapt its fishing practices over time in response to these changes. These effects could simultaneously provide new business opportunities such as fishing and tourism—and the possibility of tours for visitors interested in a close-up view of the wind structures, as has occurred for the Block Island Wind Farm.

The views of offshore WTGs could have impacts on certain businesses serving the recreation and tourism industry. Impacts could be adverse for particular locations if visitors and customers avoid certain businesses (i.e., hotels or rental dwellings) due to views of the WTGs; impacts could be neutral or beneficial if views do not affect visitor decisions or influence some visitors beneficially. As presented in Section 3.10.5.2, up to 111 WTGs associated with planned offshore wind projects would be visible from beaches and coastal areas in the geographic analysis area for recreation and tourism.

A joint research study of the University of Connecticut and Lawrence Berkeley National Laboratory found no net effects from WTGs on property values (Atkinson-Palombo and Hoen 2014). The study examined impacts of 41 onshore WTGs 0.25 to 1 mile (0.4 to 1.6 kilometers) from residences. The study noted weak evidence linking the announcement of new WTGs to adverse impacts on home prices, and found that those effects were no longer apparent after the start of WTG operations. The effects of offshore wind structures would be different from those in the report data in that offshore WTGs would be much larger than the onshore WTGs, but much farther from residences, and would appear small on the horizon.

Overall, the presence of offshore wind structures would have continuous, long-term negligible impacts on demographics, employment, and economics. As discussed above, the commercial fishing industry is anticipated to be able to adjust to changes in fishing practices to maintain the viability of the industry in the presence of offshore wind structures. The presence of structures could also result in beneficial impacts for the recreational fishing and tourism industries.

Traffic: Offshore wind construction and decommissioning and, to a lesser extent, offshore wind operations would generate increased vessel and highway traffic. This additional traffic would support increased employment and economic activity for marine transportation and supporting businesses, investment in the ports proposed for the Projects, and investment in other ports outside of the geographic analysis area. Increased vessel traffic would have continuous, beneficial impacts during all Project phases, with moderate impacts during construction and decommissioning.

Impacts of short-term increased vessel traffic during construction could include increased vessel traffic congestion, delays at ports, and a risk for collisions between vessels. As stated in Section 3.9, planned offshore wind projects would result in a small, incremental increase in vessel traffic, with a short-term peak during construction. Increased vessel traffic would be localized near affected ports and offshore construction areas. Congestion and delays could increase fuel costs (i.e., for vessels forced to wait for port traffic to pass), and could decrease productivity for commercial shipping, fishing, and recreational vessel businesses, whose income depends on the ability to spend time out of port. Collisions could lead to vessel damage and spills, which could have direct costs (i.e., vessel repairs and spill cleanup) as well as indirect costs from damage caused by spills.

The magnitude of increased vessel traffic is described in more detail in Section 3.16, *Navigation and Vessel Traffic*, and would depend upon the vessel traffic volumes generated by each offshore wind project, the extent of concurrent or sequential construction of wind energy projects, and the ports selected for each project. Increased vessel and highway traffic congestion and collision risk are anticipated to have negligible impacts on demographics, employment, and economics during all project phases due to the implementation of environmental protection measures.

Land disturbance: Offshore wind development would require onshore cable installation, substation construction or expansion, and possibly expansion of shore-based port facilities. Depending on siting,

land disturbance could result in localized, temporary disturbances of businesses near cable routes and construction sites for substations and other electrical infrastructure, due to typical construction impacts such as increased noise, traffic, and road disturbances.

These impacts would be similar in character and duration to other common construction projects, such as utility installations, road repairs, and industrial site construction. Impacts on employment would be localized, temporary, and beneficial (jobs and revenues to local businesses that participate in onshore construction), although there could be potential for adverse effects as well (lost revenue due to construction disturbances).

3.11.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, the geographic analysis area would continue to be influenced by regional demographic and economic trends. Ongoing activities would continue to sustain and support growth of the geographic analysis area's diverse economy, based on anticipated population growth and ongoing development of businesses and industry. Tourism and recreation would continue to be important to the economies of the coastal areas. Marine industries such as commercial fishing and shipping would continue to be active and important components of the regional economy. Counties in the geographic analysis area would continue to seek to diversify their economies, protect environmental resources, and maintain or increase their year-round population.

BOEM anticipates that ongoing activities related to continued commercial shipping and commercial fishing; ongoing port maintenance and upgrades; periodic channel dredging; maintenance of piers, pilings, seawalls, and buoys; and the use of small-scale, onshore renewable energy would have **negligible to minor adverse** impacts and **minor beneficial** impacts on demographics, employment, and economics, driven primarily by the continued operation of existing marine industries, especially commercial fishing, recreation and tourism, and shipping; increased pressure for environmental protection of coastal resources; the need for port maintenance and upgrades; and the risks of storm damage and sea level rise.

Cumulative Impacts of the No Action Alternative. BOEM recognizes that while many of the jobs generated by offshore wind projects are temporary construction jobs, the combination of these jobs over multiple projects would create notable benefits during the construction phases of these projects. This would particularly be the case as the domestic supply chain for offshore wind evolves over time. Offshore wind projects also support long-term O&M jobs; long-term tax revenues; long-term economic benefits of improved ports and associated industrial land areas; diversification of marine industries, especially in areas currently dominated by recreation and tourism; and growth in a skilled marine construction workforce.

Regional offshore wind development is anticipated to generate increased investment within the geographic analysis area in ports, shipping and logistics capability (both land and marine), component laydown and assembly facilities, job training, and other services and infrastructure necessary for offshore wind construction and operations. If U.S. supply chains develop as anticipated, additional manufacturing and servicing businesses would result, either in the geographic analysis area or at other locations in the United States. While it is not possible to estimate the extent of job growth and economic output within the geographic analysis area specifically, planned offshore wind activities would result in notable and measurable benefits to employment, economic output, infrastructure improvements, and community services, especially job training, that occur as a result of offshore wind development.

Accordingly, based on the impact definitions in Table 3.11-1 in Section 3.11.2, BOEM anticipates that planned offshore wind activities in the geographic analysis area, combined with ongoing and planned activities other than offshore wind, would result in cumulative **moderate beneficial** impacts.

In addition to the beneficial economic activity from regional offshore wind development, BOEM anticipates **negligible** to **minor adverse** cumulative impacts on demographics, employment, and economics. Planned offshore wind activities are expected to affect commercial and for-hire fishing businesses and marine recreational businesses (tour boats, marine suppliers) primarily through noise and vessel traffic during construction and the presence of offshore structures during operations. These IPFs would temporarily disturb fish and marine mammal species and displace commercial or for-hire fishing vessels, potentially resulting in conflicts over other fishing grounds, increased operating costs, and lower revenue for marine industries and supporting businesses. The long-term presence of offshore wind structures would also affect these marine industries due primarily to increased navigational constraints and risks as well as potential gear damage and loss. However, temporary disturbances such as from noise and traffic would not be expected to result in measurable adverse impacts on population, employment, or economics. It is expected that temporary adverse effects would be minimized and would not disrupt community cohesion or the economies of the affected areas. The long-term presence of structures is not expected to have adverse impacts on the economy overall; rather, employment impacts would be beneficial and there could be beneficial impacts on the commercial fishing and recreation and tourism economies as well, as discussed above.

3.11.4 Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following design parameters for the proposed Projects (Appendix E) would influence the magnitude of the impacts on demographic, employment, or economic characteristics:

- Overall size of the Projects (the 816-MW EW 1 Project and 1,260-MW EW 2 Project in Lease Area OCS-A 0512) and number of WTGs;
- The extent to which Empire hires local residents and obtains supplies and services from local vendors;
- The onshore export cable routes, including routing variants, and extent of ground disturbance for new onshore substations;
- The time of year during which construction occurs;
- The port(s) selected to support construction, installation, and decommissioning;
- The port(s) selected to support O&M; and
- The design parameters that could affect commercial fishing and recreation and tourism because impacts on these activities affect employment and economic activity.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- WTG number, size, and location: The level of impact related to WTGs is proportional to the number of WTGs installed; more WTGs would present greater economic benefits.
- Onshore export cable routes and substation footprints: The route chosen (including variants within the general route) and substation footprints would determine the communities that may be affected by construction activities.
- Beneficial impacts on employment and the economy in the geographic analysis area would be highly dependent on the percentage of workers, materials, equipment, vessels, and services that can be locally sourced.

- Season of construction: Construction outside of the recreation and tourism season would have a lesser impact on the recreation and tourism economy than construction during the active season.

3.11.5 Impacts of the Proposed Action on Demographics, Employment, and Economics

Effects on demographics, employment, and economics from the Proposed Action would include population changes due to workforce needs associated with the Proposed Action; housing needs for Proposed Action workforce; job creation; tax revenues, payroll, and other Proposed Action expenditures; and other funds provided by Empire in connection with the Proposed Action. Other effects include economic activity generated within the geographic analysis area through spending by employees or vendors; payment of personal income taxes by the Empire workforce; and spending by governments, based upon income received from Empire in connection with the Proposed Action.

Economic effects may occur in the recreation, tourism, and commercial fishing sectors, as discussed below in the analysis of individual IPFs. Impacts on commercial fisheries may in turn affect the economic health of the communities as well as the cultural identity and values—and therefore the well-being—of individuals and communities that identify as “fishing” communities. Impacts on recreation and tourism could affect the economic health of businesses and individuals that serve tourists and seasonal residents.

The Proposed Action could have a broader economic impact than indicated by its payroll and expenditures due to its position as one of the nation’s first large-scale offshore wind energy projects. The approval of the Proposed Action would encourage and support continued investment in other offshore wind projects and the creation of a domestic supply chain for the offshore wind industry in the eastern United States.

Regarding demographics, jobs and economic activity, the Proposed Action’s beneficial impacts on employment and the economy in the geographic analysis area would be highly dependent on assumptions regarding the percentage of workers, materials, equipment, vessels, and services that can be locally sourced.

In the COP (Appendix O; Empire 2023), Empire provides estimates of expected local economic and employment benefits of the two phases of development proposed by Empire for Lease Area OCS-A 0512. Empire’s economic impact study estimates that the Proposed Action would directly support the following employment in New York State alone.

The Proposed Action is expected to support over 6,300 total job-years during the construction phase and approximately 300 annual jobs (133 direct jobs and 168 indirect/induced jobs) during the approximately 34-year-long operations phase (Tables I-23 and I-25 in Appendix I; COP Appendix O; Empire 2023). The Projects are anticipated to result in approximately 1,185 indirect construction job-years in supply chain industries over the construction period. In addition to the estimated job impacts, Empire is also investing in various community development and workforce training and readiness funds in New York State. Empire estimates that the aggregate value for these funds could be between \$25 million and \$30 million for both EW 1 and EW 2 over the entire lifetime of the two facilities. The actual annual contributions of these funds would be relatively small, at less than a \$1 million per year, and are likely to support an additional 10 to 15 jobs annually in New York State for the entire 30+ years of operation. The socioeconomic benefits of these contributions are likely to be far greater than the jobs they would support in the region. For example, these funds would provide vital resources in supporting workforce training and readiness and help support efforts for just transition of the workforce, such as by providing educational initiatives in the local communities and other green initiatives aimed at developing a robust supply chain. These investments would also help further the development of the offshore wind industry in New York State (COP Appendix O; Empire 2023).

Tables I-23, I-24, and I-25 in Appendix I summarize the estimates of construction-phase economic activity, tax revenues (state and local and federal), and O&M-phase economic activity, respectively, generated by the Proposed Action within New York State.

A study from the New York Workforce Development Institute provided estimates of salaries for jobs in the wind energy industry that concur with Empire's projections. Anticipated salaries range from \$43,000 to \$96,000 for trade workers and technicians, \$65,000 to \$73,000 for ships' crew and officers, and \$64,000 to \$150,000 for managers and engineers (Gould and Cresswell 2017).

The Proposed Action would have long-term, minor beneficial impacts on employment and economic activity in the geographic analysis area, based upon anticipated short-term and modest long-term job creation, expenditures on local businesses, generation of tax revenues, and provision of grant funds. The Proposed Action would have negligible adverse impacts on demographics and housing within the geographic analysis area. As noted in Section 3.11.3.3, the growth of the overall offshore wind industry is anticipated to result in moderate beneficial impacts on employment and economics in the geographic analysis area. The Proposed Action would be part, but would not change the magnitude, of the impact.

Impacts from the Proposed Action resulting from the IPFs identified below would include beneficial, long-term impacts from increases in employment, port utilization and expansion, and vessel traffic and negligible impacts from short-term increases in noise during construction, land disturbance, and the long-term presence of offshore lighting and structures. The Proposed Action would contribute to impacts through all the IPFs. The most impactful beneficial IPFs would be increased port utilization and vessel traffic, while the most impactful adverse IPFs would be the long-term presence of offshore structures, which would affect businesses accustomed to navigating in the Lease Area. However, the Proposed Action would result in negligible incremental adverse impacts and the long-term presence of offshore structures could also have beneficial effects as a result of increased eco-tourism (e.g., people paying to charter a boat to see the wind farm, fish on the structure).

Energy generation/security: The Proposed Action would produce over 2,000 MW of electricity and a stable source of renewable energy, contributing to energy security and resiliency for the geographic analysis area. The Proposed Action would have long-term, localized, minor beneficial impacts on demographics, employment, and economics from energy generation/security.

Lighting: Lighting for vessels in transit and in the offshore work area would occur when Project construction or maintenance takes place during early-morning, dusk, or nighttime hours. Short-term vessel lighting is not anticipated to discourage tourist-related business activities and would not affect other businesses. Therefore, lighting from the Proposed Action would have short-term, negligible impacts. Vessel lighting from other offshore wind projects would have similar impacts as those of the Proposed Action, but at different locations and times. If lighting from Proposed Action vessels occurred simultaneously, the impacts of this lighting on demographics, employment, and economics would also be short term and negligible. The permanent aviation safety lighting required for the Proposed Action's WTGs could be visible from beaches and coastal locations (i.e., City of Long Beach, Monmouth County, and Ocean County), possibly affecting employment and economics in these areas if the lighting discourages visits or vacation home rentals or purchases in coastal locations where the Proposed Action's WTG lighting is visible. Lighting from all the Proposed Action's WTGs could theoretically be visible from onshore locations. All WTGs would require mid-level lighting at the halfway point between the top of the nacelle and ground level and WTGs more than 699 feet (213 meters) above ground level would require two additional flashing red lights on the back of the nacelle (Section 2.1.2.1.2). ADLS would activate the Proposed Action's WTG lighting when aircraft approach the structure, which is expected to occur less than 0.1 percent of annual nighttime hours. Even without ADLS, the presence of aviation safety lighting on the WTGs for the Proposed Action is anticipated to have a long-term, negligible impact

on demographics, employment, and economics in the geographic analysis area. Use of ADLS would reduce the already negligible impact..

Noise: The contribution of the Proposed Action to noise from survey activities, O&M, pile driving, trenching, and vessels would affect certain marine business activities associated with commercial and for-hire fishing, marine sightseeing, and recreational boating. As a result, the Proposed Action would have intermittent, short-term, negligible noise impacts on visitors, workers, and residents. As Project activities are expected to occur in developed areas and with the proposed APMs, the Proposed Action would have negligible impacts on demographics, employment, and economics as a result of noise.

Port utilization: The Proposed Action would diversify jobs and revenues in the geographic analysis area's Ocean Economy sector. In particular, the Proposed Action would enlarge and require new skills within the marine construction sector. These jobs within the Ocean Economy sector would be concentrated in Kings and Albany Counties, the locations of the proposed ports. SBMT in Kings County would be redeveloped to support the offshore wind industry as described in Section 2.1.2.4. There would be approximately 85 employees at SBMT during operations to support storage, staging, pre-assembly, and the transfer of WTG components.

The Proposed Action could temporarily compete with the commercial fishing industry for marine workers and services during construction, potentially increasing labor and service costs and encouraging vessel owners to use services in ports not supporting offshore wind development (see Section 3.9).

Employment and economic benefits of the Proposed Action at SBMT would have long-term, minor beneficial impacts. Some of the new employment may be supported by the existing workforce and would not be expected to exacerbate housing conditions in the geographic analysis area (see Appendix I). The Proposed Action would have a moderate beneficial impact on demographics, employment, and economics from port utilization due to greater economic activity and increased employment at ports used by the Proposed Action.

Presence of structures: Views of the offshore structures (i.e., WTGs and OSS) would be limited primarily to coastal areas of New York and New Jersey that have views of the Atlantic Ocean (i.e., Kings County, City of Long Beach, Nassau County, Suffolk County, and Monmouth County). Views of WTGs could have impacts on businesses serving the recreation and tourism industry. Considering the distance from shore and limited visibility of the offshore structures from residences, coastlines, and businesses, operation of the Proposed Action would have negligible adverse impacts on economics due to property value impacts and viewshed impacts on recreational and tourist businesses.

Traffic: The Proposed Action would generate vessel and highway traffic during construction, O&M, and decommissioning. Increased vessel traffic would increase the use of port and marine businesses, including tug services, dockage, fueling, inspection/repairs, and provisioning. The vessel traffic generated by the Proposed Action would result in increased business for marine transportation and supporting services in the geographic analysis area with continuous, short-term, and minor beneficial impacts during construction and decommissioning, and negligible beneficial impacts during operations.

Vessel traffic associated with the Proposed Action could also result in temporary, periodic congestion within and near ports. While there would be potential delays from increased congestion and increased risk of damage from collisions, the Proposed Action would have negligible impacts on demographics, employment, and the economy from traffic during all Project phases. Empire would implement measures to avoid, minimize, and mitigate impacts associated with vessel traffic, including rolling construction zones (APM 212), strategic timing of construction activities (APM 213), implementation of safety zones around relevant structures and vessels in a dynamic approach (APM 221), installation of AIS on all Project vessels (APM 222), use of the surrounding TSS by Project vessels (APM 223), vessel speed

restrictions, and collision avoidance measures. Any potential short-term increases in onshore traffic would be mitigated through the use of APMs and would not be expected to result in measurable adverse impacts on demographics, employment, or economics.

Land disturbance: Construction of the Proposed Action would require onshore cable installation and construction of two onshore substations including one each for EW 1 and EW 2. The Proposed Action would result in localized, short-term negligible impacts as a result of disturbance of businesses near the onshore cable route and substation construction sites. The Projects were sited, planned, and designed to avoid and minimize typical construction impacts such as increased noise, traffic, and road disturbances. These impacts would be similar in character and duration to those of other common construction projects, such as utility installations, road repairs, and industrial site construction. With implementation of proposed APMs (Appendix H, Attachment H-2), there would not be a measurable adverse impact on demographics, employment, and economics from land disturbance. Impacts on employment would be beneficial.

3.11.5.1. Impact of the Connected Action

The connected action would affect demographics, employment, and economics in the geographic analysis area through the following IPFs: noise, port utilization, presence of structures, traffic, and land disturbance. The purpose of the connected action is to upgrade SBMT to enable it to serve as a staging facility and O&M facility for the offshore wind industry. The connected action includes the construction of an approximately 60,000-square-foot O&M facility containing approximately 22,000 square feet of office and support space, approximately 3,000 square feet of waiting area for employees deploying to offshore work sites, and approximately 35,000 square feet of warehouse facilities and associated utility space with a maximum height of 32.8 feet from grade. The outside areas around the buildings would be landscaped and include associated parking. During operations, SBMT is expected to support approximately 85 employees, with roughly 80 percent being in the professional services sector. The remaining 20 percent of employees are anticipated to work within the construction sector, a major employment industry within some of the affected geographies.

Noise: The connected action would contribute temporary construction noise and noise from O&M and vessels that would affect certain marine business activities associated with marine sightseeing and recreational boating. As a result, the connected action would have negligible impacts on demographics, employment, and economics resulting from noise.

Port utilization: NYCEDC would construct improvements at SBMT to enable it to serve as a staging facility and O&M facility for the offshore wind industry. Upgrades would include seaward bulkhead extension, bulkhead repairs, upgrades for crane positions, wharf upgrades, dredging, and fender placement for vessel berthing. These planned improvements at SBMT, including in-water work, are being separately reviewed by USACE and state and local agencies (NYCEDC 2023).

In the near term, SBMT would be used to support the EW 1 and EW 2 projects and it is expected to support different offshore wind developers and projects in the future. BOEM expects that SBMT would experience long-term, moderate beneficial impacts from greater economic activity and increased employment due to increased utilization of the marine terminal for WTG staging and an O&M facility, as well as through increased demand for vessel maintenance services, vessel berthing, loading and unloading, warehousing, capital investment for improvements, and other business activity related to offshore wind.

Presence of structures: The connected action would construct a seaward bulkhead extension, new wharf and crane positions for WTG component loading and unloading, a wharf for service operation vessels and crew transfer vessels, and an O&M facility at SBMT. Considering that planned uses are consistent with

the zoning of SBMT for heavy industry and the context of the SBMT site within a high- and medium-intensity developed area, BOEM expects that construction and operation of the SBMT Project would have long-term, negligible impacts on existing demographics surrounding the site and long-term, moderate beneficial impacts on employment and economics due to upgrades to the SBMT site to support the offshore wind industry in the near term and for future offshore wind projects in the New York and New Jersey region.

Traffic: The connected action would generate vessel traffic in SBMT. The proposed facility improvements would provide marine vessel access and allow the storage, staging, pre-assembly, and transfer of materials utilized in construction, installation, and O&M of offshore wind projects. Increased vessel traffic would increase the use of port and marine businesses, including tug services, dockage, fueling, inspection/repairs, and provisioning. The vessel traffic generated by the connected action would result in increased business for marine transportation and supporting services in the geographic analysis area with minor beneficial impacts during construction and decommissioning and operations.

Vessel traffic associated with the connected action could also result in temporary, periodic congestion within and near ports, leading to potential delays and an increased risk for collisions between vessels, which would result in economic costs for vessel owners. It is anticipated that potential increases in vessel traffic would be mitigated by environmental protection measures and that there would be no measurable adverse impact on the economy. Therefore, the connected action would have negligible impacts on demographics, employment, and economics during construction and operations as a result of vessel traffic.

Land disturbance: The connected action would construct an O&M facility at SBMT. SBMT is entirely developed with several buildings and paving throughout and is in a developed area zoned for heavy industry. No zoning changes are anticipated to be required for the connected action. Therefore, BOEM expects that land disturbance for construction and operation of planned improvements at SBMT would have negligible impacts on demographics, employment, and economics due to land disturbance. The connected action is also expected to result in minor beneficial impacts on the economy and employment during construction and operations associated with demolition of existing buildings, construction of new buildings, and increased port activity.

3.11.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned activities, and the connected action at SBMT. In context of reasonably foreseeable environmental trends, the cumulative impacts of ongoing and planned activities, including the Proposed Action, are anticipated to be moderate beneficial for employment and economics in the geographic analysis area.

Energy generation/security: The Proposed Action's cumulative energy security/generation impacts on demographics, employment, and economics would be notable and measurable due to increased renewable energy generation. The impacts of the Proposed Action, when combined with ongoing and planned activities, would therefore be moderate beneficial.

Lighting: The Proposed Action's cumulative impacts on demographics, employment, and economics as a result of lighting would be negligible. Lights on 111 WTGs associated with other offshore wind projects in the geographic analysis area for recreation and tourism (in addition to 147 WTGs from the Proposed Action—a total of 258 WTGs) could also be visible, but the resulting impacts on demographics, employment, and economics are not anticipated to be measurable. Therefore, the combined lighting impacts from ongoing and planned activities including offshore wind would be negligible.

Noise: The Proposed Action's cumulative impacts on demographics, employment, and economics as a result of noise would be negligible. The onshore construction noise activities from the Proposed Action are not anticipated to overlap in location with those of other offshore wind projects. Cumulative noise impacts on demographics, employment, and economics would be anticipated to be short term and negligible through the use of proposed environmental protection measures and because construction and operational activities would generally take place in areas already developed with commercial and industrial uses or offshore.

Port utilization: Other planned offshore wind activity would provide business activities at the same ports as the Proposed Action as well as other ports within the geographic analysis area. As noted in Section 3.11.1, port investments are ongoing and planned in response to offshore wind activity. An offshore wind tower manufacturing facility would be developed at the Port of Albany, in Albany County. This facility would create up to 350 direct jobs in the region (Equinor 2020).

The Proposed Action's cumulative impacts on demographics, employment, and economics as a result of port utilization and expansion would be notable and therefore moderate beneficial. Port utilization for the offshore wind industry would contribute associated trained and skilled offshore wind workforce and would serve as an economic engine in port communities and the region as a whole.

Presence of structures: Across the New York and New Jersey lease areas, up to 1,352 WTGs and other offshore structures, including those of the Proposed Action, would affect employment and economics by affecting marine-based businesses. Presence of structures would have both beneficial impacts, such as by providing sightseeing opportunities and fish aggregation that benefit recreational businesses, and adverse effects, such as by causing fishing gear loss, navigational hazards, and viewshed impacts that could affect business operations and income (see Sections 3.9 and 3.18). The cumulative impacts on demographics, employment, and economics due to the presence of structures would be negligible. WTGs associated with other offshore wind projects would also be visible (see Section 3.11.3.2); however, potential adverse effects on commercial fishing and recreation would not result in measurable impacts on demographics, employment, and the economy overall. Presence of structures could also result in positive benefits for commercial fishing and recreation.

Traffic: The Proposed Action combined with increased traffic congestion and collision risk from ongoing and planned activities would have unmeasurable and therefore negligible impacts on demographics, employment, and economics during all Project phases. It is anticipated that any short-term increases in traffic would be mitigated through the use of environmental protection measures and that there would not be significant disruptions to community cohesion or economic activity. Increased vessel traffic would produce demand for supporting marine services, with beneficial impacts on employment and economics during all Project phases, including minor to moderate beneficial impacts during construction and decommissioning and negligible beneficial impacts during operations.

Land disturbance: The exact extent of land disturbance associated with other projects would depend on the locations of landfall, onshore transmission cable routes, and onshore substations for offshore wind energy projects. Cumulative impacts of the Proposed Action in combination with ongoing and planned activities would have no impact or negligible cumulative impacts on demographics, employment, and economics due to land disturbance because most activities would occur offshore or in commercially and industrially developed areas and would be mitigated through the use of environmental protection measures. Also, anticipated job creation associated with ongoing and planned offshore wind projects is notable and therefore moderate beneficial.

3.11.5.3. Conclusions

Impacts of the Proposed Action. The Proposed Action would have long-term, **negligible** to **minor beneficial** impacts on employment and economic activity in the geographic analysis area, based upon anticipated short-term and modest long-term job creation, expenditures on local businesses, generation of tax revenues, and provision of grant funds. The Proposed Action would have **negligible** adverse impacts on demographics and housing within the geographic analysis area. Impacts from the Proposed Action resulting from the IPFs identified above would include beneficial, long-term impacts from energy security/generation, port utilization and expansion, presence of structures, vessel traffic, and climate change and adverse impacts from short- and long-term increases in light, noise during construction, long-term presence of structures, vessel traffic and collisions, and land disturbance. Adverse impacts from the Proposed Action would be **negligible**.

BOEM expects that the connected action would have **negligible** impacts on demographics, employment, and economics due to noise, traffic, and land disturbance. The introduction of new facilities at SBMT for use of the marine terminal for WTG staging and an O&M facility for offshore wind projects would have **negligible** impacts on existing demographics and long-term, **minor** to **moderate beneficial** impacts on employment and economics due to the presence of structures and port utilization.

Under the Proposed Action, construction, O&M, and eventual decommissioning would occur within the range of design parameters outlined in the COP, subject to applicable mitigation measures (Appendix H). Impacts of the Proposed Action for demographics, employment, and economics are summarized as **negligible** along with **minor beneficial**.

Cumulative Impacts of the Proposed Action. BOEM anticipates that the cumulative impacts on demographics, employment, and economics would be **negligible** to **minor** and **moderate beneficial**. See Section 3.9 for impacts on commercial and for-hire recreational fishing, for-hire recreational boating, and associated businesses.

3.11.6 Impacts of Alternatives B, C, D, E, F, G, and H on Demographics, Employment, and Economics

Impacts of Alternatives B, C, D, E, F, G, and H. Alternatives that make minor modifications to the WTG array (Alternatives B, E, and F), narrow the selection of submarine or onshore cable routes (Alternatives C, D, and G), or result in alternate methods of dredge and fill activities (Alternative H) would not have impacts on demographics, employment, and economics that are materially different than the impacts of the Proposed Action.

Alternatives B, E, and F would alter the turbine array layout compared to the Proposed Action. Alternative F provides for 54 WTGs in EW 1 and 84 WTGs in EW 2 (for a total of 138 WTGs) compared to up to 147 WTGs for the Proposed Action. Therefore, the beneficial impacts on employment and the economy would be similar to those described for the Proposed Action. Alternative F would optimize the production of energy, resulting in the most cost-efficient and highest annual renewable energy production, which would result in additional minor beneficial impacts compared to Alternatives B and E. Alternative B would remove six WTG positions from the northwestern end of EW 1 to reduce impacts on Cholera Bank, scenic resources, and navigation. As such, there would still be negligible impacts on economics due to property value impacts and viewshed impacts on recreational and tourist businesses. Alternative E would create a separation between the EW 1 and EW 2 Projects and remove seven WTG positions. Adverse economic impacts with Alternatives B, E, and F would still be expected to be negligible. See Section 3.9 for impacts on commercial and for-hire recreational fishing, for-hire recreational boating, and associated businesses.

Under Alternatives C, D, and G, with the alternate cable routes, adverse impacts on the economy would still be expected to be negligible.

Alternative H would use an alternate method of dredge or fill activities during construction at the SBMT, requiring a permit from USACE that would reduce the discharge of dredged material. Therefore, adverse impacts on the economy would still be expected to be negligible.

Cumulative Impacts of Alternatives B, C, D, E, F, G, and H. In context of reasonably foreseeable environmental trends, the cumulative impacts resulting from individual IPFs combined with ongoing and planned activities under Alternatives B, C, D, E, F, G, and H would be similar to those of the Proposed Action: negligible or minor adverse impacts on demographics, employment, and economics along with cumulative moderate beneficial impacts due to new hiring and economic activity.

3.11.6.1. Conclusions

Impacts of Alternatives B, C, D, E, F, G, and H. Accordingly, the impacts resulting from individual IPFs associated with Alternatives B, C, D, E, F, G, and H on demographics, employment, and economics would be the same as those of the Proposed Action alone: **negligible** adverse impacts due to the IPFs discussed above, along with **negligible to minor beneficial** impacts due to new hiring and economic activity.

Cumulative Impacts of Alternatives B, C, D, E, F, G, and H. In context of reasonably foreseeable environmental trends, the cumulative impacts resulting from individual IPFs combined with ongoing and planned activities under Alternatives B, C, D, E, F, G, and H would be similar to those of the Proposed Action: **negligible to minor** adverse impacts on demographics, employment, and economics along with overall **moderate beneficial** impacts due to new hiring and economic activity.

3.11.7 Comparison of Alternatives

Alternatives B, E, and F would reduce the number of WTGs (Alternative F) or remove select WTG positions from potential development (Alternatives B and E) compared to the Proposed Action and still maintain negligible adverse economic impacts. Alternatives C, D, and G would also be expected to have negligible adverse impacts on the economy as a result of the alternate submarine or onshore cable routes. Similarly, Alternative H is anticipated to have negligible adverse economic impacts. Alternative H proposes an alternate method of dredge or fill during SBMT construction that would require a permit from USACE and reduce the discharge of dredged material.

In context of reasonably foreseeable environmental trends, the cumulative impacts associated with Alternatives B, C, D, E, F, G, and H when each is combined with the impacts of ongoing and planned activities would be the same as for the Proposed Action—**negligible to minor** adverse impacts and **moderate beneficial** impacts.

3.11.8 Summary of Impacts of the Preferred Alternative

The Preferred Alternative is a combination of Alternatives C-1, D, F, G, and H. The Preferred Alternative incorporates the same workforce training and local hiring initiatives proposed for the Proposed Action. Alternative C-1 would avoid routing the export cable through the Ambrose Navigation Channel, which is used by fishing vessels traveling to and from Brooklyn/Sheepshead Bay, such that disruptions to transiting fishing vessels are expected to be reduced relative to Alternative C-2 under this alternative (see Section 3.9). Alternative F would entail the removal of WTG positions from a contiguous area in the southeastern portion of EW 1, potentially resulting in an expansion of fishing activity and views relative to the Proposed Action (see Sections 3.9 and 3.20). Alternative D would require a slightly longer export cable to avoid sand borrow areas offshore Long Island and may result in slightly greater construction

impacts, including job creation and other economic benefits, related to avoidance of the area by nearshore fishing vessels. Alternatives G and H are not expected to result in changes to demographics, employment, and economics relative to the Proposed Action. Overall, the Preferred Alternative would be similar to the Proposed Action in terms of impacts on demographics, employment, and economics including new hiring and economic activity. Accordingly, impacts of the Preferred Alternative alone would remain of the same level as for the Proposed Action (negligible along with minor beneficial).

3.11.9 Proposed Mitigation Measures

No measures to mitigate impacts on demographics, employment, and economics have been proposed for analysis.

3.18. Recreation and Tourism

This section discusses potential impacts on recreation and tourism from the proposed Projects, alternatives, and ongoing and planned activities in the geographic analysis area. The geographic analysis area, as shown on Figure 3.18-1, includes an area that extends 40 miles (64.4 kilometers) around the borders of the Wind Farm Development Area. The geographic analysis area includes portions of New York, Kings, Queens, Richmond, Nassau, and Suffolk Counties in New York and Monmouth and Ocean Counties in New Jersey. Section 3.11, *Demographics, Employment, and Economics*, discusses the economic aspects of recreation and tourism in the geographic analysis area.

3.18.1 Description of the Affected Environment for Recreation and Tourism

Proposed Project facilities would be within and off the coasts of New York and New Jersey. The coastal areas support ocean-based and onshore recreation and tourist activities, such as recreational and for-hire boating and fishing, guided tours, day use of parks and beaches, outdoor sports, and scenic or wildlife viewing. As indicated in Section 3.11, *Demographics, Employment, and Economics*, recreation and tourism contribute substantially to the economies of New York's and New Jersey's coastal counties. In 2019, 265.5 million people visited New York and spent about \$73.6 billion, leading to a \$117.6 billion total economic impact through tourism (Empire State Development n.d.). In 2019, 116 million people visited New Jersey and spent \$46.4 billion, making tourism the sixth largest employer in New Jersey (Tourism Economics 2019). Annual tourism in New Jersey's coastal communities is a \$16 billion industry (NJDEP 2021).

Coastal New York and New Jersey have a wide range of visual characteristics, with communities and landscapes ranging from large cities to small towns, suburbs, rural areas, beaches, and wildlife preserves. As a result of the proximity to the Atlantic Ocean, as well as the views associated with the shoreline, the New York and New Jersey shores have been extensively developed for water-based recreation and tourism. The scenic quality of the coastal environment is important to the identity, attraction, and economic health of many coastal communities. Additionally, the visual qualities of these historic coastal towns, which include marine activities within small-scale harbors and the ability to view birds and marine life, are important community characteristics. Coastal communities provide hospitality, entertainment, and recreation for both residents and tourists.

There are several recreation areas within the geographic analysis area. Otis Pike Fire Island High Dunes Wilderness, a 7-mile stretch of undeveloped barrier island on Fire Island, is the only federally designated wilderness area within the state of New York and is the closest wilderness area in the nation to a major metropolitan area. Recreation activities within the wilderness area include hiking trails, backcountry camping opportunities, fishing, and scenic views and abundant wildlife that attract bird watchers and wildlife viewers. The Gateway National Recreation Area includes three units: the Jamaica Bay Unit (Jamaica Bay and surrounding properties in Brooklyn and Queens including the western end of the Rockaway Peninsula), the Staten Island Unit (Fort Wadsworth, Miller Field, and Great Kills), and the Sandy Hook Unit (the Sandy Hook peninsula). The Gateway National Recreation Area provides visitors green spaces and beaches alongside historic structures and cultural landscapes and provides space for recreation activities including boating, bicycle paths, bird watching, archery, camping, fishing, and guided tours.



Figure 3.18-1 Recreation and Tourism Geographic Analysis Area

Land and Water Conservation Fund assisted sites are properties acquired or developed using Land and Water Conservation Fund assistance to preserve, develop, and ensure accessibility to quality outdoor recreation resources. These properties cannot be wholly or partially converted to uses other than public outdoor recreation without the approval of the National Park Service pursuant to Land and Water Conservation Fund Act (54 USC 200305(f)(3)) and implementing regulations (36 CFR 59.3). The following Land and Water Conservation Fund assisted sites are closest to onshore Project infrastructure: Lido Beach Town Park, Lido Beach Pool Complex, Long Beach Wantagh Bikeway, Long Beach Boardwalk, Jones Beach State Park, and Long Beach Recreation Center.

Water-oriented recreational activities in the geographic analysis area include recreational fishing, boating, and surfing. Boating covers a wide range of activities, from ocean-going vessels to small boats used by residents and tourists in sheltered waters, and includes sailing, fishing, shell fishing, kayaking, canoeing, and paddleboarding. Commercial businesses offer boat rentals, such as canoes, kayaks, and private charter boats for recreation, fishing, and wildlife viewing. Surfing can occur year-round, with the prime season in the fall. Many of the activities make use of coastal and ocean amenities that are free for public access. Nonetheless, these features function as key drivers for many coastal businesses, particularly those within the recreation and tourism sectors. As discussed in Section 3.11, *Demographics, Employment, and Economics*, recreation and hospitality are major sectors of the local economy, supported by ocean-based recreation uses.

Offshore wildlife viewing in charter boats, such as bird and whale watching, is particularly popular off the New York and New Jersey coasts and in the New York Harbor between spring and fall due to migrations. Some bird watching does take place on shore from Jones Beach to the Fire Island National Seashore in New York and across the Gateway National Recreation Area, which includes Jamaica Bay and the Sandy Hook peninsula. Chartered bird and seal watching tours occur at New York Harbor during the winter months. Whale watching occurs at New York Harbor and throughout the New York Bight, especially during the summer months (COP Volume 2e, Section 8.11.1.1; Empire 2023). Underwater recreation, such as diving and snorkeling to see shipwrecks, reefs, canyons, and marine wildlife, happens throughout the year in New York and New Jersey, but it is most popular between May and October (COP Volume 2e, Section 8.11.1.2; Empire 2023). Surface-based marine recreational activities popular along the New York coastline, particularly during the summer, include swimming, surfing, kayaking, paddle boarding, windsurfing, and kite boarding. Most of these activities take place off Long Island, including along the Rockaways, Long Beach, Jones Beach, and Fire Island. Surfing usually occurs along Long Beach, Jones Beach Island, Cedar Beach, and Robert Moses State Park (COP Volume 2e, Section 8.11.1.3; Empire 2023).

There is a large and robust recreational fishing industry in New York and New Jersey. In 2019, there were 13.4 million recreational saltwater angler trips (i.e., charter boats, party boats, private/rental boats, and shore) in New York and 13.3 million in New Jersey, with shore fishing representing the majority (more than half) of those trips. In 2020, recreational fishing had a \$297.9 million economic impact on New York and a \$455.6 million economic impact in New Jersey (NMFS 2023). The areas in which sport fishing take place, such as Cholera Bank and Angler's Bank, are not within the Lease Area or within the submarine export cable siting corridors; however, fishermen may choose to travel through the Lease Area to reach the aforementioned areas. Recreational saltwater fishing takes place throughout the year but is especially prevalent from April through November, with peaks in May and June. Annual saltwater fishing tournaments also take place in the New York Bight, targeting species such as black sea bass, bluefish, striped bass, summer flounder, tautog, tuna, and shark. Recreational shell fishing occurs mainly in state waters, targeting species such as blue crabs, scallops, quahogs, Atlantic surfclam, and softshell clams (COP Volume 2e, Section 8.8.2.1; Empire 2023).

3.18.2 Impact Level Definitions for Recreation and Tourism

Definitions of impact levels are provided in Table 3.18-1.

Table 3.18-1 Impact Level Definitions for Recreation and Tourism

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on the recreation setting, recreation opportunities, or recreation experiences would be so small as to be unmeasurable.
	Beneficial	No effect or measurable impact.
Minor	Adverse	Impacts would not disrupt the normal functions of the affected activities and communities.
	Beneficial	A small and measurable improvement to infrastructure/facilities and community services, or benefit for tourism.
Moderate	Adverse	The affected activity or community would have to adjust somewhat to account for disruptions due to the Projects.
	Beneficial	A notable and measurable improvement to infrastructure/facilities and community services, or benefit for tourism.
Major	Adverse	The affected activity or community would have to adjust to significant disruptions due to large local or notable regional adverse impacts of the Projects.
	Beneficial	A large local, or notable regional improvement to infrastructure/facilities and community services, or benefit for tourism.

3.18.3 Impacts of the No Action Alternative on Recreation and Tourism

When analyzing the impacts of the No Action Alternative on recreation and tourism, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for recreation and tourism. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities, as described in Appendix F, *Planned Activities Scenario*.

3.18.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for recreation and tourism described in Section 3.18.1, *Description of the Affected Environment for Recreation and Tourism*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind activities within the geographic analysis area include commercial fishing, emplacement of submarine cables and pipelines, dredging and port improvement projects, marine minerals use and ocean dredging, military use, marine transportation, and onshore development activities (see Appendix F, Section F.2). Ongoing activities would contribute to impacts on recreation and tourism through the primary IPFs of anchoring, land disturbance, lighting, cable emplacement and maintenance, noise, presence of structures, and vessel traffic.

There are no ongoing offshore wind activities within the geographic analysis area for recreation and tourism.

3.18.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Ongoing and planned non-offshore wind activities would contribute to periodic disruptions to recreation and tourism activities but are typical occurrences along the New York and New Jersey coastlines and would not substantially affect visitor use or experience. Visitors would continue to pursue activities that rely on the area's coastal and ocean environment, scenic qualities, natural resources, and establishments that provide services for recreation and tourism. See Table F1-20 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for recreation and tourism.

Planned offshore wind projects in the geographic analysis area are planned within Lease Areas OCS-A 0544 (Vineyard Mid-Atlantic Offshore Wind), OCS-A 0537 (OW Ocean Winds East LLC), OCS-A 0538 (Attentive Energy LLC), and OCS-A 0539 (Bight Wind Holdings LLC). These projects are estimated to collectively install 449 WTGs, 9 OSS, and 1,889 statute miles (1,913 kilometers) of submarine export cable and interarray cable in the geographic analysis area between 2026 and 2030.

The sections below summarize the potential impacts of planned offshore wind activities in the geographic analysis area on recreation and tourism during construction, O&M, and decommissioning of the projects. BOEM expects planned offshore wind activities to affect recreation and tourism through the primary IPFs of anchoring, land disturbance, lighting, cable emplacement and maintenance, noise, presence of structures, and vessel traffic.

Anchoring: Anchoring could potentially affect recreational boating in the geographic analysis area both through the presence of an increased number of anchored vessels during offshore wind construction, O&M, and decommissioning and through the creation of offshore areas with cable or scour protection where anchors of smaller recreational vessels may fail to hold.

Development of planned offshore wind projects between 2026 and 2030 would increase the number of vessels anchored offshore. The greatest volume of anchored vessels would occur in offshore work areas during construction and installation. Vessel anchoring would also occur during O&M but at a reduced frequency. Planned offshore wind projects would add an estimated 371 acres (150 hectares) of scour protection for WTG foundations and 171 acres (69 hectares) of cable protection to the geographic analysis area, which could create resistance to anchoring for recreational boats.

Anchored vessels for construction, O&M, and decommissioning of planned offshore wind projects would have localized, intermittent, long-term impacts on recreational boating. The addition of scour and cable protection would have localized, long-term impacts on anchoring for recreational boats. BOEM expects that recreational boaters could navigate around anchored vessels and adjust the locations for dropping anchor to avoid cable and scour protection with only brief inconvenience, and impacts would be minor.

Land disturbance: Planned offshore wind development would require installation of landfalls, onshore export cable and interconnection cable, and onshore substations, which could result in localized, temporary disturbance to recreational activity or tourism-based businesses near construction sites. BOEM expects these impacts would be localized and temporary during construction, O&M, and decommissioning. The exact extent of impacts would depend on the locations of onshore infrastructure for planned offshore wind projects; however, the No Action Alternative would generally have localized, temporary, and minor impacts.

Lighting: Planned offshore wind projects would add new sources of light to onshore and offshore areas including from nighttime vessel lighting and fixed lighting at onshore substations and an estimated 449

WTGs and 9 OSS. BOEM expects that lighting at onshore substations would have negligible impacts on recreation and tourism. Impacts of vessel lighting would be temporary for the duration that the vessel is engaged in construction, O&M, or decommissioning activities and is either anchored or transiting at night. WTGs would be lit and marked in accordance with FAA and USCG requirements for aviation and navigation obstruction lighting, respectively. Impacts of lighting on WTG and OSS structures would be long term.

Aviation warning lighting required for WTGs would be visible from beaches and coastlines within the geographic analysis area and could have impacts on recreation and tourism in certain locations if the lighting influences visitor decisions in selecting coastal locations to visit. FAA hazard lighting systems would be in use for the duration of O&M for up to 449 WTGs (Appendix F, Table F2-1). The installation of these WTGs affixed with red flashing lights mounted on opposite rear sides of the nacelle and spaced around the mast midway between the nacelle and AMSL within the offshore wind lease areas would have long-term minor to major impacts on sensitive onshore and offshore viewing locations, based on viewer distance and angle of view and assuming no obstructions. Atmospheric and environmental factors such as haze and fog would influence visibility and perception of hazard lighting from sensitive viewing locations.

A University of Delaware study evaluating the impacts of visible offshore WTGs on beach use found that WTGs visible more than 15 miles (24.1 kilometers) from the viewer would have negligible impacts on businesses dependent on recreation and tourism activity (Parsons and Firestone 2018). The study participants viewed visual simulations of WTGs in clear, hazy, and nighttime conditions (without ADLS). A 2017 visual preference study conducted by North Carolina State University evaluated the impact of offshore wind facilities on vacation rental prices. The study found that nighttime views of aviation hazard lighting (without ADLS) for WTGs close to shore (5 to 8 miles [8 to 13 kilometers]) would adversely affect the rental price of properties with ocean views (Lutzeyer et al. 2017). It did not specifically address the relationship between lighting, nighttime views, and tourism for WTGs 15 or more miles (24.1 or more kilometers) from shore. WTGs associated with planned offshore wind projects in the geographic analysis area would be more than 15 miles (24.1 kilometers) from coastal locations with views of the WTGs. For example, the nearest distance between the Mid-Atlantic Offshore Wind Lease Area and the New York or New Jersey coast is over 23 miles (37 kilometers), while the OW Ocean Winds East LLC Lease Area is more than 40 miles (64.4 kilometers) from either the New York or New Jersey coast.

The New York and New Jersey shores that are within the viewshed of planned offshore wind projects have been extensively developed. Because of the high development density, existing nighttime lighting is prevalent. Elevated boardwalks, jetties, and seawalls afford greater visibility of offshore elements for viewers in beach areas. Nighttime views toward the ocean from the beach and adjacent inland areas are diminished by ambient light levels and glare of shorefront developments. While ambient nighttime lighting may be expected within the more developed areas of the New York and New Jersey shores, within the region's national parks, wildlife refuges, and wilderness areas, darkness and the night sky and the feelings associated with open space in a high-density area are considered fundamental resources that contribute to the visitor experience (NPS 2014). Completely natural night skies are not obtainable at these parks given the surrounding urban environment of New York City; however, many of the parks do offer relatively dark night skies where visitors can experience night skies with only dim and distant artificial lights (NPS 2014).

Visible aviation warning lighting would add a developed/industrial visual element to views that were previously characterized by dark, open ocean, broken only by transient lighted vessels and aircraft passing through the view. The implementation of ADLS would activate the hazard lighting system in response to detection of nearby aircraft. The synchronized flashing of the navigational lights, if ADLS is implemented, would result in shorter-duration night sky impacts on the seascape, landscape, and viewers. The shorter-duration synchronized flashing of the ADLS is anticipated to have reduced visual impacts at

night as compared to the standard continuous, medium-intensity red strobe FAA warning system due to the duration of activation.

In addition to recreational fishing, some recreational boating in the region involves whale watching and other wildlife-viewing activity. A 2013 BOEM study evaluated the impacts of WTG lighting on birds, bats, marine mammals, sea turtles, and fish. The study found that existing guidelines “appear to provide for the marking and lighting of [WTGs] that will pose minimal if any impacts on birds, bats, marine mammals, sea turtles or fish” (Orr et al. 2013). By extension, existing lighting guidelines or ADLS (if implemented) would not affect recreational fishing or wildlife viewing.

As a result, although lighting on WTGs would have a continuous, long-term, adverse impact on recreation and tourism, the impact in the geographic analysis area is likely to be limited to individual decisions by visitors to the New York and New Jersey shores and elevated areas, with less impact on the recreation and tourism industry as a whole.

Cable emplacement and maintenance: An estimated 1,189 statute miles (1,913 kilometers) of submarine export cable and interarray cable would be installed in the geographic analysis area between 2026 and 2030 for planned offshore wind projects. Recreational uses would be temporarily displaced from work zones during cable installation. Cable installation could also have temporary impacts on fish and invertebrates of interest for recreational fishing, due to trenching and associated underwater noise and turbidity near the work zone. The degree of temporal and geographic overlap of each cable is unknown, although cables for some projects could be installed simultaneously. Displacement of recreational activities due to cable emplacement would be temporary and limited to the construction safety zones established for safe performance of the work. Displacement of recreational uses for cable maintenance during the O&M phase of each project would be temporary and intermittent over the life of the project.

Noise: Noise from operation of construction equipment, pile driving, and vehicle or vessel traffic could result in adverse impacts on recreation and tourism. Onshore construction noise near beaches, parkland, recreation areas, or other areas of public interest would temporarily disturb the quiet enjoyment of the site (in locations where such quiet is an expected or typical condition). Similarly, offshore construction noise would intrude upon the natural sounds of the marine environment. Construction noise could cause some boaters to avoid construction areas, although the most intense noise sources (such as pile driving) would originate within the safety zones that USCG may establish for areas of active construction, which would be off-limits to boaters. BOEM conducted a qualitative analysis of impacts on recreational fisheries for the construction phases of offshore wind development in the Atlantic OCS region. Results showed the construction phase is expected to have a slightly negative to neutral impact on recreational fisheries due to both direct exclusion of fishing activities and displacement of mobile target species by construction noise (Kirkpatrick et al. 2017). BOEM expects that the impact of noise on recreation and tourism during construction would be temporary and localized. Multiple construction projects at the same time would increase the number of locations within the geographic analysis area that experience noise disruptions. The impact of noise during O&M would be localized, continuous (for operation of WTGs and OSS), and long term, with brief periods of more-intense noise during occasional repair activities.

Adverse impacts of noise on recreation and tourism would also result from the adverse impacts on species important to recreational fishing and sightseeing within the geographic analysis area. Pile driving using an impact hammer would cause the most impactful noises. Because most recreational fishing takes place closer to shore, only a small proportion of recreational fishing would be affected by construction of WTGs, OSS, and submarine cables. Recreational fishing such as for tuna, shark, and marlin is more likely to be affected, as these fisheries are farther offshore than most fisheries and, therefore, more likely to experience temporary impacts resulting from the noise generated by construction for planned offshore wind projects. Construction noise could contribute to temporary impacts on marine mammals, with resulting impacts on chartered tours for whale watching or other wildlife viewing. However, planned

projects are expected to comply with mitigation measures (e.g., exclusion zones, protected species observers) that would avoid and minimize underwater noise impacts on marine mammals.

Noise from operational WTGs would be expected to have little effect on finfish, invertebrates, and marine mammals, and consequently little effect on recreational fishing or sightseeing. BOEM expects that planned offshore wind construction would result in localized, temporary impacts on recreational fishing and marine sightseeing related to fish and marine mammal populations. Multiple construction projects would increase the spatial and temporal extent of temporary disturbance to marine species within the geographic analysis area. As shown in Table F2-1 in Appendix F, BOEM expects that up to four offshore wind projects (not including the Proposed Action) could be under construction simultaneously in the recreation and tourism geographic analysis area. No long-term, adverse impacts are anticipated, provided that mitigation measures are implemented to prevent population-level harm to fish and marine mammal populations.

Presence of structures: The construction and installation of 449 WTGs and 9 OSS within the recreation and tourism geographic analysis area would contribute to impacts on recreational fishing and boating. The offshore structures would have long-term, adverse impacts on recreational boating and fishing through the risk of allision; risk of gear entanglement, damage, or loss; navigational hazards; space use conflicts; presence of cable infrastructure; and visual impacts. However, planned offshore wind structures could have beneficial impacts on recreation through fish aggregation and reef effects. The WTGs and OSS installed within offshore wind lease areas are expected to serve as additional artificial reef structures, providing additional locations for recreational for-hire fishing trips, potentially increasing the number of trips and revenue.

The presence of planned offshore wind structures would increase the risk of allision or collision with other vessels and the complexity of navigation within the geographic analysis area. Generally, the vessels more likely to allide with WTGs or OSS would be smaller vessels moving within and near wind farm installations, such as recreational vessels. Planned offshore wind development could require adjustment of routes for recreational boaters, anglers, sailboat races, and sightseeing boats, but the adverse impact of the planned offshore wind structures on recreational boating would be limited by the distance offshore. Recreational boating routes in the geographic analysis area mainly occur within 3 nm (5.5 kilometers) of the coastline within the New York Bight (COP Volume 2e, Section 8.7.1.1; Empire 2023).

The geographic analysis area would have an estimated 371 acres (150 hectares) of scour protection for WTG foundations and 171 acres (69 hectares) of cable protection, which results in an increased risk of entanglement. Accurate marine charts could make operators of recreational vessels aware of the locations of the cable protection and scour protection. If the hazards are not noted on charts, operators may lose anchors, leading to increased risks associated with drifting vessels that are not securely anchored. Lessees would engage with both USCG and NOAA in developing a comprehensive aid to navigation plan. Buried offshore cables would not pose a risk for most recreational vessels, as smaller-vessel anchors would not penetrate to the target burial depth for the cables. Because anchoring is uncommon in water depths where the No Action Alternative WTGs would be installed, anchoring risk is more likely to be an impact over export cables in shallower water closer to coastlines. The risk to recreational boating would be localized, continuous, and long-term.

Planned offshore wind structures could provide new opportunities for offshore tourism by attracting recreational fishing and sightseeing. The WTG and OSS structures could produce artificial reef effects. The “reef effect” refers to the introduction of a new hard-bottom habitat that has been shown to attract numerous species of algae, shellfish, finfish, and sea turtles to new benthic habitat. The reef effect could attract species of interest for recreational fishing and result in an increase in recreational boaters traveling farther from shore in order to fish. The potential attraction of sea turtles to the structures may also attract recreational boaters and sightseeing vessels. In a 2020 survey-based study, 11.4 percent of participants

indicated that they would make a trip to tour offshore wind facilities 12.5 miles offshore (Parsons et al. 2020). The number of participants that indicated they would tour offshore wind facilities decreases as the project moves farther offshore. Of the respondents that reported they would take a trip, the majority of those reported they expect to only take a one-time trip. Although the likelihood of recreational vessels visiting the offshore structures would diminish with distance from shore, increasing numbers of offshore structures may encourage a greater volume of recreational vessels to travel to the offshore wind lease areas. Additional fishing and tourism activity generated by the presence of structures could also increase the likelihood of allisions and collisions involving recreational fishing or sightseeing vessels, as well as commercial fishing vessels.

As it relates to the visual impacts of structures, the vertical presence of WTGs on the offshore horizon may affect recreational experience and tourism in the geographic analysis area. Section 3.20, *Scenic and Visual Resources*, describes the visual impacts from offshore wind infrastructure. If the purpose of the viewer's sightseeing excursion is to observe the mass and scale of the WTGs' offshore presence, then the increasing visual dominance would benefit the viewer's experience as the viewer navigates toward the WTGs. However, if experiencing a vast pristine ocean condition is the purpose of the viewer's sightseeing excursion, then the increasing visual dominance may detract from the viewer's experience.

Studies and surveys that have evaluated the impacts of offshore wind facilities on tourism found that established offshore wind facilities in Europe did not result in decreased tourist numbers, tourist experience, or tourist revenue, and that Block Island Wind Farm's WTGs provide excellent sites for fishing and shell fishing (Smythe et al. 2018). A survey-based study found that for prospective offshore wind facilities (based on visual simulations), proximity of WTGs to shore is correlated to the share of respondents who would expect a worsened experience visiting the coast (Parsons and Firestone 2018).

- At 15 miles (24.1 kilometers), the percentage of respondents who reported that their beach experience would be worsened by the visibility of WTGs was about the same as the percentage of those who reported that their experience would be improved (e.g., by knowledge of the benefits of offshore wind).
- About 68 percent of respondents indicated that the visibility of WTGs would neither improve nor worsen their experience.
- Reported trip loss (respondents who stated that they would visit a different beach without offshore wind) averaged 8 percent when wind projects were 12.5 miles (20 kilometers) offshore, 6 percent when 15 miles (24.1 kilometers) offshore, and 5 percent when 20 miles (32 kilometers) offshore.
- About 2.6 percent of respondents were more likely to visit a beach with visible offshore wind facilities at any distance.

A study focused on the changes to the vacation rental market after the construction of Block Island Wind Farm found that Block Island Wind Farm led to significantly increased nightly reservations, occupancy rates, and monthly revenues for properties in Block Island during peak tourism season in July and August (Carr-Harris and Lang 2019). The study estimates that Block Island Wind Farm caused a 7-night increase in reservations, a 19-percent increase in occupancy rates, and a \$3,490 increase in rental property revenue during July and August. Outside of peak tourism season, Block Island Wind Farm did not have an impact on the vacation rental market.

However, a 2003 survey focused on tourist feelings about potential offshore wind development in Cape Cod, Massachusetts found that, based on visual simulations of prospective offshore wind facilities, 3.2 percent of tourists said they would spend an average of 2.9 fewer days in Cape Cod, and a further 1.8 percent said they would not visit at all if the wind turbines were built (Haughton et al. 2003).

A 2019 survey of 553 coastal recreation users in New Hampshire included participants in water-based recreation activities such as fishing from shore and boats, motorized and non-motorized boating, beach activities, and surfing at the New Hampshire seacoast. Most (77 percent) supported offshore wind development along the New Hampshire coast, while 12 percent opposed it and 11 percent were neutral. Regarding the impact on their outdoor recreation experience, 43 percent anticipated that offshore wind development would have a beneficial impact, 31 percent anticipated a neutral impact, and 26 percent anticipated an adverse impact (BOEM 2021a).

Additionally, a 2020 survey-based preference study to determine attitude toward offshore wind and if the presence of offshore wind turbines affects the number of trips a beachgoer makes to the beach found that developed beaches with boardwalks and beaches that were designated as local, state, or national parks had the lowest amount of reported trip cancellation (Parsons et al. 2020). Because many of New Jersey's most visited beaches, including Atlantic City, are quite developed, long-term impacts on recreation and tourism are not expected. The beachgoers at local, state, or national park beaches self-reported as more favorable toward wind power and correspondingly appeared less inclined to cancel a trip due to the presence of wind turbines.

It is important to note that the wind turbines used for the visual simulations in the studies above used smaller WTGs than are proposed for the planned offshore wind projects in the region, including the Proposed Action. At an eye level of 5.5 feet (1.7 meters) above sea level, the Delaware study's 579-foot (176.5-meter) WTGs would be visible out to 32.4 miles (52.1 kilometers). The 951-foot (290-meter) Empire Wind WTGs would be visible out to 40.5 miles (65.2 kilometers). Greater eye-level heights would increase the visible distance in both cases. At Empire Wind's distance from the nearest beach of 14.1 miles (22.7 kilometers), the upper 512 feet (156.1 meters) of the Delaware study's 579-foot (176.5-meter) WTG would be visible to viewers. At this distance, the upper 866.9 feet (264.2 meters) of Empire Wind WTGs would be visible. Therefore, in both the 2018 Parsons and Firestone study and Empire Wind's cases, the WTGs' hubs, nacelles, navigation lights, and rotor blades would be visible to viewers on the nearest beach. The taller Empire Wind WTGs would result in increased numbers of WTGs visible in the wind farm. Such additional WTGs would be seen as lower than/below the tops of the forward row of WTGs and would be increasingly obscured by those intervening in the view. The wind farm would be perceived as a mass of WTGs, rather than as individual WTGs.

As described under the IPF for light, the shore areas within the viewshed of the WTGs include both highly developed areas and undeveloped national parks and wilderness areas such as Otis Pike Fire Island High Dunes Wilderness. Public beaches and tourism attractions in this area are highly valued for scenic, historic, and recreational qualities, and draw large numbers of daytime visitors during the summertime tourism seasons. When visible (i.e., on clear days, in locations with unobstructed ocean views), WTGs would add a developed/industrial visual element to ocean views that were previously characterized by open ocean, broken only by transient vessels and aircraft passing through the view.

Based on the currently available studies, portions of the 449 WTGs associated with the No Action Alternative could be visible from shorelines (depending on vegetation, topography, weather, atmospheric conditions, and the viewers' visual acuity). WTGs visible from some shoreline locations in the geographic analysis area would have adverse impacts on visual resources when discernible due to the introduction of industrial elements in previously undeveloped views. Based on the relationship between visual impacts and impacts on recreational experience, the impact of visible WTGs on recreation would be long term, continuous, and adverse. Seaside locations could experience some reduced recreational and tourism activity, but the visible presence of WTGs would be unlikely to affect shore-based or marine recreation and tourism in the geographic analysis area as a whole.

Traffic: Planned offshore wind project construction and decommissioning and, to a lesser extent, planned offshore wind project operation would generate increased vessel traffic that could inconvenience

recreational vessel traffic within the geographic analysis area. The impacts would occur primarily during construction, along routes between ports and the planned offshore wind construction areas. Vessel traffic for each project is not known but is anticipated to be similar to that of the Proposed Action, which is projected to generate an average of 2.8 vessel trips per day between ports and the Lease Area during construction and 1.4 vessel trips per day during operations. Between 2026 and 2030, as many as four offshore wind projects (not including the Proposed Action) could be under construction simultaneously. During such periods, assuming similar vessel counts, construction of offshore wind projects would generate an average of 11.2 vessel trips per day from Atlantic coast ports to worksites within the geographic analysis area, and operations would generate an average of 5.6 vessel trips per day. This level of increase in vessel traffic would represent only a modest increase compared to the background volumes of vessel traffic in and around the New York Bight, and BOEM expects that vessel traffic would have minor impacts on recreation and tourism in the geographic analysis area.

3.18.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, recreation and tourism would continue to be affected by existing environmental trends and ongoing activities. BOEM anticipates that the impacts of ongoing activities (including commercial fishing, emplacement of submarine cables and pipelines, dredging and port improvement projects, marine minerals use and ocean dredging, military use, marine transportation, and onshore development activities) would have **minor** effects on recreation and tourism in the geographic analysis area because these are typical activities occurring along the New York and New Jersey coastlines and would not substantially affect visitor use or experience.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and recreation and tourism would continue to be affected by the primary IPFs of anchoring, land disturbance, lighting, cable emplacement and maintenance, noise, presence of structures, and vessel traffic. The impacts of planned non-offshore wind activities would be similar to the impacts of ongoing, non-offshore wind activities. Planned offshore wind activities would have localized, temporary, **minor** impacts on recreation and tourism related to land disturbance, cable emplacement and maintenance, noise, and traffic. Planned offshore wind activities would have localized, long-term, **minor** impacts on recreation and tourism due to anchoring and lighting, and localized, long-term, **minor** adverse and **minor beneficial** impacts on recreation and tourism due to the presence of structures, with beneficial impacts attributed to the anticipated reef effect resulting from installation of new offshore structures. BOEM expects the cumulative impacts of the No Action Alternative would result in **minor** impacts on recreation and tourism.

Planned offshore wind activities are expected to contribute considerably to several IPFs, the most prominent being noise and cable emplacement during construction and the presence of offshore structures during operations. Noise and cable emplacement could temporarily displace recreational uses at construction sites and affect recreational fishing and sightseeing as a result of the impacts on fish, invertebrates, and marine mammals. The long-term presence of offshore wind structures would result in increased navigational complexity, potential entanglement and loss of gear, and visual impacts from offshore structures. BOEM also anticipates that the planned offshore wind activities in the analysis area would result in **minor beneficial** cumulative impacts due to the presence of offshore structures and cable hard cover, which could provide opportunities for fishing and sightseeing due to the reef effect.

3.18.4 Relevant Design Parameters & Potential Variances in Impacts for the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than described in the sections below. The

following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on recreation and tourism:

- The Project layout including the number, type, height, and placement of the WTGs and OSS, and the design and visibility of lighting on the structures;
- Arrangement of WTGs and accessibility of the Wind Farm Development Area to recreational boaters; and
- The duration and time of year during which onshore and nearshore construction occurs.

Variability of the proposed Project design exists as outlined in Appendix E. Below is a summary of potential variances in impacts:

- WTG number, size, location, and lighting: More WTGs and larger turbine sizes closer to shore could increase visual impacts that affect onshore recreation and tourism as well as recreational boaters. Arrangement and type of lighting systems would affect nighttime visibility of WTGs onshore.
- WTG arrangement and orientation: Different arrangements of WTG arrays may affect navigational patterns and safety of recreational boaters.
- Duration and timing of construction: Tourism and recreational activities in the geographic analysis area tend to be higher from May through September, and especially from June through August (Parsons and Firestone 2018). Impacts on recreation and tourism would be greater if Project construction were to occur during this season. A shorter or longer duration for construction activities would decrease or increase the time that recreational uses could be displaced from construction sites.

3.18.5 Impacts of the Proposed Action on Recreation and Tourism

The Proposed Action would install 147 WTGs, two OSS, and 376 statute miles (605 kilometers) of submarine export cable and interarray cable in the geographic analysis area between 2023 and 2027. BOEM expects the Proposed Action to affect recreation and tourism through the primary IPFs of anchoring, land disturbance, lighting, cable emplacement and maintenance, noise, presence of structures, and vessel traffic.

Anchoring: Anchoring could potentially affect recreational boating in the geographic analysis area both through the presence of an increased number of anchored vessels during offshore wind construction, O&M, and decommissioning (creating space use conflicts) and through the creation of offshore areas with cable or scour protection where anchors of smaller recreational vessels may fail to hold.

Construction of the Proposed Action between 2023 and 2027 would increase the number of vessels anchored offshore. Most construction vessels used for the Projects would maintain position using dynamic positioning, which limits the use of anchors and jack-up features. Any anchors or jack-up features would be placed within the previously cleared areas around foundations (APM 94). Empire would implement up to 1,640-foot (500-meter) safety zones around active construction sites (APM 176), which would reduce the potential for interaction between recreational and tour boats with anchored construction vessels; however, safety zones would also temporarily displace those uses from the work area. Vessel anchoring would also occur during O&M but at a reduced frequency. The Proposed Action would add an estimated 139 acres (56.3 hectares) of scour protection for WTG foundations and 23 acres (9.3 hectares) of cable protection to the geographic analysis area, which could make anchoring more difficult for recreational boats.

Anchored vessels for construction, O&M, and decommissioning of the Proposed Action would have localized, intermittent, temporary impacts on recreational boating. The addition of scour and cable protection would have localized, long-term impacts on anchoring for recreational boats. BOEM expects

that recreational boaters could navigate around anchored vessels and adjust the locations for dropping anchor to avoid cable and scour protection with only brief inconvenience, and impacts would be minor.

Land disturbance: Construction of the Proposed Action would require installation of landfalls, onshore export cable and interconnection cable, and onshore substations, which could result in localized, temporary disturbance to recreational activity or tourism-based businesses near construction sites. Onshore export cable routes and possible landfalls for EW 2 have the potential to overlap with the following Land and Water Conservation Fund assisted sites, which could result in temporary land disturbance and disruption of recreational activities within these locations. EW 2 Landfall A, EW 2 Landfall B, and EW 2 Landfall E are all outside the boundary of the Land and Water Conservation Fund protected parkland of the Long Beach Boardwalk. The proposed staging area in Town Park at Point Lookout is not within a Land and Water Conservation Fund site. The location of EW 2 Landfall C at Lido Beach Town Park West does not have Land and Water Conservation Fund protections. The location of EW 2 Landfall D at Lido Beach Town Park is within the boundary of a site that received two Land and Water Conservation Fund grants in the 1970s. Any action that would remove any part of this Land and Water Conservation Fund-protected park from public outdoor recreation use for longer than 12 months or would entail the permanent conveyance of surface land rights may trigger the conversion process. The New York State Department of Parks, Recreation and Historic Preservation has determined that if there is no surface disturbance or remnant surface structures from construction activities within the Land and Water Conservation Fund Protected Boundary, a conversion of Land and Water Conservation Fund protected property is not required (Carter pers. comm.).

Empire would implement measures to avoid and minimize impacts resulting from land disturbance, including revegetating disturbed areas (APM 49), implementing an invasive species control plan and invasive species survey (APM 48 and APM 56), and limiting construction beyond existing disturbed areas (APM 57). Onshore construction activities could disrupt access to public use areas and degrade the recreational experience through establishment of restricted work zones and increases in traffic, noise, and construction emissions. Empire would use ultra-low diesel fuel (APM 29) and limit unnecessary idling of diesel and gasoline engines during construction (APM 34), which would reduce noise and air emissions during construction. BOEM expects impacts of land disturbance during construction, O&M, and decommissioning would be localized and temporary.

The proposed onshore substations would be in predominantly high- and medium-intensity developed areas and construction is not expected to affect recreation or tourism in the long term. Because onshore construction would not occur within national parks or wilderness areas, construction-related impacts that would affect visitor experience, such as vibrations, noise, increases in traffic, or temporary increase in air pollution, are not expected. Empire would develop a traffic management plan to limit construction-related traffic disturbance (APM 155) and use temporary construction zones to minimize areas of road closures (APM 159), which would maintain access to recreation areas and local businesses. If tourism decreases during construction, individual businesses may be affected and could experience long-term effects. More information on potential economic impacts as a result of the Proposed Action can be found in Section 3.11.5. The selection of the Onshore Substation C location could disrupt use of a marina at the Onshore Substation C site and restrict public access to a portion of the waterfront along Reynolds Channel, which would result in long-term impacts on existing recreational uses. This impact would be localized but would be long term if shoreline access is restricted at the Onshore Substation C parcel.

Overall, BOEM expects that impacts of the Proposed Action on recreation and tourism due to land disturbance would be negligible to minor, due to the temporary nature of construction impacts and limited geographic extent of impacts related to conversion of affected properties from existing uses to a use for an electric utility.

Lighting: The Proposed Action would add new sources of light to onshore and offshore areas including from nighttime vessel lighting, and fixed lighting on 147 WTGs, two OSS, and two onshore substations. Onshore substations would be in developed areas and BOEM expects that lighting at onshore substations would have negligible impacts on recreation and tourism. Impacts of vessel lighting would be temporary for the duration that the vessel is engaged in construction, O&M, or decommissioning activities and is either anchored or transiting at night. WTGs would be lit and marked in accordance with FAA and USCG requirements for aviation and navigation obstruction lighting, respectively. Impacts of lighting on WTG and OSS would be long term.

Aviation warning lighting required for WTGs would be visible from beaches and coastlines within the geographic analysis area and could have impacts on recreation and tourism in certain locations if the lighting influences visitor decisions in selecting coastal locations to visit. FAA hazard lighting systems would be in use for the duration of O&M. The installation of these WTGs affixed with red flashing lights mounted on opposite rear sides of the nacelle and spaced around the mast midway between the nacelle and AMSL within the offshore wind lease areas would have long-term, minor to major impacts on sensitive onshore and offshore viewing locations, based on viewer distance and angle of view and assuming no obstructions. Atmospheric and environmental factors such as haze and fog would influence visibility and perception of hazard lighting from sensitive viewing locations.

The New York and New Jersey shores that are within the viewshed include extensively developed shores and relatively undeveloped national parks and wilderness areas. Because of the high development density, existing nighttime lighting is prevalent. Elevated boardwalks, jetties, and seawalls afford greater visibility of offshore elements for viewers in beach areas. Nighttime views toward the ocean from the beach and adjacent inland areas are diminished by ambient light levels and glare of shorefront developments, except in the national parks and wilderness areas within the geographic analysis area. Visible aviation warning lighting would add a built visual element to views that were previously characterized by dark, open ocean, broken only by transient lighted vessels and aircraft passing through the view. Empire would implement an ADLS or similar system on WTGs as a base case, pending commercial availability, technical feasibility, and agency review and approval (APM 137). The implementation of ADLS would activate the hazard lighting system in response to detection of nearby aircraft. The synchronized flashing of the navigational lights, if ADLS is implemented, would result in shorter-duration night sky impacts on the seascape, landscape, and viewers. The shorter-duration synchronized flashing of the ADLS is anticipated to have reduced visual impacts at night as compared to the standard continuous, medium-intensity red strobe FAA warning system due to the duration of activation.

As a result, although lighting on WTGs would have a long-term impact, the impact in the geographic analysis area is likely to be limited to individual decisions by visitors to the New York and New Jersey shores and elevated areas, with less impact on the recreation and tourism industry as a whole. Due to the distance of the Proposed Action's WTGs and OSS from shore and potential to implement ADLS or a similar system on WTGs, BOEM expects that aviation hazard lighting for the Proposed Action would result in a long-term, intermittent, minor impacts on recreation and tourism in the geographic analysis area. Lighting associated with vessel traffic and onshore substations would have negligible impacts on recreation and tourism.

Cable emplacement and maintenance: The Proposed Action would install 376 statute miles (605 kilometers) of submarine export cable and interarray cable in the geographic analysis area between 2023 and 2027. Cable emplacement would generate vessel traffic and trenching along cable routes, creating space use conflicts and resulting in short-term disturbance to species important to recreation and tourism. Recreational and tour boats traveling near the offshore cable routes would need to navigate around vessels and access-restricted areas associated with the offshore cable installation. Empire would work with USCG to communicate these zones and other work areas to the boating public via Local Notices to Mariners

(APM 179 and APM 183). Space use conflicts with recreation and tourism related to offshore cable emplacement would result in localized, temporary, minor impacts.

Cable installation could also affect fish and marine mammals of interest for recreational fishing and sightseeing through dredging and resulting underwater noise and turbidity. Empire would install silt curtains in sensitive areas, based on sediment modeling, to reduce sediment transport (APM 89). Impacts of cable installation on fish and marine mammals would be localized and temporary and affected species are expected to recover upon completion of the activity, resulting in minor impacts on recreation and tourism (see Section 3.19, *Sea Turtles*, and Section 3.16, *Navigation and Vessel Traffic*).

Noise: Noise from the operation of construction equipment, pile driving, and vehicle or vessel traffic could result in adverse impacts on recreation and tourism. Onshore construction noise near beaches, parkland, recreation areas, or other areas of public interest would temporarily disturb the quiet enjoyment of the site (in locations where such quiet is an expected or typical condition). Empire would implement measures such as use of mufflers, adjustable backup alarms, and noise barriers to reduce onshore construction noise (APM 35, APM 36, APM 42).

Similarly, offshore construction noise would intrude upon the natural sounds of the marine environment. Empire would comply with IMO noise standards on vessels used for nearshore and offshore work (APM 41). Construction noise could cause some boaters to avoid construction areas, although the most-intense noise sources (such as pile driving) would originate within the safety zones established for areas of active construction (APM 176), which would exclude recreational and tour boats. BOEM expects that the impact of noise on recreation and tourism during construction would be temporary and localized. The impact of noise during O&M would be localized, continuous (for operation of WTGs and OSS), and long term, with brief periods of more-intense noise during occasional repair activities.

Adverse impacts of noise on recreation and tourism would also result from the adverse impacts on species important to recreational fishing and sightseeing within the geographic analysis area. Pile driving using an impact hammer would cause the most impactful noises. Because most recreational fishing takes place closer to shore, only a small proportion of recreational fishing would be affected by the construction of WTGs and OSS. Recreational fishing such as for tuna, shark, and marlin is more likely to be affected, as these fisheries are farther offshore than most fisheries and, therefore, more likely to experience temporary impacts resulting from the noise generated by construction within the Lease Area.

Construction noise could contribute to temporary impacts on marine mammals, with resulting impacts on chartered tours for whale watching or other wildlife viewing. Empire would implement measures such as seasonal pile driving closures (APM 102), ramp-up measures when pile driving is initiated (APM 103), establishment of pre-clearance and shutdown zones (APM 104 and APM 106), and noise attenuation measures (APM 108) to reduce impacts of underwater noise on marine mammals. Lower levels of noise associated with cable installation activities could also affect fish species and marine mammals in the nearshore environment. Noise from operational WTGs would be expected to have little effect on finfish, invertebrates, and marine mammals, and consequently little effect on recreational fishing or sightseeing.

Overall, noise generated from construction, O&M, and decommissioning of the Proposed Action alone would have localized, temporary, minor impacts on recreation and tourism.

Presence of structures: The construction and installation of 147 WTGs and two OSS within the Lease Area would contribute to impacts on recreational fishing and boating. The offshore structures would have long-term, adverse impacts on recreational boating and fishing through the risk of allision; risk of gear entanglement, damage, or loss; navigational hazards; space use conflicts; presence of cable infrastructure; and visual impacts. However, future offshore wind structures could have beneficial impacts on recreation through fish aggregation and reef effects. The WTGs and OSS installed within the Wind Farm

Development Area are expected to serve as additional artificial reef structures, providing additional locations for recreational for-hire fishing trips, potentially increasing the number of trips and revenue.

The presence of offshore wind structures would increase the complexity of navigation within the Lease Area and risk of allision (with fixed structures) or collision (with other vessels). The presence of structures within the Lease Area could require adjustment of routes for recreational boaters, anglers, sailboat races, and sightseeing boats, but the impact on recreational boating would be limited by the distance offshore. Recreational boating routes in the geographic analysis area mainly occur within 3 nm (5.5 kilometer) of the coastline within the New York Bight (COP Volume 2e, Section 8.7.1.1; Empire 2023).

The Proposed Action would install an estimated an estimated 131 acres (53 hectares) of scour protection for WTG foundations and 123 acres (49.8 hectares) of cable protection in the geographic analysis area, increasing the risk of entanglement with fishing gear. Buried offshore cables would not pose a risk for most recreational vessels, as smaller-vessel anchors would not penetrate to the target burial depth for the cables. Also, because anchoring is more common in shallower water depths, anchoring risk is more likely to be an impact over export cables in shallower water closer to coastlines. The risk to recreational boating from the addition of scour and cable protection would be localized, continuous, and long term.

Construction of new offshore structures in the Lease Area could provide new opportunities for offshore tourism by attracting recreational fishing, wildlife sightseeing, and tours of offshore wind infrastructure. The WTG and OSS structures are expected to produce artificial reef effects. The “reef effect” refers to the introduction of a new hard-bottom habitat that has been shown to attract numerous species of algae, shellfish, finfish, and sea turtles to new benthic habitat. The reef effect could attract species of interest for recreational fishing, resulting in an increase in recreational boaters traveling farther from shore in order to fish. The potential attraction of sea turtles to the structures may also attract recreational boaters and sightseeing vessels. Although the likelihood of recreational vessels visiting the offshore structures would diminish with distance from shore, increasing numbers of offshore structures may encourage a greater volume of recreational vessels to travel to the Lease Area. Additional fishing and tourism activity generated by the presence of structures could also increase the likelihood of allisions and collisions involving recreational fishing or sightseeing vessels, as well as commercial fishing vessels.

As it relates to the visual impacts of structures, the vertical presence of the Proposed Action’s 147 WTGs and two OSS on the offshore horizon may affect recreational experience and tourism in the geographic analysis area. Section 3.20 describes the visual impacts from offshore wind infrastructure. During construction, viewers on the New York and New Jersey Shores would see the upper portions of tall equipment such as mobile cranes. These cranes would move from WTG to WTG as construction progresses, and thus would not be long-term fixtures. Based on the duration of construction activity, visual contrast associated with construction of the Proposed Action would have a temporary, minor impact on recreation and tourism.

The visual contrast created by the WTGs during operations could have a beneficial, adverse, or neutral impact on the quality of the recreation and tourism experience depending on the viewer’s values, the activity engaged in, and the purpose for visiting the area. As described in Section 3.18.3.2, studies and surveys that have evaluated the impacts of offshore wind facilities on tourism have identified variable reactions to offshore wind, with respondents having positive, neutral, or negative views of the effect that offshore wind infrastructure would have on their experience of coastal recreation (Parsons and Firestone 2018; BOEM 2021a), while a study in Europe found that established offshore wind facilities did not result in decreased tourist numbers, tourist experience, or tourist revenue (Smythe et al. 2018). The Proposed Action WTGs would be set back more than 22 miles from Gateway National Recreation Area units (see distances to KOP-2 and KOP-14 in Appendix M, Table M-5) and impacts on recreation and tourism within the recreation area are anticipated to be minor and long term.

Based on the impacts of the WTGs and OSS on navigation and fishing, the potential reef effects of these structures, and the risks to anchoring and gear loss associated with scour or cable protection, the Proposed Action would have long-term, continuous, minor beneficial and minor adverse impacts on recreation and tourism.

Traffic: The Proposed Action would contribute to increased vessel traffic and associated vessel collision risk along routes between ports and the offshore construction areas, and within the Lease Area during Project construction, O&M, and decommissioning. The Proposed Action is projected to generate an average of 2.8 vessel trips per day between ports and the Lease Area during construction, and 1.4 vessel trips per day during operations. This level of increase in vessel traffic would represent only a modest increase compared to the background volumes of vessel traffic in and around the New York Bight, and BOEM expects that vessel traffic would have long-term, minor impacts on recreation and tourism in the geographic analysis area.

Empire is considering the use of helicopters during construction and to support offshore O&M activities. Details on specific routes and frequency of trips are not known at this time; however, they have the potential to cross noise-sensitive recreational areas including Gateway National Recreation Area and Otis Park Fire Island High Dunes Wilderness. The mean existing sound level at Gateway National Recreation Area is estimated to be 47.3 dB (Wood 2015). Helicopters traveling at 500 feet are approximately 87 dB, which is loud enough to interrupt normal conversations. Depending on the number and frequency of helicopter trips, the impact of the additional noise from helicopter use could result in localized, continuous, and long-term impacts.

Non-routine activities such as response to spills from maintenance or repair vessels would generally require intense, temporary activity to address emergency conditions or respond to an oil spill. Non-routine activities could temporarily prevent or deter recreation or tourist activities near the site of a given non-routine event. Empire would develop an emergency plan and OSRP (APM 191 and APM 99) and provide marine coordination for vessels associated with the Projects through a central coordination hub from which all Project vessel movements would be managed and third-party traffic would be monitored (APM 173). With implementation of navigation-related mitigation measures, the impacts of non-routine activities on recreation and tourism would be minor.

3.18.5.1. Impact of the Connected Action

The potential impacts of the connected action on recreation and tourism were evaluated through the following IPFs: land disturbance, lighting, and noise.

Land disturbance: Construction of the connected action would require demolition of existing structures and paving, excavation of fill to install support structures, installation of support structures, above-ground structures including three crane pads, paving for assembly roads and replacement of existing pavement, and construction of an O&M facility including utilities. The proposed construction activities could result in localized, temporary disturbance to recreation activities or tourism-based businesses near the construction site. The proposed SBMT enhancements would be in a developed area zoned for heavy manufacturing that generates noise, traffic, or pollutants; therefore, construction of the connected action would have negligible impacts on recreation and tourism due to land disturbance. Operation of the connected action is not expected to have impacts on recreation and tourism, as activities would be consistent with existing land use and zoning.

Lighting: The areas adjacent to SBMT have been extensively developed. Because of the high development density and the industrial and commercial nature of surrounding properties, existing nighttime lighting is prevalent. Permanent lighting and other utilities associated with the crane platform would be established on the wharf. Although lighting associated with the construction and operation of

the connected action would have a long-term impact, the overall impact on recreation and tourism in the geographic analysis area is likely to be limited.

Noise: Noise from the operation of construction equipment and associated vehicle traffic could result in impacts on recreation and tourism in the areas surrounding SBMT by temporarily disturbing the natural sounds of the marine environment or the expected quiet of recreation areas. However, onshore construction would be limited to areas zoned for heavy industries that generate ongoing noise and traffic. Noise from constructing the connected action would have temporary but negligible impacts on recreation and tourism near SBMT. Noise from operation of the connected action is not expected to have a significant adverse effect, as the proposed increases in traffic would result in a noise increase of 3 A-weighted decibels and the crane pads are farther than 1,500 feet from the closest noise sensitive receptor (see Appendix Q).

3.18.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind activities, other planned offshore wind activities, and the connected action at SBMT.

In context of reasonably foreseeable environmental trends, BOEM expects that the Proposed Action in combination with other ongoing and planned activities in the geographic analysis area would result in localized minor impacts on recreation and tourism related to anchoring and land disturbance. BOEM expects that lighting for the Proposed Action and other ongoing and planned activities would have negligible to minor impacts on recreation and tourism. The cumulative impacts of the Proposed Action related to cable emplacement would be minor on recreation and tourism due to the localized and temporary nature of the impacts and ability of displaced users to use alternate nearby locations during construction and installation, O&M, and decommissioning of offshore export cables. Noise created as a result of the Proposed Action in combination with other ongoing and planned activities would have minor impacts on recreation and tourism due to the localized and temporary nature of the impacts and ability of displaced users to use alternate nearby locations during construction and decommissioning. Impacts of noise on recreation and tourism during operations would be negligible and long term. The combined impacts of the presence of structures on recreation and tourism from the cumulative impacts of the Proposed Action would range from minor beneficial (related to reef effects and recreational fishing and sightseeing opportunity) to minor adverse (related to increased navigational complexity, space-use conflicts, anchoring, and gear entanglement or loss). Structures from other planned offshore wind development would generate comparable types of impacts as the Proposed Action. The geographic extent of impacts would increase as additional offshore wind projects are constructed, but the level of impacts considering the Proposed Action and other ongoing and planned activities would likely be the same. In context of reasonably foreseeable environmental trends, combined vessel traffic impacts on recreation and tourism from ongoing and planned activities, including the Proposed Action, would be temporary and minor during construction and long term and minor during operations.

3.18.5.3. Conclusions

Impacts of the Proposed Action. In summary, the impacts from individual IPFs associated with the Proposed Action alone would be **minor** adverse (related to IPFs for anchoring, land disturbance, lighting, cable emplacement, noise, and traffic) and **minor** adverse to **minor beneficial** (related to the presence of structures). IPFs could disrupt recreation and tourism during construction but be localized and temporary, and recreation and tourism could be temporarily displaced to alternate areas. During operations, the presence of offshore structures would increase navigational complexity in the Lease Area and scour and cable protection could increase the risk of gear entanglement or loss, and difficulty with anchoring. Beneficial impacts on recreation and tourism would result from the reef effect (providing additional

locations for recreational for-hire fishing trips) and sightseeing attraction of offshore wind energy structures.

The connected action would have **negligible** adverse impacts on recreation and tourism from land disturbance, lighting, and noise.

Cumulative Impacts of the Proposed Action. In context of other reasonably foreseeable environmental trends, the contribution of the Proposed Action to the impacts of individual IPFs resulting from ongoing and planned activities (including planned offshore wind) would be **minor** adverse (related to IPFs for anchoring, land disturbance, lighting, cable emplacement, noise, and traffic) and **minor** adverse to **minor beneficial** (related to the presence of structures). Considering all IPFs together, the cumulative impact of the Proposed Action in combination with ongoing and planned activities would range from **minor** adverse to **minor beneficial**.

3.18.6 Impacts of Alternatives B, E, and F on Recreation and Tourism

Impacts of Alternatives B, E, and F. Alternatives B, E, and F would alter the turbine array layout compared to the Proposed Action. Alternatives B and E would allow for installation of up to 147 WTGs as defined in Empire's PDE. Alternative F would allow for installation of up to 138 WTGs. Alternative B would remove six WTG positions closest to Cholera Bank, Alternative E would remove a row of seven WTG positions to create a separation between EW 1 and EW 2, and Alternative F would optimize the turbine array layout while addressing geotechnical considerations. The Alternative F layout would install nine fewer WTGs compared to the Proposed Action, which would improve access for fishing.

Further opening access to Cholera Bank and interior portions of EW 1 and creating openings within the layout or separation between EW 1 and EW 2 would all reduce space use conflicts for recreational boating, fishing, and sightseeing; risk of allision with structures; and risk of gear entanglement or loss compared to the Proposed Action. However, BOEM expects that the overall impact level would not be reduced and would be the same as that of the Proposed Action. Impacts from individual IPFs associated with Alternative B, E, or F alone would be minor adverse (related to IPFs for anchoring, land disturbance, lighting, cable emplacement, noise, and traffic) and minor adverse to minor beneficial (related to the presence of structures).

Cumulative Impacts of Alternatives B, E, and F. In context of other reasonably foreseeable environmental trends in the area, the contribution of Alternative B, E, or F to the cumulative impacts on recreation and tourism would generate comparable types of impacts as those of the Proposed Action. The geographic extent of impacts would increase as additional offshore wind projects are constructed, but the level of impacts considering Alternative B, E, or F and other ongoing and planned activities would likely be the same: minor adverse (related to IPFs for anchoring, land disturbance, lighting, cable emplacement, noise, and traffic) and minor adverse to minor beneficial (related to the presence of structures). Considering all IPFs together, the cumulative impacts of Alternative B, E, or F would range from minor adverse to minor beneficial.

3.18.6.1. Conclusions

Impacts of Alternatives B, E, and F. The impacts from individual IPFs associated with Alternative B, E, or F alone or in combination with ongoing and planned activities would be **minor** adverse (related to IPFs for anchoring, land disturbance, lighting, cable emplacement, noise, and traffic) and **minor** adverse to **minor beneficial** (related to the presence of structures).

Cumulative Impacts of Alternatives B, E, and F. Considering all IPFs together, the cumulative impacts of Alternative B, E, or F in combination with ongoing and planned activities would range from **minor** adverse to **minor beneficial**.

3.18.7 Impacts of Alternatives C, D, G, and H on Recreation and Tourism

Impacts of Alternatives C, D, G, and H. The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Projects under Alternative C, D, G, or H would be the same as those described under the Proposed Action. Submarine and onshore cable route options around the Gravesend Anchorage (Alternative C-1) and the Ambrose Navigation Channel (Alternative C-2), to avoid the sand borrow area (Alternative D), or to utilize a cable bridge to cross Barnums Channel (Alternative G) are already covered under the Proposed Action as part of the PDE approach and narrowing the submarine and onshore cable route options under Alternative C, D, or G would not change the analysis of any IPF. Alternative methods for dredge and fill activities under Alternative H would also have no impact on recreation and tourism.

Cumulative Impacts of Alternatives C, D, G, and H. In context of reasonably foreseeable environmental trends, the contribution of Alternative C, D, G, or H to the cumulative impacts on recreation and tourism would be the same as that described under the Proposed Action: minor adverse (related to IPFs for anchoring, land disturbance, lighting, cable emplacement, noise, and traffic) and minor adverse to minor beneficial (related to the presence of structures). The cumulative impacts of Alternative C, D, G, or H would be the same as described under the Proposed Action: minor adverse to minor beneficial.

3.18.7.1. Conclusions

Impacts of Alternatives C, D, G, and H. Submarine and onshore cable route options analyzed under Alternatives C, D, and G are already covered as part of the PDE approach and narrowing the cable route options would not change the analysis of any IPF. Alternative methods for dredge and fill activities under Alternative H would also have no impact on recreation and tourism. The impacts from individual IPFs associated with Alternative C, D, G, or H would be **minor** adverse (related to IPFs for anchoring, land disturbance, lighting, cable emplacement, noise, and traffic) and **minor** adverse to **minor beneficial** (related to the presence of structures). Considering all IPFs together, the overall impacts of Alternative C, D, G, or H would range from **minor** adverse to **minor beneficial**.

Cumulative Impacts of Alternatives C, D, G, and H. In context of reasonably foreseeable environmental trends, the contribution of Alternatives B, C, D, E, F, G, and H to the cumulative impacts on recreation and tourism would be the same as that described under the Proposed Action: **minor** adverse (related to IPFs for anchoring, land disturbance, lighting, cable emplacement, noise, and traffic) and **minor** adverse to **minor beneficial** (related to the presence of structures).

3.18.8 Comparison of Alternatives

Alternatives B, E, and F would alter the turbine array layout compared to the Proposed Action. Alternatives B and E would allow for installation of up to 147 WTGs as defined in Empire's PDE and Alternative F would allow for installation of up to 138 WTGs. The overall impact level would remain the same as that of the Proposed Action: **minor** adverse (related to IPFs for anchoring, land disturbance, lighting, cable emplacement, noise, and traffic) and **minor** adverse to **minor beneficial** (related to the presence of structures).

Because Alternatives C, D, and G are already covered under the Proposed Action as part of the PDE approach and narrowing the PDE for submarine and the onshore cable installation under Alternatives C, D, or G would not change the analysis of any IPF, the impacts on recreation and tourism from these alternatives would be the same as under the Proposed Action: **minor** adverse (related to IPFs for anchoring, land disturbance, lighting, cable emplacement, noise, and traffic) and **minor** adverse to **minor beneficial** (related to the presence of structures).

In context of reasonably foreseeable environmental trends, the contribution of Alternatives B, C, D, E, F, G, and H to the cumulative impacts on recreation and tourism would be the same as that of the Proposed Action: **minor** adverse (related to IPFs for anchoring, land disturbance, lighting, cable emplacement, noise, and traffic) and **minor** adverse to **minor beneficial** (related to the presence of structures). Considering all the IPFs together, BOEM anticipates that the contribution of Alternative B, C, D, E, F, G, or H to the impacts from ongoing and planned activities would result in **minor** adverse to **minor beneficial** cumulative impacts on recreation and tourism in the geographic analysis area.

3.18.9 Summary of Impacts of the Preferred Alternative

The Preferred Alternative is a combination of Alternatives C-1, D, F, G, and H. The Preferred Alternative would route the EW 1 export cable through an anchorage area at Gravesend Bay rather than through the Ambrose Navigation Channel; provide for a minimum 500-meter buffer between the EW 2 submarine export cable and a sand borrow area offshore Long Beach; optimize the EW 1 and EW 2 WTG layouts to maximize annual energy production and minimize wake loss while addressing geotechnical considerations; utilize an above-water cable bridge to construct the EW 2 onshore export cable crossing at Barnums Channel; and use a method of dredge or fill activities for construction of the EW 1 export cable landfall that would reduce the discharge of dredged material. As described above, modifications to export cable corridor routes and the utilization of a cable bridge to cross Barnums Channel are not expected to change the impacts on recreation and tourism as compared to Alternative A. Removing nine WTG positions as compared to Alternative A would reduce space-use conflicts for recreational boating, fishing, and sightseeing; reduce risk of allision with structures; and reduce risk of gear entanglement or loss. Although there are fewer structures, BOEM does not anticipate the overall impact level to be reduced, as the presence of structures would still result in **minor** adverse impacts related to IPFs for anchoring, land disturbance, lighting, cable emplacement, noise, and traffic and **minor** adverse to **minor beneficial** impacts related to the presence of structures.

3.18.10 Proposed Mitigation Measures

No measures to mitigate impacts on recreation and tourism have been proposed for analysis.

This page intentionally left blank.

3.19. Sea Turtles

This section discusses existing sea turtle resources within the geographic analysis area and the potential impacts on these resources from the Proposed Action, alternatives, and ongoing and planned activities within that area. The geographic analysis area, as shown on Figure 3.19-1, includes the Northeast Shelf, Southeast Shelf, and Gulf of Mexico LMEs to capture the movement range for sea turtle species that could be affected by the Projects.

3.19.1 Description of the Affected Environment for Sea Turtles

Five species of sea turtle have been documented in U.S. waters of the northwest Atlantic Ocean, where almost all Project activities would occur: green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), Kemp's ridley (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), and loggerhead (*Caretta caretta*). All five species are listed under the ESA; hawksbill, Kemp's ridley, and leatherback sea turtles are listed as endangered, and green and loggerhead sea turtles are listed as threatened. Critical habitat has been designated for green, hawksbill, leatherback, and loggerhead sea turtles; however, critical habitat for these species is not within or in the vicinity of the Project area. Project vessels transiting routes to and from the Gulf of Mexico may travel through critical habitat for the Northwest Atlantic DPS of loggerhead sea turtles, specifically wintering habitat, breeding habitat, migratory habitat, or *Sargassum* habitat. Although hawksbill sea turtles have been documented in OCS waters of the northwest Atlantic Ocean, they are rare in this region and are considered unlikely to occur. This species occurs regularly in the Gulf of Mexico. However, only two vessel round trips from Corpus Christi are expected for the Projects, making impacts in the Gulf of Mexico unlikely. Therefore, hawksbill sea turtle will not be described further in this section. A description of the four species likely to occur in the Project area is provided below. Additional information on sea turtle species is provided in COP Volume II, Section 5.7.1 (Empire 2023).

Sea turtles generally migrate into or through the Project area as they travel between their northern-latitude feeding grounds and their nesting grounds in the southern U.S., the Gulf of Mexico, and the Caribbean. As ocean waters warm in the spring, sea turtles migrate northward to their feeding grounds in the Mid-Atlantic, typically arriving in the spring or summer and remaining through the fall. As water temperatures cool, most sea turtles begin their return migration to the south. Historically, this southward migration begins in October, and most turtles are gone by the first week in November. Some individuals may remain in the Mid-Atlantic into the winter when they could experience cold stunning (Empire 2023).

The best available information on the occurrence and distribution of sea turtles in the Project area is provided by a combination of sighting, stranding, and bycatch data, including:

- Site-specific aerial survey data collected by Empire (see Appendix P of the COP, summarized in Table 5.7-1 and Figure 5.7-3 in Volume 2b of the COP; Empire 2023)
- Protected Species Observer data collected in the Project area (summarized in Table 5.7-2 in Volume 2b of the COP; Empire 2023)
- Aerial survey data collected by NYSERDA and NYSDEC (Normandeau and APEM 2018; Tetra Tech and LGL 2019, 2020; Tetra Tech and Smultea Sciences 2018; Tetra Tech and LGL 2019, 2020)
- Sighting data retrieved from the Ocean Biodiversity Information System (Halpin et al. 2009; Roberts et al. 2016a, 2016b, 2017, 2018, 2020)
- Data from NOAA's Atlantic Marine Assessment Program for Protected Species surveys (NEFSC and SEFSC 2018, 2020)
- Other regional data (CETAP 1981; Kenney and Vigness-Raposa 2010; Kraus et al. 2016; NMFS 2019)

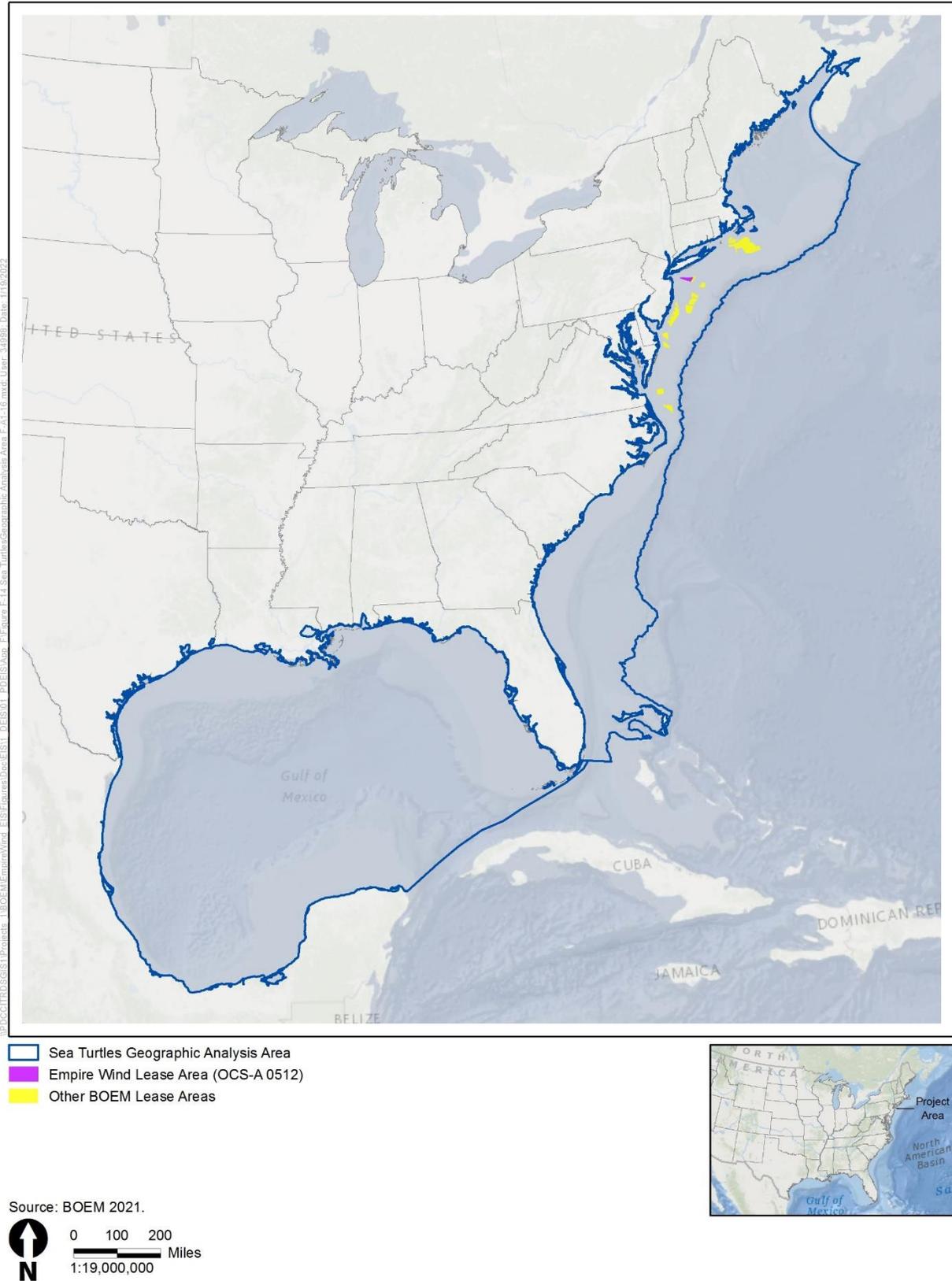


Figure 3.19-1 Sea Turtles Geographic Analysis Area

These data are summarized on Figure 5.7-2 in Volume 2b of the COP (Empire 2023). Species occurrence is summarized in Table 3.19-1 and described in the following paragraphs.

Green sea turtle: Green sea turtles found in the Project area most likely belong to the North Atlantic DPS, although Project vessels transiting through the South Atlantic and Gulf of Mexico may encounter individuals from both the North Atlantic and South Atlantic DPSs (Bass and Witzell 2000; Foley et al. 2007). This species inhabits tropical and subtropical waters around the globe. In the U.S., green sea turtles occur from Texas to Maine, as well as the Caribbean. Late juveniles and adults are typically found in nearshore waters of shallow coastal habitats (NMFS 2021a). No green sea turtle nesting has been documented on the New York coast. The adult diet is largely herbivorous, composed primarily of algae and seagrasses with occasional sponges and invertebrates (NMFS 2021a). Although they have the potential to occur year-round, green sea turtles generally occur seasonally in the Project area with the highest densities observed between June and November. Green sea turtles have been sighted in the vicinity of the Project area in relatively low numbers compared to the other three species. Seasonal densities of this species were derived from NYSERDA annual reports and are provided in Table 23 of Appendix M-2 of the COP (Empire 2023). Green sea turtles have a density of 0.00 animal per 100 km² in all four seasons. There is no population estimate for the North Atlantic DPS of green sea turtles. However, nester abundance for this DPS is estimated at 167,424 (Seminoff et al. 2015). All major nesting populations in this DPS have shown long-term increases in abundance (Seminoff et al. 2015). Nester abundance for the South Atlantic DPS is estimated at 63,332, although many nesting sites have insufficient data to estimate abundance (Seminoff et al. 2015). Long-term data are lacking to evaluate trends for this DPS. A detailed species description for green sea turtles is provided in Section 5.7.1.2 of Volume 2b of the COP (Empire 2023).

Table 3.19-1 Sea Turtles Likely to Occur in the Project Area

Common Name	Scientific Name	DPS/ Population	ESA Status	Relative Occurrence in the Project Area	Seasonal Occurrence in the Project Area
Green	<i>Chelonia mydas</i>	North Atlantic DPS	Threatened	Regular	June to November
Kemp's ridley	<i>Lepidochelys kempii</i>	-	Endangered	Common	June to November
Leatherback	<i>Dermochelys coriacea</i>	Northwest Atlantic subpopulation	Endangered	Common	June to November
Loggerhead	<i>Caretta caretta</i>	Northwest Atlantic DPS	Threatened	Common	June to November

Kemp's ridley sea turtle: All Kemp's ridley sea turtles, including those found in the Project area, belong to a single population. This species primarily inhabits the Gulf of Mexico, although large juveniles and adults travel along the U.S. Atlantic coast. At these life stages, Kemp's ridley sea turtles occupy nearshore habitats in subtropical to warm temperate waters, including sounds, bays, estuaries, tidal passes, shipping channels, and beachfront waters. A single Kemp's ridley nest was documented on Queen's Beach, New York in 2018. However, this nest was outside the known nesting range for the species, which is essentially limited to the beaches of the western Gulf of Mexico (NMFS and USFWS 2015). The diet of Kemp's ridley sea turtles is composed of crabs, mollusks, shrimp, fish, and vegetation (Ernst et al. 1994). Kemp's ridley sea turtles could occur in the Project area year-round, but they are mainly in the region during the summer and fall. Annual density of Kemp's ridley sea turtles is provided on Figure 5.7-4 in

Volume 2b of the COP (Empire 2023). Seasonal densities of this species were derived from NYSERDA annual reports and are provided in Table 23 of Appendix M-2 of the COP (Empire 2023). Kemp's ridley sea turtles have seasonal densities of 0.001 animal per 100 km² for spring, 0.010 animal per 100 km² for summer, 0.002 animal per 100 km² for fall, and 0.000 animal per 100 km² for winter. In 2012, the population of individuals age 2 and up was estimated at 248,307 turtles (NMFS and USFWS 2015 citing Gallaway et al. 2013). Since 2009, there has been a decline in nest abundance for this population (NMFS and USFWS 2015). A detailed species description for Kemp's ridley sea turtles is provided in Section 5.7.1.2 of Volume 2b of the COP (Empire 2023).

Leatherback sea turtle: Leatherback sea turtles that occur in the Project area belong to the Northwest Atlantic population identified in the 2020 status review for the species (NMFS and USFWS 2020); however, this population has not been identified as a DPS or listed separately under the ESA at this time. This species is found in the Atlantic, Pacific, and Indian Oceans (NMFS 2021b). Leatherback sea turtles can be found throughout the western North Atlantic Ocean as far north as Nova Scotia, Newfoundland, and Labrador (Ernst et al. 1994). While early life stages prefer oceanic waters, adult leatherback sea turtles are generally found in mid-ocean, continental shelf, and nearshore waters (NMFS and USFWS 1992). This species does not nest along the New York coast. Leatherback sea turtle diets are composed almost exclusively of jellyfish, salps, and other gelatinous prey (Bjorndal 1997). This species displays a marked migration pattern, entering the Mid-Atlantic in spring and remaining through the summer months (Shoop and Kenney 1992). However, leatherback sea turtles could occur in the Project area throughout the year. Annual density of leatherback sea turtles is provided on Figure 5.7-6 in Volume 2b of the COP (Empire 2023). Seasonal densities of this species were derived from NYSERDA annual reports and are provided in Table 23 of Appendix M-2 of the COP (Empire 2023). Leatherback sea turtles have a seasonal density of 0.000 animal per 100 km² for spring, 0.003 animal per 100 km² for summer, 0.008 animal per 100 km² for fall, and 0.000 animal per 100 km² for winter. The best available estimate of nesting female abundance for the Northwest Atlantic population is 20,659 females. This population is currently exhibiting an overall decreasing trend in annual nesting activity (NMFS and USFWS 2020). A detailed species description for leatherback sea turtles is provided in Section 5.7.1.2 of Volume 2b of the COP (Empire 2023).

Loggerhead sea turtle: Loggerhead sea turtles found in the Project area belong to the Northwest Atlantic DPS. This species inhabits nearshore and offshore habitats throughout the globe (Dodd 1988). Loggerhead sea turtles occur throughout the Northwest Atlantic as far north as Newfoundland (NMFS 2021c). This species does not nest along the New York coast. Juvenile loggerhead sea turtles have omnivorous diets, consuming crabs, mollusks, jellyfish, and vegetation. Adults are carnivores, consuming primarily benthic invertebrates (Dodd 1988). Although they have the potential to occur year-round, loggerhead sea turtles generally occur seasonally in the Project area during summer and fall with the highest densities observed in the summer months. Annual density of loggerhead sea turtles is provided on Figure 5.7-2 in Volume 2b of the COP (Empire 2023). Seasonal densities of this species were derived from NYSERDA annual reports and are provided in Table 23 of Appendix M-2 of the COP (Empire 2023). Loggerhead sea turtles have a seasonal density of 0.003 animal per 100 km² for spring, 0.268 animals per 100 km² for summer, 0.002 animal per 100 km² for fall, and 0.000 animal per 100 km² for winter. The most recent population estimate for the Northwest Atlantic continental shelf, calculated in 2010, is 588,000 juvenile and adult loggerhead sea turtles (NEFSC and SEFSC 2011). The recovery units for the Northwest Atlantic DPS have shown no trend or an increasing trend in nest abundance; however, these recovery units have not met their recovery criteria for annual increases in nest abundance (Bolten et al. 2019). A detailed species description for loggerhead sea turtles is provided in Section 5.7.1.2 of Volume 2b of the COP (Empire 2023).

All four sea turtle species in the geographic analysis area are subject to regional, pre-existing threats. These threats include fisheries bycatch, loss or degradation of nesting and foraging habitat, entanglement

in fishing gear, vessel strikes, predation and harvest, disease, and climate change. Green, Kemp’s ridley, and loggerhead sea turtles are also susceptible to cold stunning.

Although sea turtles possess auditory organs that are adapted for underwater hearing, hearing abilities for these species are not well studied but have been reported to be limited to low frequencies, typically below 1,600 Hz. The documented hearing range for each of the four sea turtle species is provided in Table 3.19-2.

Table 3.19-2 Sea Turtle Hearing Ranges

Species	Hearing Range (Hertz)		Source
	Minimum	Maximum	
Green	50	1,600	Dow Piniak et al. 2012a
Kemp’s ridley	100	500	Bartol and Ketten 2006
Leatherback	50	1,200	Dow Piniak et al. 2012b
Loggerhead	50–100	800–1,120	Martin et al. 2012

3.19.2 Impact Level Definitions for Sea Turtles

Definitions of impact levels are provided in Table 3.19-3.

Table 3.19-3 Impact Level Definitions for Sea Turtles

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on sea turtles would be undetectable or barely measurable, with no consequences to individuals or populations.
	Beneficial	Impacts on sea turtles would be undetectable or barely measurable, with no consequences to individuals or populations.
Minor	Adverse	Impacts on sea turtles would be detectable and measurable, but of low intensity, highly localized, and temporary or short term in duration. Impacts may include injury or loss of individuals, but these impacts would not result in population-level effects.
	Beneficial	Impacts on sea turtles would be detectable and measurable, but of low intensity, highly localized, and temporary or short term in duration. Impacts could increase survival and fitness, but would not result in population-level effects.
Moderate	Adverse	Impacts on sea turtles would be detectable and measurable and could result in population-level effects. Adverse effects would likely be recoverable and would not affect population or DPS viability.
	Beneficial	Impacts on sea turtles would be detectable and measurable and could result in population-level effects. Impacts would be measurable at the population level.
Major	Adverse	Impacts on sea turtles would be significant and extensive and long term in duration, and could have population-level effects that are not recoverable, even with mitigation.
	Beneficial	Impacts would be significant and extensive and contribute to population or DPS recovery.

3.19.3 Impacts of the No Action Alternative on Sea Turtles

When analyzing the impacts of the No Action Alternative on sea turtles, BOEM considered the impacts of ongoing activities, including ongoing non-offshore wind and ongoing offshore wind activities, on the baseline conditions for sea turtles. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with other planned non-offshore wind and offshore wind activities as described in Appendix F, *Planned Activities Scenario*.

3.19.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for sea turtles, described in Section 3.19.1, *Description of the Affected Environment for Sea Turtles*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore wind and offshore wind activities within the geographic analysis area that contribute to impacts on sea turtles are generally associated with coastal and offshore development, marine transport, fisheries use, and climate change. Coastal and offshore development, marine transport, and fisheries use and associated impacts are expected to continue at current trends and have the potential to affect sea turtles through accidental releases (see Table F1-23 in Appendix F for a summary of accidental releases anticipated), which can have physiological effects on sea turtles; EMF and light, which can result in behavioral changes in sea turtles; new cable emplacement and maintenance and port utilization, which can disturb benthic habitats and affect water quality; noise, which can have physiological and behavioral effects on sea turtles; the presence of structures, which can result in behavioral changes in sea turtles, effects on prey species, and increased risk of interactions with fishing gear; and vessel traffic, which increases risk of vessel collision. Global climate change is an ongoing risk for sea turtle species in the geographic analysis area. Warming and sea level rise could affect sea turtles through increased storm frequency and severity, altered habitat/ecology, altered migration patterns, increased disease incidence, increased erosion and sediment deposition, and development of protective measures (e.g., seawalls and barriers); ocean acidification may also affect sea turtles (Hawkes et al. 2009). Warming and sea level rise, with their associated consequences, and ocean acidification could lead to long-term, high-consequence impacts on sea turtles, including changes to sea turtle distribution, habitat use, migratory patterns, nesting periods, nestling sex ratios, nesting habitat quality or availability, prey distribution or abundance, and foraging habitat availability (Fuentes and Abbs 2010; Janzen 1994; Newson et al. 2009; Witt et al. 2010).

Ongoing offshore wind activities within the geographic analysis area that contribute to impacts on sea turtles include:

- Continued O&M of the Block Island project (five WTGs) installed in state waters;
- Continued O&M of the Coastal Virginia Offshore Wind project (two WTGs) installed in OCS-A 0497; and
- Ongoing construction of two offshore wind projects, the Vineyard Wind 1 project (62 WTGs and 1 OSS) in OCS-A 0501 and the South Fork project (12 WTGs and 1 OSS) in OCS-A 0517.

Ongoing O&M of the Block Island and Coastal Virginia Offshore Wind projects and ongoing construction of the Vineyard Wind 1 and South Fork projects would affect sea turtles through the primary IPFs of noise, presence of structures, and vessel traffic. Ongoing offshore wind activities would have the same type of impacts from noise, presence of structures, and vessel traffic that are described in detail in Section 3.19.3.2 for planned offshore wind activities but the impacts would be of lower intensity.

See Table F1-21 for a summary of potential impacts associated with ongoing non-offshore wind and offshore activities by IPF for sea turtles.

3.19.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Planned non-offshore wind activities within the geographic analysis area that contribute to impacts on sea turtles include undersea transmission lines, gas pipelines, and other submarine cables; tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; oil and gas activities; and onshore development activities (see Section F.2 in Appendix F for a complete description of planned activities). BOEM expects planned activities other than offshore wind to affect sea turtles through several primary IPFs, including accidental releases, EMF, light, new cable emplacement and maintenance, port utilization, noise, and the presence of structures. See Table F1-21 for a summary of potential impacts associated with planned non-offshore wind activities by IPF for sea turtles.

The sections below summarize the potential impacts of other ongoing and planned offshore wind activities on sea turtles during construction, O&M, and decommissioning of the projects. Other ongoing and planned offshore wind activities in the geographic analysis area for sea turtles include the construction, O&M, and decommissioning of 30 offshore wind projects.

BOEM expects ongoing and planned offshore wind activities to affect sea turtles through the following primary IPFs.

Accidental releases: Ongoing and planned offshore wind activities may increase accidental releases of fuels, fluids, hazardous materials, and trash and debris due to increased vessel traffic and installation of WTGs and other offshore structures. The risk of accidental releases is expected to be highest during construction, but accidental releases could also occur during operation and decommissioning.

Ongoing and planned offshore wind activities are expected to gradually increase vessel traffic over the next 35 years, increasing the risk of accidental releases of fuels, fluids, and hazardous materials. There would also be a low risk of fuel, fluid, and hazardous materials leaks from any of the 2,884 WTGs (Table F2-1 in Appendix F) anticipated in the geographic analysis area (including ongoing and planned projects but not including the Proposed Action). The total volume of WTG fuels, fluids, and hazardous materials in the geographic analysis area is estimated at 14.3 million gallons (Table F2-3 in Appendix F). OSS and ESPs are expected to hold an additional 10.8 million gallons of fuels, fluids, and hazardous materials (Table F2-3 in Appendix F). BOEM has modeled the risk of spills associated with WTGs and determined that a release of 128,000 gallons is likely to occur no more frequently than once every 1,000 years and a release of 2,000 gallons or less is likely to occur every 5 to 20 years (Bejarano et al. 2013). Sea turtle exposure to oil spills through aquatic contact or inhalation of fumes can result in death (Shigenaka et al. 2010) or sublethal effects, including but not limited to adrenal effects, dehydration, hematological effects, increased disease incidence, hepatological effects, poor body condition, dermal effects, and skeletomuscular effects (Bembenek-Bailey et al. 2019; Camacho et al. 2013; Mitchelmore et al. 2017; Shigenaka et al. 2010; Vargo et al. 1986). Such sublethal effects would affect individual fitness but are not expected to affect sea turtle populations. In addition to direct effects on sea turtles, accidental releases can indirectly affect sea turtles through impacts on prey species (see Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*). Given the volumes of fuels, fluids, and hazardous materials potentially involved and the likelihood of release occurrence, the increase in accidental releases associated with planned offshore wind activities is expected to fall within the range of releases that occur on an ongoing basis from non-offshore wind activities.

Increased vessel traffic would also increase the risk of accidental releases of trash and debris during construction, operation, and decommissioning of offshore wind facilities. All sea turtle species are known to ingest trash and debris, including plastic fragments, tar, paper, polystyrene foam, hooks, lines, and net fragments (Bugoni et al. 2001; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014; Tomás et al. 2002). Such ingestion can occur accidentally or intentionally when individuals mistake the debris for potential prey items (Gregory 2009; Hoarau et al. 2014; Tomás et al. 2002). Ingestion of trash and debris can result in death or sublethal effects, including but not limited to dietary dilution, chemical contamination, depressed immune system, poor body condition, reduced growth rates, reduced fecundity, and reduced reproductive success (Gall and Thompson 2015; Hoarau et al. 2014; Nelms et al. 2016; Schuyler et al. 2014). These sublethal effects would affect individual fitness, but mortality and sublethal effects associated with ingestion of trash and debris are not expected to have population-level effects. BOEM assumes that all vessels will comply with laws and regulations to minimize trash releases and expects that such releases would be small and infrequent. The amount of trash and debris accidentally released during planned offshore wind activities would likely be miniscule compared to trash releases associated with ongoing activities, including land-based activities and commercial and recreational fishing.

EMF: Ongoing and planned offshore wind activities would install up to 10,306 miles (16,586 kilometers) of export and interarray cables, increasing the production of EMF and heat in the geographic analysis area. EMF and heat effects would be reduced by cable burial to an appropriate depth and shielding, if necessary. Cables are also expected to be separated by a minimum distance of 330 feet, avoiding additive EMF and heat effects from adjacent cables.

Sea turtles are capable of detecting magnetic fields, and behavioral responses to such fields have been documented. The threshold for behavioral responses varies somewhat among species. Loggerhead sea turtles have exhibited responses to field intensities ranging from 0.0047 to 4,000 microteslas, and green sea turtles have responded to field intensities ranging from 29.3 to 200 microteslas (Normandeau et al. 2011); other species are expected to have similar thresholds due to similar anatomical features, behaviors, and life history characteristics. Juvenile and adult sea turtles may detect EMFs associated with ongoing and planned activities when foraging on benthic prey or resting on the bottom in relatively close proximity to cables. There are no data on EMF impacts on sea turtles associated with underwater cables. Migratory disruptions have been documented in sea turtles with magnets attached to their heads (Luschi et al. 2007), but evidence that EMF associated with planned offshore wind activities would likely result in some deviations from direct migration routes is lacking (Snoek et al. 2016). Any deviations are expected to be minor (Normandeau et al. 2011), and any increased energy expenditure due to these deviations would not be biologically significant.

Buried submarine cables can warm the surrounding sediment in contact with the cables up to tens of centimeters (Taormina et al. 2018). There are no data on cable heat effects on sea turtles (Taormina et al. 2018). However, increased heat in the sediment could affect benthic organisms that serve as prey for sea turtles that forage in the benthos. Based on the narrowness of cable corridors and expected weakness of thermal radiation, impacts on benthic organisms are not expected to be significant (Taormina et al. 2018) and would be limited to a small area around the cable. Given the expected cable burial depths, thermal effects would not occur at the surface of the seabed where sea turtles would forage. Therefore, any effects on sea turtle prey availability would be too small to be detected or meaningfully measured.

Gear utilization: Ongoing and planned offshore wind activities are expected to include monitoring surveys in the project areas. Sea turtles could be affected by these surveys through survey vessel traffic and interactions with survey gear. Survey vessels would produce underwater noise and increase the risk of vessel strikes. The effects of vessel noise and increased strike risk would be similar to those discussed under the *Noise* and *Traffic* IPFs.

Additional impacts on sea turtles could result from interactions with mobile (e.g., trawl, dredge) or fixed (e.g., trap, hydrophone) survey gear. Offshore wind projects are expected to use trawl surveys, among other methods, for project monitoring. The capture and mortality of sea turtles in fisheries utilizing bottom trawls are well documented (Henwood and Stuntz 1987; NMFS and USFWS 1991, 1992; NRC 1990). Although sea turtles are capable of extended dive durations, entanglement and forcible submersion in fishing gear leads to rapid oxygen consumption (Lutcavage and Lutz 1997). Based on available research, restricting tow times to 30 minutes or less is expected to prevent sea turtle mortality in trawl nets (Epperly et al. 2002; Sasso and Epperly 2006). BOEM anticipates trawl surveys for offshore wind project monitoring would be limited to tow times of 20 minutes, indicating that this activity poses a negligible risk of mortality. Additional mitigation measures would be expected to eliminate the risk of serious injury and mortality from forced submergence for sea turtles caught in bottom-trawl survey gear. Tows for clam dredge surveys would have a very short duration of 120 seconds, and the survey vessels would be subject to mitigation measures similar to those for the trawl survey. Therefore, effects of dredge surveys on sea turtles would be insignificant or discountable.

The vertical buoy and anchor lines associated with monitoring surveys using fixed gear, such as fish traps or baited remote underwater video, could pose a risk of entanglement for sea turtles. While there is a theoretical risk of sea turtle entanglement in trap and pot gear, particularly for leatherback sea turtles (NMFS 2016), the likelihood of entanglement would be discountable given the patchy distribution of sea turtles, the small number of vertical lines used in the surveys, and the relatively limited duration of each sampling event. BOEM also anticipates mitigation measures would be in place to reduce sea turtle interactions during fisheries surveys. Sea turtle prey species (e.g., crabs, whelks, fish) may be collected as bycatch in trap gear. However, all bycatch is expected to be returned to the water and would still be available as prey for sea turtles regardless of their condition, particularly for loggerhead sea turtles, which are known to forage for live prey and scavenge dead organisms. Given the non-extractive nature of fixed-gear surveys, any effects on sea turtles from the collection of potential sea turtle prey would be so small that it cannot be meaningfully measured, detected, or evaluated. Therefore, indirect effects on sea turtles due to collection of potential prey items would be insignificant. Hydrophone mooring lines for passive acoustic monitoring studies pose a theoretical entanglement risk to sea turtles, similar to trap and pot surveys. However, BOEM anticipates that monitoring studies utilizing moored systems would be required to use the best available technology to reduce any potential risks of entanglement. Therefore, passive acoustic studies are expected to pose a discountable risk of entanglement to sea turtles.

Monitoring surveys are expected to occur at short-term, regular intervals over the duration of the monitoring program. Although the potential extent and number of animals potentially exposed cannot be determined without project-specific information, impacts of gear utilization on sea turtles are expected to be negligible given the negligible risk of mortality, the discountable risk of entanglement, and the insignificant effect on sea turtle prey availability.

Lighting: Vessels and offshore structures associated with planned offshore wind activity will produce light at night. Lighting on vessels and offshore structures could elicit attraction, avoidance, or other behavioral responses in sea turtles. In laboratory experiments, juvenile loggerhead sea turtles consistently oriented toward lightsticks of various colors and types used by pelagic longline fisheries (Wang et al. 2019), indicating that hard-shelled sea turtle species expected to occur in the vicinity of the Projects (i.e., green, Kemp's ridley, and loggerhead) could be attracted to offshore light sources. In contrast, juvenile leatherback sea turtles failed to orient toward or oriented away from lights in laboratory experiments (Gless et al. 2008), indicating that this species may not be attracted to offshore lighting. Any behavioral responses to offshore lighting are expected to be localized and temporary.

Under the planned activities scenario described in Appendix F, 2,884 WTGs and 68 OSS/ESPs would be constructed between 2023 and 2030 (Tables F2-1 and F2-2 in Appendix F). These offshore structures would have yellow flashing navigational lighting and red flashing FAA hazard lights, in accordance with

BOEM's (2021c) lighting and marking guidelines. Following these guidelines, direct lighting would be avoided, and indirect lighting of the water surface would be minimized to the greatest extent practicable. As described in the previous paragraph, offshore lighting may attract juvenile green, Kemp's ridley, and loggerhead sea turtles, based on laboratory experiments. The flashing lights on offshore structures associated with planned offshore wind activities are unlikely to disorient juvenile or adult sea turtles, as they do not present a continuous light source (Orr et al. 2013). There is no evidence that lighting on oil and gas platforms in the Gulf of Mexico, which may have considerably more lighting than offshore WTGs, has had any effect on sea turtles over decades of operation (BOEM 2019a). Therefore, lighting on offshore structures associated with planned offshore wind activities is not expected to have detectable effects on sea turtles.

Cable emplacement and maintenance: Ongoing and planned offshore wind activities will involve the placement and maintenance of export and interarray cables. Cable emplacement and maintenance activities disturb bottom sediment, resulting in temporary increases in suspended sediment concentrations. Cable emplacement associated with ongoing and planned offshore wind activities (not including the Proposed Action) is expected to disturb more than 36,125 acres of seabed (Table F2-2 in Appendix F) between 2023 and 2030. This acreage could be reduced if open-access offshore transmission systems are built, as have been proposed. However, such projects are not considered reasonably foreseeable at this time. During cable installation, sediment plumes would be present for up to 6 hours at a time until the activity is completed and suspended sediment settles back to the seabed; areas subject to cumulative increases in suspended sediment from simultaneous activities would be limited because the occurrence of concurrent cable installation operations is expected to be limited. The increases in suspended sediment associated with new cable emplacement and maintenance would be short term and localized to the cable corridor. There are no data on the physiological effects of suspended sediment on sea turtles. However, elevated suspended sediment may cause sea turtles to alter their normal movements and behaviors, as sea turtles would be expected to avoid the area of elevated suspended sediment. Such alterations are expected to be too small to be detected (NMFS 2020a). No effects are anticipated if sea turtles swim through the area of elevated suspended sediment. Suspended sediment is most likely to affect sea turtles if the area of elevated concentrations acts as a barrier to normal behaviors. However, no adverse effects are anticipated due to sea turtles swimming through the area of elevated suspended sediment or avoiding the area (NMFS 2020a). In addition to direct effects on sea turtle behavior, suspended sediment can indirectly affect sea turtles through impacts on prey species, including benthic mollusks, crustaceans, sponges, and sea pens. Elevated suspended sediment concentrations are shown to have adverse effects on benthic communities when they exceed 390 mg/L (NMFS 2020a citing EPA 1986). See Section 3.13, *Finfish, Invertebrates, and Essential Fish Habitat*, for a discussion of impacts on prey species.

Any dredging required prior to cable emplacement could have additional impacts on sea turtles due to impingement, entrainment, or capture in certain types of dredges. Mechanical dredging is not expected to capture, injure, or kill sea turtles (NMFS 2020b). Hopper dredges may strike, impinge, or entrain sea turtles, which may result in injury or mortality (Ramirez et al. 2017 citing Dickerson et al. 1990; Ramirez et al. 2017 citing Dickerson et al. 1991; Ramirez et al. 2017 citing Reine et al. 1998; Ramirez et al. 2017 citing Richardson 1990). The sea turtle species most often affected by dredge interactions is loggerhead sea turtles, followed by green sea turtles, then Kemp's ridley sea turtles (Ramirez et al. 2017). However, the risk of interactions between hopper dredges and sea turtles is expected to be lower in the offshore environment where dredging for offshore wind cables would most likely occur (Michel et al. 2013; NMFS 2020b). The risk of injury or mortality of individual sea turtles due to dredging associated with planned offshore wind activities is considered low, and population-level effects are unlikely to occur.

Noise: Ongoing and planned offshore wind activities would generate anthropogenic noise from aircraft, G&G surveys, offshore wind turbines, pile driving, cable laying, and vessels. These noise sources have

the potential to affect sea turtles through behavioral or physiological effects. The potential impacts associated with each noise source are discussed separately in the following paragraphs.

Helicopters may be used to transport crew during construction or operation of offshore wind facilities. When aircraft travel at relatively low altitude, non-impulsive aircraft noise has the potential to elicit stress or behavioral responses (e.g., diving or swimming away or altered dive patterns) (BOEM 2017; NSF and USGS 2011; Samuel et al. 2005). Helicopters transiting to offshore wind facilities are expected to fly at sufficient altitudes to avoid behavioral effects on sea turtles, with the exception of WTG inspections, take-off, and landing. Any behavioral responses elicited during low-altitude flight would be temporary, dissipating once the aircraft leave the area; these responses are not expected to be biologically significant.

G&G surveys would be conducted for site assessment and characterization activities associated with offshore wind facilities. Site assessment and characterization activities are expected to occur intermittently over a 2- to 10-year period at locations spread throughout much of the geographic analysis area. Although schedules for many planned offshore wind activities are still being developed, it would be possible to avoid overlapping noise impacts on sea turtles by scheduling site assessment and characterization activities to avoid conducting simultaneous G&G surveys in proximity to each other. Such surveys can generate high-intensity, impulsive noise that has the potential to affect sea turtles through auditory injuries, stress, disturbance, and behavioral responses. TTS or PTS could occur if sea turtles are close to survey activities. However, TTS and PTS are considered unlikely, as sea turtles are expected to avoid survey activities and survey vessels would travel quickly (NSF and USGS 2011). BOEM has concluded that underwater noise associated with G&G surveys for offshore wind activities would likely result in temporary displacement and behavioral effects or biologically insignificant physiological effects (BOEM 2019a) and has developed Project Design Criteria and BMPs for offshore wind data collection activities (e.g., G&G surveys) to minimize impacts on protected species (BOEM 2021b) that lessees will be required to follow. Any resulting impacts on individual sea turtles are not expected to result in stock or population-level effects.

Operating WTGs generate non-impulsive underwater noise that is audible to sea turtles. Monitoring data indicate that SPL_{RMS} produced by operating turbines generally range from 110 to 125 dB in the 10-Hz to 8-kilohertz frequency range (Tougaard et al. 2020). Noise levels produced by WTGs are expected to decrease to ambient levels within a relatively short distance from the turbine foundations (Kraus et al. 2016; Thomsen et al. 2015). At Block Island Wind Farm, turbine noise reaches ambient noise levels within 164 feet (50 meters) of the turbine foundations (Miller and Potty 2017). Maximum noise levels anticipated from operating WTGs are below recommended thresholds for sea turtle injury and behavioral effects, and noise levels are expected to reach ambient levels within a short distance of turbine foundations. Additionally, studies suggest that sea turtles acclimate to repetitive underwater noise in the absence of an accompanying threat (Bartol and Bartol 2011; Hazel et al. 2007; Navy 2018). Therefore, no noise impacts on sea turtles are anticipated from operating WTGs.

Construction of ongoing and planned offshore wind projects will generate impulsive pile-driving noise during foundation installation. Pile driving is expected to occur for 4 to 6 hours at a time as 2,884 WTGs and 68 OSS/ESPs are constructed between 2023 and 2030 (Tables F2-1 and F2-2 in Appendix F). The intense, impulsive noise associated with pile driving can cause behavioral or physiological effects. Potential behavioral effects of pile driving noise include altered dive patterns, short-term disturbance, startle responses, and short-term displacement (NSF and USGS 2011; Samuel et al. 2005). Potential physiological effects include temporary stress response and, close to the pile-driving activity, TTS or PTS. Behavioral effects and most physiological effects are expected to be of short duration and localized to the ensonified area. PTS could permanently limit an individual's ability to locate prey, detect predators, or find mates and could therefore have long-term effects on individual fitness. BOEM expects that sea turtles would be displaced for 6 to 14 hours per day during foundation installation, depending on the type of turbine foundation. Therefore, any disruptions to foraging or other normal behaviors would be

temporary and increased energy expenditures associated with this displacement are expected to be small. It is possible that pile driving could displace animals into areas with lower habitat quality or higher risk (e.g., vessel collision or fisheries interaction). Multiple construction activities within the same calendar year could potentially affect migration, foraging, breeding, and individual fitness. The magnitude of impacts would depend upon the locations, duration, and timing of concurrent construction; such impacts could be long term and of high intensity and high exposure level. For example, individuals repeatedly exposed to pile driving over a significant period of time (e.g., a season, a year, or a life stage) may incur energetic costs associated with avoidance movements that would be sufficient to cause long-term effects on individual fitness (Navy 2018). However, habituation may occur in sea turtles (Hazel et al. 2007), potentially reducing avoidance and reducing the impacts of repeated exposures.

Noise-producing activities associated with cable laying include route identification surveys, trenching, jet plowing, backfilling, and cable protection installation. Modeling based on noise data collected during cable laying operation in Europe estimates that underwater noise levels would exceed 120 dB in a 98,842-acre area surrounding the source (Bald et al. 2015; Nedwell and Howell 2004; Taormina et al. 2018). As the cable-laying vessel and equipment would be continually moving, the ensonified area would also move. Given the dynamic nature of the ensonified area, a given location would not be ensonified for more than a few hours. Therefore, it is unlikely that cable-laying noise would result in adverse effects on sea turtles.

Vessels generate low-frequency (10 to 100 Hz) (MMS 2007), non-impulsive noise that could affect sea turtles. Vessel noise overlaps with the hearing range of sea turtles and may elicit behavioral responses, including startle responses and changes in diving patterns, or a temporary stress response (NSF and USGS 2011; Samuel et al. 2005). Vessel activity associated with planned offshore wind activities is expected to peak in 2024 when up to 379 vessels could be involved in construction of offshore wind facilities (BOEM 2019b). This increase in vessel activity could cause repeated, intermittent impacts on sea turtles resulting from short-term, localized behavioral responses, which would dissipate once the vessel leaves the area. BOEM considers these behavioral effects to be unlikely given the patchy distribution of sea turtles in the geographic analysis area, and, therefore, no stock or population-level effects would be expected.

Port utilization: The increased size of vessels and increased volume of vessel traffic associated with planned offshore wind activities will likely result in port expansion within the geographic analysis area. At least two proposed offshore wind projects are considering port expansion, and other ports along the East Coast may be upgraded to accommodate the development of offshore wind projects. Increased port utilization and expansion results in increased noise associated with vessels or pile driving for port expansion and increased suspended sediment concentrations during port expansion activities, including dredging and pile driving. The impacts of vessel noise on sea turtles are expected to be short term and localized, as previously described for the noise IPF in this section. Impacts on water quality associated with increased suspended sediment would also be temporary and localized, as previously described for the new cable emplacement and maintenance IPF in this section. Additionally, the area affected by benthic disturbance would be small compared to available foraging habitat.

Increased port utilization may require dredging at ports or within navigation channels to accommodate the large ships required to carry WTG components. In addition to benthic disturbance and increased suspended sediment concentrations, dredging can affect sea turtles through impingement, entrainment, or capture in the dredges, as described for the new cable emplacement and maintenance IPF in this section. These impacts would be localized to nearshore habitats, and typical mitigation measures (e.g., timing restrictions) are expected to minimize risk to sea turtles. Therefore, risks of injury or mortality are considered low and population-level effects are unlikely to occur.

Presence of structures: An estimated 2,884 WTGs and 68 OSS/ESPs could be built in the geographic analysis area for planned and ongoing offshore wind activities. These structures would occupy open-water, pelagic habitat and would provide presently unavailable hard structure within the water column. Approximately 4,259 acres of hard scour protection would be installed around the WTG foundations, and an additional 2,646 acres of hard protection would be installed around the export and interarray cables (Table F2-2 in Appendix F). The rock and concrete material used for scour protection and cable protection represents presently unavailable benthic hard structure on the seabed. The installation of WTGs and OSS/ESPs and hard protection could result in hydrodynamic changes; obstructions that cause loss of fish gear resulting in entanglement or ingestion by sea turtles; habitat conversion from open-water pelagic and benthic soft substrates to structurally complex, mid-water and benthic hard bottom; new areas of prey aggregation; avoidance or displacement; and behavioral disruption.

The presence of WTGs and OSS/ESPs could alter local hydrodynamic patterns at a fine scale. Water flows are reduced immediately downstream of foundations but return to ambient levels within a relatively short distance (Miles et al. 2017). The downstream area affected by reduced flows is dependent on pile diameter. For monopiles (i.e., the structures with the largest diameter), effects are expected to dissipate within 300 to 400 feet. Although effects from individual structures are highly localized, the presence of an estimated 2,877 WTGs and 68 OSS/ESPs associated with ongoing and planned offshore wind activities (not including the Proposed Action) could result in regional impacts on wind wave energy, mixing regimes, and upwelling (van Berkel et al. 2020). These localized and regional alterations to hydrodynamics could have impacts on sea turtle prey species. Fine-scale effects on water flow could have localized impacts on prey distribution and abundance. Regional hydrodynamic effects could affect prey species at a broader scale. Effects on surface currents could influence patterns of larval distribution (Johnson et al. 2021) and seasonal mixing regimes could influence primary productivity, both of which could in turn affect the distribution of fish and invertebrates on the OCS (Chen et al. 2018; Lentz 2017; Matte and Waldhauer 1984). Hydrodynamic alterations due to the presence of WTGs could increase primary productivity in the vicinity of the structures (Carpenter et al. 2016; Schultze et al. 2020). However, such an increase would be highly localized and the increased productivity may be consumed by filter feeders colonizing the structures (Slavik et al. 2019) rather than leading to increased prey abundance for sea turtles.

In-water structures associated with ongoing and planned activities may serve as artificial reefs, resulting in increased recreational fishing activity in the vicinity of the structures. An increase in recreational fishing activity increases the risk of sea turtles becoming entangled in or ingesting lost fishing gear, which could injure or kill sea turtles. Specifically, entanglement and hooking can cause abrasions, loss of limbs, or increased drag resulting in reduced swimming efficiency and decreased ability to forage or avoid predators (Berreiros and Raykov 2014; Gregory 2009; Vegter et al. 2014). Between 2016 and 2018, 186 sea turtles were observed to have been hooked or entangled by recreational fishing gear. Although recreational fishermen would be expected to disperse effort across many WTG foundations to avoid overcrowding, risk of entanglement and ingestion of fishing gear could increase as fishermen and sea turtles are attracted to the structures.

Although the artificial reef effect could increase risk of interactions with recreational fishing gear, this effect could also benefit sea turtles due to prey aggregation. In-water structures result in the conversion of open-water and soft-bottom habitat to hard-bottom habitat. This habitat conversion attracts and aggregates prey species (Causon and Gill 2018; Taormina et al. 2018), essentially creating artificial reefs. The aggregation of prey at artificial reefs can result in increased foraging opportunities for sea turtles. In the Gulf of Mexico, green, Kemp's ridley, leatherback, and loggerhead sea turtles have been documented in the presence of offshore oil and gas platforms (Gitschlag and Herczeg 1994; Gitschlag and Renault 1989; Hastings et al. 1976; Rosman et al. 1987), indicating that sea turtles are likely to use habitat created by in-water structures in the geographic analysis area. However, increased foraging opportunities are not

expected to be biologically significant given the broad geographic range used by sea turtles on their annual foraging migrations compared to the localized scale of artificial reef effects.

Although sea turtle prey may be aggregated through the reef effect, it may also aggregate sea turtle predators. In field surveys of artificial and natural reefs off North Carolina conducted by Paxton et al. (2020), higher densities of large, reef-associated predators, specifically transient predators, were observed on artificial reefs than natural reefs. The aggregation of transient predators (e.g., sharks, barracuda, jacks, mackerel) at artificial reefs was associated with greater vertical relief (Paxton et al. 2020), indicating that the vertical structure provided WTG foundations may attract relatively high densities of sharks. The attraction of both sea turtles and their predators to offshore wind structures may increase predation risk for sea turtles. Although the potential for increased predation risk associated with the presence of structures may affect individual sea turtles, it is not expected to result in population-level effects given the localized scale of artificial reef effects compared to the geographic range of sea turtles.

The presence of offshore wind facility structures could result in sea turtle avoidance and displacement, which could potentially move sea turtles into areas with lower habitat value or with a higher risk of vessel collision or fisheries interactions. Any avoidance or displacement is expected to be short term. The presence of structures could also displace commercial or recreational fishing vessels to areas outside of offshore wind farms. Assuming fishing vessels are displaced to adjacent areas, risk of interaction with fishing vessels would not be greater than current risk given the patchy distribution of sea turtles. Presence of structures could potentially lead to a shift in gear types due to displacement. If displacement leads to an overall shift from mobile to fixed gear types, there could be an increased number of vertical lines in the water, increasing the risk of sea turtle interactions with fishing gear.

Disruption of normal behaviors, such as foraging and migration, could occur due to the presence of offshore structures. Although 2,884 WTG and 68 OSS/ESP structures are anticipated (2,952 total structures), spacing would be sufficient to allow sea turtles to utilize habitat between and around structures for foraging, resting, and migrating. Although migrations could be temporarily interrupted as sea turtles stop to forage or rest around structures, the presence of structures is not expected to result in measurable changes in sea turtle migratory patterns.

Traffic: Planned offshore wind activities would result in increased vessel traffic due to vessels transiting to and from individual lease areas during construction, operation, and decommissioning.

Vessel strikes are an increasing concern for sea turtles. The percentage of stranded loggerhead sea turtles with injuries that were apparently caused by vessel strikes increased from approximately 10 percent in the 1980s to over 20 percent in 2004, although some stranded turtles may have been struck post-mortem (NMFS and USFWS 2007). Sea turtles are expected to be most vulnerable to vessel strikes in coastal foraging areas and may not be able to avoid collisions when vessel speeds exceed 2 knots (Hazel et al. 2007). Average vessel speeds in the geographic analysis area may exceed 10 knots. Increased vessel traffic may result in sea turtle injury or mortality. Vessel activity associated with planned offshore wind activities is expected to peak in 2024 when up to 379 vessels could be involved in construction of offshore wind facilities. This increase in traffic would only be a small, incremental increase in overall traffic in the geographic analysis area (see Section 3.16, *Navigation and Vessel Traffic*).

The risk of vessel strike from offshore wind vessels would be dependent on the density of sea turtles in each project area, as well as the stage of the project, time of year, number of vessels utilized for each project, and speed of each vessel. Collision risk is expected to be greatest when offshore wind vessels transit between the offshore wind lease areas and ports utilized by each project, as vessel speeds would be highest and turtles are expected to be most susceptible to strike in coastal foraging areas. The increased collision risk associated with this incremental increase in vessel traffic may result in injury or mortality of individual sea turtles. The risk would be greatest for species with the highest densities in a given project

area. The increased risk of vessel strike would not be expected to have stock or population-level impacts on sea turtles given their low densities in the geographic analysis area and patchy distribution. Additionally, BOEM expects minimization measures for vessel impacts would be required for planned offshore wind activities, further reducing the risk of injury or mortality for sea turtles.

3.19.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, sea turtles would continue to be affected by existing environmental trends and ongoing activities.

The No Action Alternative, including ongoing non-offshore wind and offshore wind activities, would result in **negligible** to **minor** adverse impacts on sea turtles. Adverse impacts would result mainly from vessel traffic. BOEM anticipates that adverse impacts associated with ongoing activities, especially those associated with the traffic and noise IPFs, would be **minor**. Other adverse impacts associated with ongoing activities would be **negligible**, particularly those impacts associated with the EMF, accidental releases, and lighting IPFs. Overall, BOEM anticipates that adverse impacts associated with ongoing activities would be **minor**.

Cumulative Impacts of the No Action Alternative. For the No Action Alternative, BOEM expects that ongoing and planned activities would result in continuing temporary to permanent impacts on sea turtles. Considering all IPFs together, ongoing activities, planned activities other than offshore wind, and planned offshore wind activities would result in **minor** impacts, largely due to pile-driving noise and the presence of structures, with some **minor beneficial** impacts possible. Habitat conversion and prey aggregation associated with the presence of structures could result in **minor beneficial** impacts due to increased foraging opportunities for sea turtles. These effects would be localized and are not expected to affect individual fitness.

3.19.4 Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in impacts similar to or less than those described in the sections below. The following PDE parameters (Appendix E) would influence the magnitude of the impacts on sea turtles:

- Foundation types used for WTGs and OSS;
- The number of foundations installed; and
- The size of foundations installed.

Variability of the Project design exists as described in Appendix E. Below is a summary of potential variances in impacts:

- WTG foundation number: the number of WTG foundations installed affects the duration of pile driving. The more WTG foundations, the longer the duration of pile driving would be.
- WTG foundation size: the size of the pile affects the amount of noise produced during pile driving and thus the size of the ensonified area. Generally, a larger pile would result in a larger ensonified area.

Although variation is expected in the design parameters, the impact assessments in Sections 3.19.5 through 3.19.8 evaluate impacts associated with the maximum-case scenario for sea turtles identified in Appendix E.

3.19.5 Impacts of the Proposed Action on Sea Turtles

As described in Section 2.1.1, the Proposed Action includes the construction of up to 147 WTGs and two OSS and the installation of up to 299 miles (260 nm) of interarray cables and 77 miles (67 nm) of export cables between 2023 and 2027. The Proposed Action also includes 35 years of O&M over a 35-year commercial lifespan and decommissioning activities at the end of commercial life. BOEM expects the Proposed Action to affect sea turtles through the following primary IPFs.

Accidental releases: The Proposed Action may increase accidental releases of fuels, fluids, hazardous materials, and trash and debris during construction, operation, and decommissioning. The Proposed Action would comply with all laws regulating at-sea discharges of vessel-generated waste (APM 117), further reducing the likelihood of an accidental release. Empire has developed an OSRP (see COP Appendix F) with measures to avoid accidental releases and a protocol to respond to such a release (APM 99). APM 117 and the OSRP (APM 99), described in Appendix H, Attachment H-2 are included as part of the Proposed Action and considered in the final impact determinations presented in Section 3.19.3.2. Therefore, accidental releases are considered unlikely.

EMF: During operation, the Proposed Action would result in the production of EMFs and heat. EMFs could cause migratory deviations, and heat has the potential to affect benthic species, which serve as prey for some sea turtle species, as described in Section 3.19.3.2. Empire would bury cables to a target depth of 6 feet (1.8 meters) wherever possible (APM 97). In areas where sufficient cable burial is not feasible, surface cable protection would be utilized. APM 97, described in Appendix H, Attachment H-2 is included as part of the Proposed Action and considered in the final impact determinations presented in Section 3.19.5.3. Cable burial and surface protection, where necessary, would minimize EMF and heat exposure. Any potential impacts on sea turtles from EMFs and heat associated with the Proposed Action are expected to be too small to be measured.

Gear utilization: Monitoring surveys for the Proposed Action may include otter trawling, trap sampling, video and still imaging, Sediment Profile and Plan View Imaging, and grab sampling. As described in Section 3.19.3.2, mobile gear surveys (e.g., trawl surveys) have the potential to capture sea turtles, and fixed-gear surveys with vertical lines (e.g., trap surveys) have the potential to entangle sea turtles. Trawl survey tows for the Proposed Action would be limited to 20 minutes to avoid mortality of sea turtles if incidentally captured (Epperly et al. 2002; Sasso and Epperly 2006); BOEM anticipates capture probability in otter trawls to be low and expects incidentally caught turtles to resume normal behavior upon release. Therefore, the risk to sea turtles from otter trawl surveys would be negligible. The likelihood of entanglement in trap surveys for the Proposed Action would be discountable given the patchy distribution of sea turtles, the small number of vertical lines used in the surveys, and the relatively limited duration of each sampling event. Additionally, trap surveys would be required to utilize mitigation measures to further reduce entanglement risk (e.g., ropeless gear, biodegradable components).

Sea turtles could also be affected by these surveys through survey vessel traffic. Survey vessels would produce underwater noise and increase the risk of vessel strikes. The effects of vessel noise and increased strike risk would be similar to those discussed under the *Noise* and *Traffic* IPFs.

In addition to direct effects on sea turtles, monitoring surveys may indirectly affect these species through capture of prey items. However, biological monitoring for the Projects is expected to be non-extractive, returning captured organisms at the end of each sampling event. Therefore, indirect effects on sea turtles due to collection of potential prey items would be insignificant, as described in Section 3.19.3.2.

Monitoring survey sampling events are expected to be short term, occurring at fixed intervals over the duration of the monitoring program. Impacts of gear utilization for the Proposed Action on sea turtles are

expected to be negligible given the negligible risk of mortality, the discountable risk of entanglement, and the insignificant effect on sea turtle prey availability.

Lighting: Vessels and offshore structures associated with the Proposed Action would have deck and safety lighting. The incremental contribution associated with the Proposed Action would be lighting of up to 147 WTGs and two OSS, a small fraction of the light sources anticipated under the No Action Alternative. As discussed in Section 3.19.3.2, light may elicit temporary, localized behavioral impacts in sea turtles, including attraction or avoidance. Empire would light WTGs and OSS in compliance with FAA and USCG standards and BOEM best practices (APM 164 and APM 215) and would design lighting to minimize exposure of light (APM 87). Empire has additionally proposed the use of an ADLS to minimize the time that FAA-required lighting is illuminated on the offshore structures associated with the Proposed Action (APM 84). APMs 84, 87, 164, and 215, described in Appendix H, Attachment H-2 are included as part of the Proposed Action and considered in the final impact determinations presented in Section 3.19.5.3. Given the APMs in place, light associated with the Proposed Action is not expected to have an effect on sea turtles.

Cable emplacement and maintenance: The Proposed Action would involve the placement and maintenance of 375 miles (326 nm) of export and interarray cables. The incremental contribution of the Proposed Action is a 1,895-acre area of seabed disturbance for the emplacement of export and interarray cables. As described in Section 3.19.3.2, cable emplacement and maintenance activities disturb bottom sediment, temporarily increasing suspended sediment concentrations, which could result in behavioral effects on sea turtles or effects on sea turtle prey species. Empire has sited cable routes to avoid sensitive benthic habitats, including eelgrass beds, where feasible (APM 118), minimizing impacts on unique sea turtle foraging habitats. APM 118, described in Appendix H, Attachment H-2 is included as part of the Proposed Action and considered in the final impact determinations presented in Section 3.19.5.3. New cable emplacement is expected to affect only a small percentage of foraging habitat available to sea turtles, and any effects on sea turtles or their prey species would be localized and short term. Recolonization and recovery of prey species is expected to occur within 2 to 4 years (Van Dalssen and Essink 2001) but could occur in as little time as 100 days (Dernie et al. 2003). Given the short-term and localized nature of impacts and the available sea turtle habitat in the geographic analysis area, impacts of new cable emplacement and maintenance on sea turtles are expected to be too small to be measured.

Local dredging may be required prior to cable emplacement in locations where submarine export cables cross existing assets, which would be accomplished using a suction hopper dredge or mass flow excavator. The risk of interactions between hopper dredges and sea turtles is expected to be low in the offshore environment where dredging for offshore wind cables would most likely occur (Michel et al. 2013; NMFS 2020b). Given the low likelihood of interactions between dredging equipment and sea turtles, impacts of dredging associated with cable emplacement are unlikely to occur.

Noise: Underwater anthropogenic noise sources associated with the Proposed Action would include operating WTGs, pile driving during construction, cable laying during construction, vessels, and potentially helicopters and drilling during construction. As described in Section 3.19.3.2, these noise sources have the potential to affect sea turtles through behavioral or physiological effects. Underwater sound propagation modeling for impact pile driving and vibratory pile driving was conducted in support of the COP (see Appendices M-1 and M-2 of the COP; Empire 2023). The potential impacts associated with each noise source are discussed separately in the following paragraphs.

Helicopters may be used to support construction or operation of the Proposed Action. As described in Section 3.19.3.2, aircraft traveling at relatively low altitude has the potential to elicit stress or behavioral responses in sea turtles. BOEM assumes helicopters transiting to and from the Project area would fly at sufficient altitudes to avoid behavioral effects on sea turtles, with the exception of WTG inspections,

take-off, and landing. Any behavioral responses elicited during low-altitude flight would be temporary, dissipating once the aircraft leave the area, and are not expected to be biologically significant.

HRG surveys would be conducted prior to construction to support final engineering design and after cable emplacement to confirm burial of submarine export and interarray cables. As described in Section 3.19.3.2, G&G survey noise could affect sea turtles through auditory injuries, stress, disturbance, and behavioral responses. However, HRG survey equipment produces less-intense noise, operates in smaller areas than other G&G survey equipment (e.g., seismic air guns), and is unlikely to result in injury given that sea turtles are expected to avoid survey activities and vessels would travel quickly (NSF and USGS 2011). HRG surveys will be required to follow the Project Design Criteria and BMPs for offshore wind data collection activities (BOEM 2021b). Additionally, any G&G surveys conducted for the Proposed Action would comply with a Project-specific Letter of Authorization, which would include measures to minimize HRG survey impacts on marine mammals that would also benefit sea turtles (i.e., use of ramp-up procedures).

As discussed in Section 3.19.3.2, operating WTGs generate non-impulsive underwater noise that is audible to sea turtles. However, maximum noise levels anticipated from operating WTGs are below recommended thresholds for sea turtle injury and behavioral effects, and noise levels are expected to reach ambient levels within a short distance of turbine foundations. Therefore, no noise impacts on sea turtles are anticipated from operating WTGs.

The loudest source of underwater noise associated with the Proposed Action would be pile driving during construction, specifically impact pile driving. As noted above, underwater sound propagation modeling for vibratory and impact pile driving was conducted in support of the COP (see Appendices M-1 and M-2, respectively, of the COP; Empire 2023). Modeling results indicated that the extent of the ensonified area associated with vibratory pile driving during cofferdam installation for the Projects is relatively small (distance from the pile generally less than 328 feet [100 meters]) compared to the ensonified area produced during impact pile driving for foundation installation. Therefore, this impact evaluation focuses on impact pile driving.

For a typical installation of 31.5-foot (9.6-meter) monopiles (COP Volume 2, Appendix M-2, Tables I-47 through I-50; Empire 2023), impact pile driving sound levels could exceed recommended sea turtle injury thresholds within up to 1.1 miles (1.71 kilometers) during the summer months without sound mitigation. Assuming 10 dB of noise attenuation due to noise mitigating technology, which is the level of attenuation generally achievable by a single noise abatement system (Bellman et al. 2020) and required for mitigation in the Proposed Action's Letter of Authorization, impact pile driving levels could exceed recommended sea turtle injury thresholds at distances up to 1,148 feet (350 meters) during summer months. Without mitigation, sound levels could exceed recommended sea turtle behavioral thresholds within up to 1.4 miles (2.31 kilometers) of pile driving. Assuming 10 dB of noise attenuation due to noise-mitigating technology, recommended sea turtle behavioral thresholds could be exceeded within up to 2,526 feet (770 meters) of pile driving. Because it is possible that some monopiles (up to 17) will be more difficult to install, modeling was also conducted for 31.5-foot (9.6-meter) monopiles under a difficult-to-drive scenario (COP Volume 2, Appendix M-2, Tables I-51 through I-54; Empire 2023). Under this scenario, sea turtles that remain within up to 1.8 miles (2.84 kilometers) of pile driving in the summer months could experience PTS without noise mitigation. Assuming 10 dB of noise attenuation, sea turtles that remain within up to 2,559 feet (780 meters) of pile driving could experience PTS. Without noise mitigation, recommended sea turtle behavioral thresholds could be exceeded within up to 2.3 miles (3.73 kilometers) of pile driving during summer months. Assuming 10 dB of noise attenuation, radial distances to recommended behavioral thresholds could be reduced to 1.0 mile (1.59 kilometers).

For 36.1-foot (11-meter) monopiles, impact pile driving sound levels in summer months could exceed recommended sea turtle injury thresholds within up to 1.0 mile (1.58 kilometers), without sound

mitigation. Assuming 10 dB of noise attenuation, the distance to the recommended sea turtle injury thresholds could be reduced to 984 feet (300 meters) of pile driving. Without mitigation, sound levels could exceed recommended sea turtle behavioral thresholds within up to 1.5 miles (2.45 kilometers) of pile driving. Assuming the use of 10 dB of noise attenuation due to noise-mitigation technology, the distance to recommended sea turtle behavioral thresholds could be reduced to 2,756 feet (840 meters) from the source of pile driving.

Average numbers of sea turtles predicted to receive sound levels above behavioral and PTS exposure criteria were modeled assuming a maximum-case 2-year construction scenario of two monopiles and three pin piles being installed per day, with 96 monopiles and 24 pin piles being installed in Year 1 and 51 monopiles and no pin piles being installed in Year 2 (COP Volume 2, Appendix M-2, Tables 10, 14, I-17, and I-18; Empire 2023) (Table 3.19-4). Without noise mitigation, up to five Kemp’s ridley sea turtles, three leatherback sea turtles, and 12 loggerhead sea turtles are expected to be exposed to sound levels exceeding recommended injury thresholds. Assuming 10 dB of noise attenuation, no sea turtles are expected to be exposed to sound levels exceeding recommended injury thresholds. Without noise mitigation, up to one green sea turtle, 33 Kemp’s ridley sea turtles, 18 leatherback sea turtles, and 538 loggerhead sea turtles are expected to be exposed to sounds levels exceeding recommended behavioral thresholds. Assuming 10 dB of noise attenuation, up to eight Kemp’s ridley sea turtles, one leatherback sea turtle, and 96 loggerhead sea turtles are expected to be exposed to sound levels exceeding recommended behavioral thresholds.

Table 3.19-4 Mean Number of Sea Turtles Predicted to Receive Sound Levels Above Injury and Behavioral Thresholds over 2-Year Construction Period

Species	Injury (L_E)		Behavior (L_p)	
	Attenuation (dB)		Attenuation (dB)	
	0	10	0	10
Green turtle	0	0	1	0
Kemp’s ridley turtle	5	0	33	8
Leatherback turtle	3	0	18	1
Loggerhead turtle	12	0	538	96

Source: COP Volume 2, Appendix M-2, Tables I-17 and I-18; Empire 2023.

L_E = sound exposure level (decibel re 1 μ Pa square second); L_p = root-mean-square sound pressure (decibel re 1 μ Pa)

As described in Section 3.19.3.2, pile driving can result in behavioral and physiological effects on sea turtles. Empire has proposed measures to avoid, minimize, and mitigate impacts of pile driving noise on sea turtles (Appendix H, Attachment H-1 and Attachment H-2), including utilization of protected species observers to monitor and enforce appropriate clearance and shutdown zones (APM 104, APM 105, APM 106, APM 107), ramp-up procedures (APM 103), noise-reducing technologies (APM 108), and seasonal pile driving restrictions (APM 102). APMs 102 through 108, described in Appendix H, Attachment H-2 are included as part of the Proposed Action and considered in the final impact determinations presented in Section 3.19.5.3. With these measures in place, no significant injuries to sea turtles are expected.

Temporary behavioral and physiological effects are expected to occur, but no stock or population-level effects are anticipated. Empire’s Letter of Authorization application includes measures for marine mammals that would also benefit sea turtles (i.e., time-of-day restrictions, use of soft-start procedures, and use of noise mitigation techniques that achieve a 10-dB attenuation). These measures would be expected to further minimize pile-driving noise effects on sea turtles but are not expected to change the impact determinations presented in Section 3.19.5.3.

As described in Section 3.19.3.2, noise-producing activities associated with cable laying may include trenching, jet plowing, backfilling, and cable protection installation. The incremental contribution of the Proposed Action is noise-producing activities associated with an additional 326 nm of export and interarray cables. The incremental impacts of the Proposed Action are not expected to exceed noise impacts of cable-laying activities under the No Action Alternative, which are not expected to result in adverse effects on sea turtles.

As described in Section 3.19.3.2, vessels associated with the Proposed Action would generate low-frequency, non-impulsive noise that could elicit behavioral or stress responses in sea turtles. It is estimated that up to 18 vessels could be utilized during construction of each phase of the Proposed Action. Additional vessels would be used during operation and decommissioning. Effects of vessel noise on individual sea turtles are expected to be temporary and localized.

Presence of structures: The Proposed Action would include construction of up to 147 WTGs and two OSS and installation of up to 254 acres of hard scour protection around the WTG foundations and export and interarray cables. As described in Section 3.19.3.2, the installation of WTGs and OSS and hard protection could result in hydrodynamic changes, entanglement or ingestion of lost fishing gear, habitat conversion and prey aggregation, avoidance or displacement, and behavioral disruption.

The presence of WTGs and OSS could alter local hydrodynamic patterns at a fine scale, which could have localized impacts on prey distribution and abundance. However, these localized impacts may not translate to impacts on sea turtle prey species.

The presence of structures may have an artificial reef effect, resulting in increased recreational fishing activity in the vicinity of the WTGs and OSS. An increase in fishing activity would increase risk of entanglement or ingestion of lost fishing gear, which can lead to sea turtle injury or death. Any increase in interactions with fishing gear is not expected to be detectable. The artificial reef effect could also result in beneficial impacts on sea turtles due to prey aggregation. The aggregation of prey species would increase sea turtle foraging opportunities around offshore wind facility structures, potentially leading to increased habitat use around the WTGs. However, the artificial reef effect could also attract sea turtle predators (i.e., sharks) (Paxton et al. 2020). Predator attraction may result in increased risk of predation for sea turtles.

The presence of offshore wind facility structures could result in sea turtle avoidance and displacement, which could potentially move sea turtles into areas with lower habitat value or with a higher risk of vessel collision or fisheries interactions. However, the habitat quality for sea turtles does not greatly vary within and around the Lease Area. Any avoidance or displacement is expected to be short term. The presence of structures could also displace commercial or recreational fishing vessels to areas outside of wind energy facilities or result in gear shifts. Risk of interaction with fishing vessels is not expected to be greater than current risk, but gear shifts that result in an increased number of vertical lines in the water would increase the risk of sea turtle interactions with fishing gear. Disruption of normal behaviors, such as foraging and migration, could occur due to the presence of offshore structures. Although migrations could be temporarily interrupted as sea turtles stop to forage or rest around structures, the presence of structures is not expected to result in measurable changes in sea turtle migratory patterns.

Traffic: The Proposed Action would result in increased vessel traffic due to vessels transiting between Project ports and facilities and the Project area during construction, operation, and decommissioning. Project ports and facilities include SBMT, the Port of Albany, the Port of Coeymans, the Nexans cable facility on the Cooper River just north of Charleston, South Carolina, and the Port of Corpus Christi. As described in Section 3.19.3.2, vessel strikes are an increasing concern for sea turtles and could result in injury or death of individual sea turtles. Risk of injury or death would be highest for loggerheads, which have the highest density in the Project area. Vessel strike is most likely to occur when Project vessels are

transiting to and from the Project area. Empire expects 18 vessels to be used during each phase of construction, and the number of vessels transiting the Project area during operation is expected to be lower. This increase in traffic would only be a small, incremental increase in overall traffic in the geographic analysis area. Empire has proposed the use of dedicated lookouts to reduce the risk of collisions with marine mammals and sea turtles (APM 119) and site-specific training on vessel strike avoidance measures for all crew members (APM 116). Empire has proposed additional measures to avoid, minimize, and mitigate impacts associated with vessel traffic on marine mammals, including vessel speed restrictions and collision avoidance measures (APMs 109 and 111), which would also benefit sea turtles. These APMs, described in Appendix H, Attachment H-2 are included as part of the Proposed Action and considered in the final impact determinations presented in Section 3.19.5.3. Given the small, incremental increase in vessel traffic compared to existing traffic and the measures that would be taken to avoid, minimize, and mitigate vessel traffic impacts, the increased collision risk associated with the incremental increase in vessel traffic due to Project vessels would not be expected to have stock or population-level impacts on sea turtles.

3.19.5.1. Impact of the Connected Action

Infrastructure improvements have been proposed at SBMT to provide the necessary structural capacity, berthing facilities, and water depths to operate as an offshore wind hub for several proposed offshore wind projects, including the Proposed Action. These improvements include in-water activities (i.e., dredging and dredged material management, replacement and strengthening of existing bulkheads, installation of new pile-supported and floating platforms, installation of new fenders) that may affect sea turtles. Some upland activities included in the improvements also have the potential to affect sea turtles. These improvements at SBMT are not being undertaken by Empire but are considered a connected action for the Projects and are therefore evaluated in this section. BOEM expects the connected action to affect sea turtles through the following primary IPFs.

Lighting: The connected action would lead to increased artificial light in the Project area. The number of lamp poles would be kept to a minimum, and changes in lighting of the water surface are expected to be negligible relative to the high levels of artificial light in Upper New York Bay. Given the small change in water surface lighting and the unlikely presence of sea turtles in the Project area for the connected action, light at SBMT is not expected to have an effect on sea turtles.

Noise: Underwater anthropogenic noise sources associated with the connected action would include pile driving during construction and vessels during construction and operation. As described in Section 3.19.3.2, these noise sources have the potential to affect sea turtles through behavioral or physiological effects. The potential impacts associated with each noise source are discussed separately in the following paragraphs.

The connected action would include installation of 36-inch (0.9-meter) steel pipe piles and steel sheet piles. Pipe piles would be installed using a vibratory hammer for the majority of installation. An impact hammer would be used to drive the final 10 to 15 feet (3 to 4.5 meters). Sheet piles would be installed entirely using a vibratory hammer. To evaluate pile driving impacts, the NMFS Multi-Species Pile Driving Calculator¹ was used to calculate distances to recommended regulatory thresholds for sea turtles assuming a strike rate of 60 strikes per minute (Matuschek and Betke 2009) and 5 dB of attenuation due to use of a bubble curtain, noise levels associated with pile driving for the connected action could exceed recommended injury thresholds for sea turtles if individuals remain within up to approximately 457 feet (139 meters) of the pile driving throughout a 24-hour pile-driving period. Noise levels may exceed recommended behavioral thresholds for sea turtles up to approximately 241 feet (74 meters) from impact

¹ Available at: <https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance>.

pile driving. For vibratory pile driving, sea turtles may experience PTS if they remain within up to 5 feet (1.4 meters) for an entire day of vibratory pile driving. Sea turtles may experience behavioral effects within up to approximately 15 feet (5 meters) of the pile. Given the relatively small distances to injury and behavioral thresholds and unlikely sea turtle presence in the Project area for the connected action, pile-driving noise impacts associated with the connected action would be extremely unlikely to occur.

As described in Section 3.19.3.2, vessels associated with the connected action would generate low-frequency, non-impulsive noise that could elicit behavioral or stress responses in sea turtles. During construction, less than one vessel per day is expected to be used. During operation, up to nine vessels may transit to and from SBMT per week. Any effects of vessel noise on individual sea turtles are expected to be temporary and localized. Based on the small volume of vessel traffic associated with the connected action, vessel noise impacts would be extremely unlikely to occur.

Port utilization: In-water activities for the SBMT improvements include dredging and dredged material management, which may affect sea turtles through physical interactions with the dredge and increased suspended sediments, as described in Section 3.19.3.2. Habitat disturbance and modification associated with dredging may also affect benthic prey species.

Dredging for the connected action could affect sea turtles through physical interactions (i.e., impingement, entrainment, or capture). Dredging at SBMT would utilize a clamshell dredge with an environmental bucket. As noted in Section 3.19.3.2, mechanical dredging, including the use of a clamshell dredge, is not expected to capture, injure, or kill sea turtles (NMFS 2020b). Additionally, turbidity curtains would be used for a large proportion of the dredge area, excluding sea turtles from most active dredging areas. Therefore, effects of physical interactions with the dredge are not expected to occur.

Dredging for the connected action would result in temporary increases in suspended sediment concentrations in the associated Project area. As described in Section 3.19.3.2, increased suspended sediment concentrations could result in behavioral effects on sea turtles or on sea turtle prey species. Any behavioral effects would be too small to be detected (NMFS 2020a), and no effects are anticipated if sea turtles swim through the area of elevated suspended sediment. Turbidity curtains would be used for a large proportion of the dredge area, minimizing water quality impacts and excluding sea turtles from most active dredging areas. Additionally, BMPs to reduce turbidity (e.g., slow bucket withdrawal) would be used. Increased suspended sediment concentrations could also affect prey species. However, any effects on sea turtles or their prey species would be localized and short term, as described in Section 3.19.3.2. Given the localized and temporary or short-term nature of the effects, the use of turbidity curtains, and the unlikely presence of sea turtles, any effects of increased suspended sediments on sea turtles would be discountable.

Habitat disturbance and modification associated with dredging could result in short-term reductions in foraging habitat or short-term effects on prey availability for some sea turtle species. Benthic communities would be expected to recover within 1 year of disturbance (NMFS 2017). Dredging may increase water depths by up to 21 feet (6.4 meters), which is not expected to have a substantial impact on benthic community composition following recolonization of the dredge area. Dredging is not expected to alter the sediment composition compared to the existing substrate in the dredge area. Given there would be no change in sediment composition, subsequent changes in benthic community composition would not be expected. However, the surface sediments following dredging may contain increased concentrations of contaminants, which may affect recolonizing benthic invertebrates. Although habitat disturbance and modification may result in reductions in foraging habitat availability or prey availability, these reductions would be short term, and there would be no changes in the benthic community composition.

Contaminants in the sediment could affect the recolonized benthic community. However, sea turtle foraging in the Project area for the connected action is extremely unlikely and the affected area would be

very small relative to available sea turtle foraging habitat. Therefore, any effects on sea turtles due to habitat disturbance and modification would be discountable.

Traffic: The connected action would result in increased vessel traffic during construction of the infrastructure improvements and during operation of SBMT as an offshore wind hub. As described in Section 3.19.3.2, vessel strikes could result in injury or death of sea turtles.

Only a small number of vessels would be used for construction of the connected action. On average, 1.7 vessel visits per day are expected, with a peak of 4.3 vessel visits per day. All construction vessels would have a large below-water envelope but would be operating at slow speeds. Less than one vessel visit per day is expected during construction. Additionally, sea turtles are not generally found in the Project area for the connected action and would be excluded from a large portion of this Project area by turbidity curtains deployed to minimize impacts on water quality during construction. Based on the low volume of traffic, unlikely sea turtle presence in the Project area for the connected action, and sea turtle exclusion by turbidity curtains, vessel strikes associated with construction traffic would be extremely unlikely to occur.

During operation, approximately nine vessel trips (i.e., 18 one-way trips) are expected each week. This increase in vessel traffic represents less than a 0.2-percent increase compared to existing vessel traffic utilizing the Port of New York (i.e., 5,355 vessels per week). Additionally, a majority of vessel traffic at SBMT (i.e., seven of nine weekly vessels) would operate at slow speeds and would have large envelopes, displacing a large volume of water and repelling aquatic fauna in proximity to the vessel. Therefore, vessel strike risk would be minimal for these vessels. Given the very small increase in vessel traffic compared to existing traffic levels and the slow speeds of the majority of vessels utilizing SBMT, vessel strike risk for sea turtles during operation of the connected action would be discountable.

3.19.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind activities, other planned offshore wind activities, and the connected action at SBMT. Ongoing and planned non-offshore wind activities within the geographic analysis area that contribute to impacts on sea turtles include undersea transmission lines, gas pipelines, and other submarine cables; tidal energy projects; marine minerals use and ocean-dredged material disposal; military use; marine transportation; fisheries use and management; oil and gas activities; and onshore development activities. The connected action would improve the SBMT facility to support offshore wind activities, increase the water depth for berthing larger vessels, and generate vessel traffic during use of the facility for staging of offshore wind turbine components. Ongoing and planned offshore wind activities in the geographic analysis area for sea turtles include the construction, O&M, and decommissioning of 30 planned offshore wind projects.

In the context of reasonably foreseeable environmental trends, the contribution of the Proposed Action to the impacts of accidental releases from ongoing and planned activities on sea turtles would likely be negligible. BOEM assumes all vessels would comply with laws and regulations to properly dispose of marine debris and minimize releases of fuels/fluids/hazardous materials. Additionally, large-scale releases are unlikely and impacts from small-scale releases would be localized and short term. Export and interarray cables from the Proposed Action and planned offshore wind development would add an estimated 11,646 miles (18,742 kilometers) of buried cable to the geographic analysis area, producing EMF in the immediate vicinity of each cable during operation (Table F2-1), of which the Proposed Action represents less than 4 percent. In context of reasonably foreseeable environmental trends, the contribution of the Proposed Action to impacts of EMF and heat from ongoing and planned activities in the geographic analysis area would be negligible given the small area that would be affected by the Projects.

The 149 structures for the Proposed Action represent only 4.8 percent of the 3,101 offshore wind structures anticipated on the OCS for existing and planned offshore wind farms, including the Proposed Action. In context of reasonably foreseeable environmental trends, the contribution of the Proposed Action to light on the OCS associated with ongoing and planned activities would be negligible given the large volume of existing vessel traffic and the relatively small number of offshore structures anticipated for the Proposed Action.

The 1,913 acres of seabed disturbance, including anchoring disturbance, associated with the proposed Projects represents only 1 percent of the 188,839 acres of seabed expected to be disturbed on the OCS due to ongoing and planned offshore wind farms, including the Proposed Action. In context of reasonably foreseeable environmental trends, the contribution of the Proposed Action to impacts of new cable emplacement and maintenance from ongoing and planned activities would be negligible.

Planned offshore wind activities would generate comparable types of noise impacts to those of the Proposed Action. The most significant sources of noise are expected to be pile driving followed by vessels. The 149 structures for the Proposed Action represent only 4.8 percent of the 3,101 offshore wind structures anticipated on the OCS for ongoing and planned offshore wind farms, including the Proposed Action, although some foundations at other planned wind farms may be installed without impact pile driving. Project vessels would represent only a small fraction of the large volume of existing traffic in the geographic analysis area. In context of reasonably foreseeable environmental trends, the contribution of the Proposed Action to noise impacts on sea turtles from ongoing and planned activities would be negligible given the magnitude of ongoing and planned activities.

The 149 structures for the Proposed Action represent only 4.8 percent of the 3,101 offshore wind structures anticipated on the OCS for ongoing and planned offshore wind farms, including the Proposed Action. In context of reasonably foreseeable environmental trends, the contribution of the Proposed Action to impacts on sea turtles due to the presence of structures from ongoing and planned activities would be negligible.

In context of reasonably foreseeable environmental trends, the contribution of the Proposed Action to impacts of vessel traffic from ongoing and planned activities would be negligible given the large volume of existing vessel traffic in the geographic analysis area.

3.19.5.3. Conclusions

Impacts of the Proposed Action. Construction, operation, and decommissioning of the Proposed Action would result in **negligible** to **minor** adverse impacts on sea turtles and could include **minor beneficial** impacts. Adverse impacts would result mainly from pile-driving noise. Beneficial impacts could result from the presence of structures. Impact determinations for each IPF are provided in the following paragraphs.

Adverse impacts associated with accidental releases, EMF, light, new cable emplacement and maintenance, aircraft noise, G&G survey noise, WTG noise, cable-laying noise, disturbed hydrodynamic patterns associated with the presence of structures, entanglement or ingestion of fishing gear associated with the presence of structures, avoidance or displacement associated with the presence of structures, and behavioral disruptions associated with the presence of structures would be **negligible**. These impacts are expected to be unlikely to occur and localized, temporary, or too small to be measured.

Adverse impacts associated with pile-driving noise, vessel noise, displacement into higher-risk areas associated with the presence of structures, and vessel traffic would be **minor**. These impacts are generally expected to be localized and temporary, although some may be long term. Adverse effects on individual sea turtles may occur due to these impacts, but no stock or population-level effects are anticipated.

Habitat conversion and prey aggregation associated with the presence of structures could result in **minor beneficial** impacts due to increased foraging opportunities for sea turtles. These effects would be localized and are not expected to affect individual fitness.

BOEM expects that the connected action alone would have **negligible** impacts on sea turtles due to light, noise, port utilization, and vessel traffic. These impacts would be unlikely to occur and, if they did occur, would be localized, temporary or short term, or too small to be measured.

An assessment of the impacts of the Proposed Action on ESA-listed sea turtles and sea turtle critical habitat will be provided in the Projects' BA. Based on this assessment, BOEM determined that the Proposed Action was not likely to adversely affect hawksbill sea turtle, given that impacts associated with the limited number of vessel transits in the Gulf of Mexico would be extremely unlikely to occur. The Proposed Action may affect and is likely to adversely affect green sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, and loggerhead sea turtle. BOEM also concluded that vessel transits through loggerhead sea turtle critical habitat would not affect any essential physical and biological features. Therefore, the Proposed Action is expected to have no effect on designated critical habitat for the Northwest Atlantic Ocean DPS of loggerhead sea turtle.

Cumulative Impacts of the Proposed Action. In context of other reasonably foreseeable environmental trends in the area, the contribution of the Proposed Action and the connected action to the impacts of individual IPFs on sea turtles from ongoing and planned activities would range from **negligible** to **minor** adverse and would also include **minor beneficial** impacts. Considering all IPFs together, BOEM anticipates that the cumulative impacts associated with all ongoing and planned activities, including the Proposed Action, would result in **minor** impacts on sea turtles. BOEM made this determination because the anticipated impact would be detectable and measurable, but these impacts would not result in population-level impacts. The main drivers for this impact rating are impact pile-driving noise, vessel noise, the presence of structures, and vessel traffic. The Proposed Action would contribute to the overall impact rating primarily through impact pile-driving noise, vessel noise, and the presence of structures.

3.19.6 Impacts of Alternatives B, E, and F on Sea Turtles

Impacts of Alternatives B, E and F. Alternatives B, E, and F would alter the turbine array layout but Alternatives B and E would allow for installation of up to 147 WTGs as defined in Empire's PDE. Under Alternative F, up to 138 WTGs would be installed, 54 WTGs in EW 1 and 84 WTGs in EW 2. The impacts resulting from individual IPFs associated with construction and installation, O&M, and decommissioning of the Projects under Alternatives B and E would be the same as those described under the Proposed Action because the same number of WTGs would be constructed throughout the Lease Area. While the WTGs may move to a different position in the Lease Area under Alternatives B and E, impacts on sea turtles would not materially change compared to the Proposed Action. The impacts resulting individual IPFs under Alternative F may be reduced, but the overall impact determination associated with this alternative is anticipated to be the same as under the Proposed Action. All other offshore and onshore Project components of Alternatives B, E, and F would be the same as under the Proposed Action.

Cumulative Impacts of Alternatives B, E and F. In context of reasonably foreseeable environmental trends, the contribution of Alternatives B, E, and F to the impacts of individual IPFs from ongoing and planned activities would be the same as that of the Proposed Action. The cumulative impacts on sea turtles of ongoing and planned activities in combination with Alternative B, E, or F would be the same level as described under the Proposed Action.

3.19.6.1. Conclusions

Impacts of Alternatives B, E, and F. Given that impacts on sea turtles are not expected to be measurably different compared to impacts under the Proposed Action, the impacts associated with these alternatives would not change the anticipated impact rating. Therefore, BOEM anticipates that impacts under Alternatives B, E, and F would have **negligible** to **minor** adverse impacts with potential **minor beneficial** impacts.

Cumulative Impacts of Alternatives B, E, and F. In context of reasonably foreseeable environmental trends, the contribution of Alternatives B, E, and F to the impacts of individual IPFs from ongoing and planned activities would be the same as that of the Proposed Action and would range from **negligible** to **minor**, with potential **minor beneficial** impacts. The cumulative impacts on sea turtles of ongoing and planned activities in combination with Alternative B, E, or F would be the same level as described under the Proposed Action.

3.19.7 Impacts of Alternative C, D, and G on Sea Turtles

Impacts of Alternatives C, D, and G. Alternatives C-1, C-2, D, and G would include variations in the export cable routes for the Projects. Alternatives C-1 and C-2 would allow BOEM to select a specific export cable route for EW 1. Alternative C-1 would pass through the anchorage area in Gravesend Bay. Alternative C-2 is an alternative route along the Ambrose Navigation Channel to avoid the anchorage area in Gravesend Bay. Under Alternative D, the export cable route for EW 1 would avoid the sand borrow area offshore of Long Island by at least 500 meters. Under Alternative G, the onshore cable route for EW 2 would use a cable bridge to cross Barnums Channel. Alternative export cable routes would not change or reduce impacts on sea turtles. Therefore, the impacts of Alternatives C-1, C-2, D, and G would not differ from the impacts anticipated under the Proposed Action.

Cumulative Impacts of Alternatives C, D, and G. Cumulative impacts of Alternatives C, D, and G would be the same as described for the Proposed Action.

3.19.7.1. Conclusions

Impacts of Alternatives C, D, and G. Given that impacts on sea turtles are not expected to differ from those under the Proposed Action, BOEM anticipates that impacts under Alternatives C-1, C-2, D, and G would have **negligible** to **minor** adverse impacts with potential **minor beneficial** impacts.

Cumulative Impacts of Alternatives C, D, and G. In context of reasonably foreseeable environmental trends, the contribution of Alternatives C, D, and G to the impacts of individual IPFs from ongoing and planned activities would be the same as that of the Proposed Action and would range from **negligible** to **minor**, with potential **minor beneficial** impacts. The cumulative impacts on sea turtles of ongoing and planned activities in combination with Alternative C, D, or G would be the same level as described under the Proposed Action.

3.19.8 Impacts of Alternative H on Sea Turtles

Impacts of Alternative H. Alternative H would utilize a method of dredge or fill activities for construction of the EW 1 landfall that would reduce the discharge of dredged material. Dredging would be conducted using a mechanical clamshell dredge, which sea turtles are expected to avoid (NMFS 2018), or similar method. Dredged sediments would be dewatered on site to reduce turbidity effects. Under Alternative H, effects of suspended sediments would be minimized and effects of physical interactions with the dredge would be minimized or avoided, compared to other dredging methods. Although impacts would be reduced, BOEM anticipates this reduction would not be sufficient to reduce the overall impact determination because of the relatively small portion of the Project area encompassed by Alternative H.

Cumulative Impacts of Alternative H. Cumulative impacts of Alternative H would be the same as described for the Proposed Action.

3.19.8.1. Conclusions

Impacts of Alternative H. Given that impact determinations for sea turtles are not expected to differ from those under the Proposed Action, BOEM anticipates that impacts under Alternative H would have **negligible** to **minor** adverse impacts with potential **minor beneficial** impacts.

Cumulative Impacts of Alternative H. In context of reasonably foreseeable environmental trends, the contribution of Alternative H to the impacts of individual IPFs from ongoing and planned activities would be the same as that of the Proposed Action and would range from **negligible** to **minor**, with potential **minor beneficial** impacts. The cumulative impacts on sea turtles of ongoing and planned activities in combination with Alternative H would be the same level as described under the Proposed Action.

3.19.9 Comparison of Alternatives

Construction, O&M, and decommissioning of Alternatives B, C, D, E, F, G, and H would have the same overall **negligible** to **minor** adverse impacts and **minor beneficial** impacts on sea turtles as described under the Proposed Action. Alternatives B would result in fewer impacts on Cholera Bank, an important fishing area, due to the removal of up to six WTG positions from the northwestern end of EW 1. Alternative E, which creates a 1-nm setback between EW 1 and EW 2 by the removal of up to seven WTG positions, would improve access for fishing; however, the resultant increase in vessel traffic through the Project area could increase the occurrence of vessel noise, vessel strikes, accidental releases of fuels/fluids/hazardous materials and trash and debris, permitted discharges, and the risk of fishing gear entanglement and loss within the Project area. Alternative F would result in fewer impacts in the Lease Area due to installation of nine fewer WTGs compared to the Proposed Action. Alternatives C-1, C-2, and D were included as part of the PDE and maximum-case scenarios evaluated for the Proposed Action and therefore do not represent any change from the Proposed Action. Alternative G would involve changes to only the onshore portion of the EW 2 export cable route; therefore, the impact of Alternative G on sea turtles would be the same as that of the Proposed Action. Alternative H would reduce effects of dredge and fill activities for construction of the EW 1 landfall but would not measurably reduce impacts on sea turtles compared to the Proposed Action.

3.19.10 Summary of Impacts of the Preferred Alternative

The Preferred Alternative is a combination of Alternatives C-1, D, F, G, and H. Therefore, the EW 1 submarine export cable route would traverse the Gravesend Anchorage Area (USCG Anchorage #25) (Alternative C-1); EW 2 cable route options would avoid impacts within 500 meters of the sand borrow area offshore Long Island (Alternative D); the wind turbine layout would be optimized to maximize annual energy production and minimize wake loss while addressing the presence of glauconite deposits across the Lease Area (Alternative F); the EW 2 export cable route would use an above-water cable bridge to construct the onshore export cable crossing at Barnums Channel (Alternative G); and the construction of the EW 1 export cable landfall would use a method of dredge or fill activities (clamshell dredging with environmental bucket) that would reduce the discharge of dredged material compared to other dredging options considered in the Empire Wind PDE (Alternative H). Alternatives C-1, D, and G would not affect impacts on sea turtles (Section 3.19.7). Alternative F would entail the removal of nine WTGs from the southeastern portion of EW 1, resulting in a small decrease in impacts in the Lease Area. Alternative H would reduce turbidity effects in the nearshore environment in proximity to the EW 1 landfall. Although the Preferred Alternative would reduce impacts on sea turtles, BOEM anticipates that impacts on sea turtles under the Preferred Alternative would not be measurably different from those anticipated under the Proposed Action.

3.19.11 Proposed Mitigation Measures

The mitigation measures listed in Table 3.19-5 are recommended for inclusion in the Preferred Alternative.

Table 3.19-5 Proposed Measures: Sea Turtles

Measure	Description	Effect
Marine debris awareness training	Vessel operators, employees, and contractors engaged in offshore activities under the approved COP must complete marine trash and debris awareness training annually. Items used during OCS activities that are likely to snag or damage fishing devices or be lost or discarded overboard, must be clearly marked with the vessel or facility identification number, and properly secured to prevent loss overboard. Empire must recover marine trash and debris that is lost or discarded in the marine environment while performing OCS activities when such incident is likely to cause undue harm or damage to natural resources or significantly interfere with OCS uses.	Marine debris and trash awareness training would minimize the risk of sea turtle ingestion of or entanglement in marine debris. While adoption of this measure would decrease risk to sea turtles, it would not alter the impact determination of negligible for accidental spills and releases.
Pile Driving Monitoring Plan	Empire must prepare a Pile Driving Monitoring Plan that details all plans and procedures for sound attenuation as well as for monitoring ESA-listed species during all impact and vibratory pile driving.	The development and implementation of a Pile Driving Monitoring Plan would increase the accountability of underwater noise mitigation during pile driving. While adoption of this measure would increase accountability during this construction activity, it would not alter the impact determination of minor for impact pile-driving noise.
Alternative Monitoring Plan	In order to conduct pile driving operations during low visibility conditions (e.g., inclement weather, darkness) when visual monitoring of the full extent of the clearance and shutdown zones is prevented, Empire must develop an Alternative Monitoring Plan and submit this plan to BOEM and NMFS for review and approval. This plan must include identification of any night vision devices proposed for detection of protected species; a demonstration of the capability of the proposed monitoring methodology to detect protected species within the full extent of the clearance and shutdown zones; evidence and discussion of the efficacy of each device proposed for low visibility monitoring; and reporting procedures, contacts, and timeframes.	The development and implementation of an Alternative Monitoring Plan would minimize the potential for exposure to sound levels above recommended thresholds during impact pile driving. While adoption of this measure would decrease risk to sea turtles during impact pile driving, it would not alter the impact determination of minor for impact pile-driving noise.

Measure	Description	Effect
Protected species observer coverage	Protected species observer coverage must be sufficient to reliably detect sea turtles at the surface in clearance and shutdown zones so that Empire can execute any pile driving delays or shutdown requirements.	Protected species observer coverage would minimize the potential for exposure to sound levels above recommended thresholds during impact pile driving. While adoption of this measure would decrease risk to sea turtles during impact pile driving, it would not alter the impact determination of minor for impact pile-driving noise.
Sound field verification	Empire must ensure that the distance to the injury and harassment thresholds for sea turtles are no larger than those modeled assuming 10 dB re 1 μ Pa noise attenuation by conducting field verification during pile driving. Empire must submit and execute a Sound Field Verification Plan. This plan must include a description of how the effectiveness of the sound attenuation methodology will be evaluated and must be sufficient to document impacts in the injury and behavioral disturbance zones for sea turtles.	Sound field verification would increase the accountability of underwater noise mitigation during pile driving. While adoption of this measure would increase accountability during this construction activity, it would not alter the impact determination of minor for impact pile-driving noise.
Shutdown zones	Shutdown zones for some species may be reduced based upon sound field verification of a minimum of 3 piles. However, shutdown zones will not be reduced to less than 500 meters for sea turtles.	Shutdown zones would minimize the potential for exposure to sound levels above recommended thresholds during impact pile driving. While adoption of this measure would decrease risk to sea turtles during impact pile driving, it would not alter the impact determination of minor for impact pile-driving noise.
Monitoring zones for sea turtles	Empire must monitor and record all observations of ESA-listed sea turtles over the full extent of any area where noise may exceed 175 dB rms during any pile driving activities and for 30 minutes following the cessation of pile driving activities.	Monitoring zones for sea turtles would minimize the potential for exposure to sound levels above recommended thresholds during impact pile driving. While adoption of this measure would decrease risk to sea turtles during impact pile driving, it would not alter the impact determination of minor for impact pile-driving noise.
Geophysical surveys	Empire must comply with all Project Design Criteria and Best Management Practices for protected species associated with offshore wind data collection found at https://www.boem.gov/sites/default/files/documents/PDCs%20and%20BMPs%20for%20Atlantic%20Data%20Collection%201122021.pdf .	Compliance with Project Design Criteria and BMPs for Protected Species would minimize risk to sea turtles during HRG surveys. While adoption of this measure would decrease risk to sea turtles, it would not alter the impact determination of negligible for HRG activities.

Measure	Description	Effect
Gear identification	To facilitate identification of gear on any entangled animals, all trap/pot gear used in Project surveys must be uniquely marked to distinguish it from other commercial or recreational gear. Gear must be marked with a 3-foot-long strip of black and white duct tape within 2 fathoms of a buoy attachment. In addition, 3 additional marks must be placed on the top, middle and bottom of the line using black and white paint or duct tape.	Gear identification would improve accountability in the case of gear loss. While adoption of this measure would improve accountability, it would not alter the impact determination of negligible for gear utilization.
Lost survey gear	All reasonable efforts that do not compromise human safety must be undertaken to recover any lost survey gear. Any lost survey gear must be reported to NMFS and BSEE.	Lost survey gear would improve accountability in the case of gear loss. While adoption of this measure would improve accountability, it would not alter the impact determination of negligible for gear utilization.
Survey training	For any vessel trips where gear is set or hauled for trawl or ventless trap surveys, at least one of the survey staff onboard must have completed Northeast Fisheries Observer Program observer training within the last 5 years or completed other equivalent training in protected species identification and safe handling. Appropriate reference materials must be on board each survey vessel. Empire must prepare a training plan that addresses how these survey requirements will be met.	Survey staff training would reduce risk of entanglement in fisheries survey gear. While adoption of this measure would reduce risk, it would not alter the impact determination of negligible for gear utilization.
Gillnets in support of sturgeon tagging	If gillnets are utilized to capture sturgeon for acoustic tagging, deployed nets must be continuously monitored for the capture of sea turtles. All gillnet soaks must be limited to 24 hours or less to reduce the potential for serious injury and mortality of entangled sea turtles. All gillnet gear must be in compliance with the Atlantic Large Whale Take Reduction Plan, Bottlenose Dolphin Take Reduction Plan, and the Harbor Porpoise Take Reduction Plan.	Continuous monitoring of gillnets would reduce risk of entanglement in gear to support fisheries monitoring. While adoption of this measure would reduce risk, it would not alter the impact determination of negligible for gear utilization.
Sea turtle disentanglement	Vessels deploying fixed gear (e.g., pots/traps) must have adequate disentanglement equipment onboard, such as a knife and boathook, onboard. Any disentanglement must occur consistent with the Northeast Atlantic Coast STDN Disentanglement Guidelines and the procedures described in "Careful Release Protocols for Sea Turtle Release with Minimal Injury" (NOAA Technical Memorandum 580).	Sea turtle disentanglement would reduce effects of entanglement in fisheries survey gear. While adoption of this measure would reduce risk, it would not alter the impact determination of negligible for gear utilization.

Measure	Description	Effect
Sea turtle identification and data collection	Any sea turtles caught or retrieved in any fisheries survey gear must first be identified to species or species group. Each ESA-listed species caught or retrieved must then be documented using appropriate equipment and data collection forms. Live, uninjured animals must be returned to the water as quickly as possible after completing the required handling and documentation.	Sea turtle identification would improve accountability for documenting take associated with fisheries surveys. While adoption of this measure would improve accountability, it would not alter the impact determination of negligible for gear utilization.
Sea turtle handling and resuscitation guidelines	Any sea turtles caught and retrieved in gear used in fisheries surveys must be handled and resuscitated (if unresponsive) according to established protocols provided at-sea conditions are safe for those handling and resuscitating the animal(s) to do so.	Sea turtle handling and resuscitation guidelines would reduce effects of entanglement in fisheries survey gear. While adoption of this measure would reduce risk, it would not alter the impact determination of negligible for gear utilization.
Take notification	The Greater Atlantic Regional Fisheries Office Protected Resources Division must be notified as soon as possible of all observed takes of sea turtles occurring as a result of any fisheries survey	Take notification would improve accountability for documenting take associated with fisheries surveys. While adoption of this measure would improve accountability, it would not alter the impact determination of negligible for gear utilization.
Periodic underwater surveys, reporting of monofilament and other fishing gear around WTG foundations	Empire must monitor potential loss of fishing gear in the vicinity of WTG foundations by surveying at least ten percent of the total installed foundations annually. Survey design and effort may be modified based upon previous survey results after review and concurrence by BOEM. Empire must conduct surveys by remotely operated vehicles, divers, or other means to determine the locations and amounts of marine debris.	Periodic underwater surveys and reporting of monofilament and other fishing gear around WTG foundations would improve understanding of the risk of entanglement associated with the presence of structures. While adoption of this measure would improve understanding of risks to sea turtles, it would not alter the impact determination of minor associated with the presence of structures.

Measure	Description	Effect
Look out for sea turtles and reporting	Project vessels must adhere to the following vessel strike avoidance measures: vessels operating north of the Virginia/North Carolina border between June 1 and November 30 must have a trained lookout posted to observe for sea turtles; vessels operating south of the Virginia/North Carolina border must have a trained lookout posted year-round to observe for sea turtles; lookout will review https://seaturtlesightings.org before each trip and report sea turtle observations in the vicinity of the planned transit to all vessel operators/captains and lookouts; lookout will monitor a 500-meter vessel strike avoidance zone; vessel operator will slow down to 4 knots if a sea turtle is sighted within 100 meters of the vessel's forward path then proceed away from the sea turtle at that speed until a 100-meter separation distance is established; vessel operator must shift to neutral if a sea turtle is sighted within 50 meters of the vessel's forward path then proceed away from the turtle at 4 knots; vessel operators must avoid transiting through areas of visible jellyfish aggregations of floating sargassum lines or mats; all crew members must be briefed on identification of sea turtles, applicable regulations, and best practices for avoiding vessel collisions with sea turtles; vessel transits to and from the wind farm area that require PSOs will maintain a speed commensurate with weather conditions and effectively detecting sea turtles.	Measures to minimize vessel interactions would reduce the risk of vessel strike. While adoption of this measure would reduce risk to sea turtles, it would not alter the impact determination of minor for vessel traffic.
Monthly/annual reporting requirements	To document the amount or extent of take that occurs during all phases of the Proposed Action, Empire must submit monthly reports during the construction phase and during the first year of operation and must submit annual reports beginning in year 2 of operation. Reports must summarize all Project activities carried out in the previous month/year, including vessel transits, piles installed, and all observations of ESA-listed species.	Reporting requirements would improve accountability for documenting take associated with the Preferred Alternative. While adoption of this measure would improve accountability, it would not alter the overall impact determination of minor.

PSO = protected species observer; rms = root mean square; STDN = Sea Turtle Disentanglement Network

3.19.11.1. Effect of Measures Incorporated into the Preferred Alternative

The mitigation measures listed in Table 3.19-5 are recommended for inclusion in the Preferred Alternative. These mitigation measures include marine debris awareness training; development and implementation of Pile Driving Monitoring, Alternative Monitoring, and Sound Field Verification Plans;

utilization of protected species observers with sufficient coverage to monitor clearance and shutdown zones; minimum sizes for shutdown zones for ESA-listed sea turtles; monitoring for sea turtles over the entire area where sound levels may exceed a root-mean-square SPL of 175 dB re to 1 μ Pa throughout the period of pile driving and 30 minutes following cessation of pile-driving activities; compliance with Project Design Criteria and BMPs for protected species associated with offshore wind data collection; unique marking of Project survey gear; recovery and reporting of lost survey gear; training in protected species identification and safe handling for at least one staff member on board all trawl and trap survey vessels; continuous monitoring of any gillnets deployed to support fisheries monitoring; access to sea turtle disentanglement equipment on board vessels deploying fixed gear; identification and data collection for any sea turtles captured during fisheries surveys; compliance with sea turtle handling and resuscitation guidelines; notification of sea turtle takes resulting from fisheries surveys; monitoring for potential loss of fishing gear by conducting periodic underwater surveys of WTG foundations; sea turtle-specific vessel strike avoidance measures that account for seasonality in the Project area and along vessel transit routes; and submission of reports detailing Project activities and observations of sea turtles. These measures, if adopted, would reduce impacts on sea turtles but would not reduce the overall impact determination of minor for the Preferred Alternative. In addition to the mitigation listed above, NMFS will identify terms and conditions in the Biological Opinion for the Empire Wind Projects (EW 1 and EW 2) in support of BOEM's ESA consultation with NMFS. The draft terms and conditions are included in Appendix H, Table H-1 and the final terms and conditions will be incorporated into the ROD as conditions of COP approval.

This page intentionally left blank.

3.22. Wetlands

This section discusses potential impacts on wetlands from the proposed Projects, alternatives, and ongoing and planned activities in the geographic analysis area. The wetlands geographic analysis area, as shown on Figure 3.22-1, includes all subwatersheds that intersect the Onshore Project area. See Section 3.21 for a discussion of impacts on water quality.

3.22.1 Description of the Affected Environment for Wetlands

The National Wetlands Inventory (NWI) and NYSDEC wetland data were used to determine the potential presence of wetlands. A preliminary reconnaissance of the onshore portion of EW 1 was conducted in December 2018 to verify the presence of mapped wetland identified by the NWI and NYSDEC wetland data and to assess potential presence of unmapped wetlands. The EW 2 Project components were not under consideration at the time of the preliminary reconnaissance; therefore, the analysis of EW 2 was conducted based on NWI and NYSDEC wetland data. In order to confirm the extent and presence of regulated wetlands, Empire will conduct a wetland delineation to identify the wetlands under jurisdiction of USACE and NYSDEC. Authorization from USACE and New York Public Service Commission under Article VII is required prior to dredge or fill of jurisdictional wetlands. CWA Section 404 requires that all appropriate and practicable steps be taken first to avoid and minimize impacts on jurisdictional wetlands; for unavoidable impacts, compensatory mitigation is required to replace the loss of wetlands.

Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3(c)(16)). Under the New York State code of regulations (6 CRR-NY 661.4), tidal wetlands are more broadly defined in that vegetation is not a requirement to be considered wetland. Wetlands are important features in the landscape that provide numerous beneficial services or functions. Some of these include protecting and improving water quality, providing fish and wildlife habitats, storing floodwaters, providing aesthetic value, ensuring biological productivity, filtering pollutant loads, and maintaining surface water flow during dry periods. New York’s coastal wetlands, including the wetlands in the geographic analysis area, protect coastal water quality by acting as a sink for land-derived nutrients and contaminants, constitute an important component of coastal food webs, provide valuable wildlife habitat, and protect upland and shoreline areas from flooding and erosion.

The acreage of NWI wetland communities present within the geographic analysis area is shown in Table 3.22-1.

Table 3.22-1 NWI Wetland Communities in the Geographic Analysis Area

Wetland Community	Acres	Percent of Total
Estuarine and Marine Wetland	6,493	96
Freshwater Emergent Wetland	204	3
Freshwater Forested/Shrub Wetland	72	1
Total	6,769	100.0%

Source: USFWS 2021.

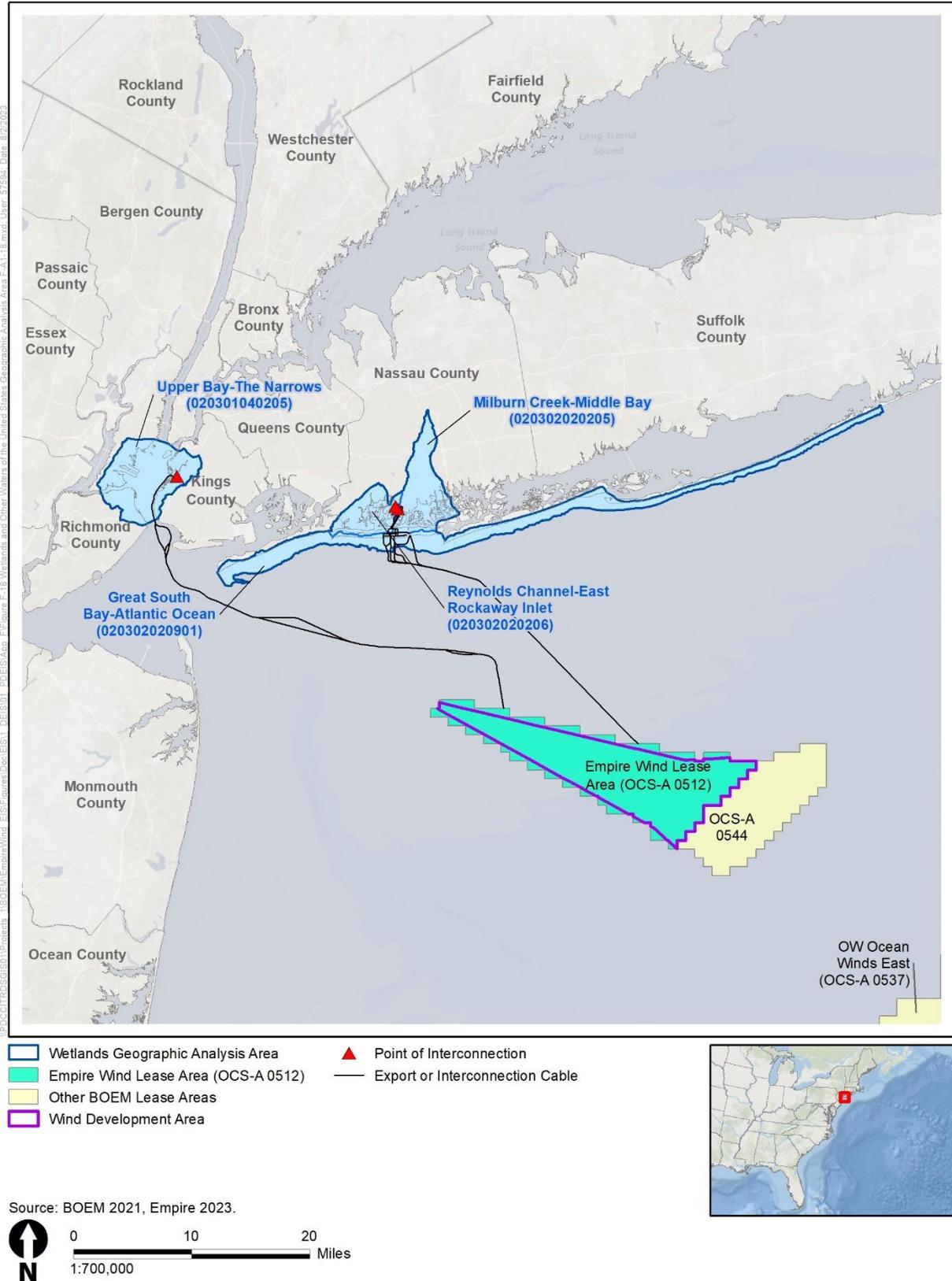


Figure 3.22-1 Wetlands Geographic Analysis Area

EW 1

The EW 1 submarine export cable route would extend across the New York Bight into Lower New York Bay, up the Narrows, and into Upper New York Bay before it makes landfall. The Upper Bay-the Narrows subwatershed (hydrologic unit code [HUC] 020301040205) encompasses the submarine export cable's approach/landfall, the EW 1 Onshore Substation, and the location of the O&M facility. The EW 1 interconnection cable route, onshore substation, and O&M facility site are situated above the bank of the Upper Bay. The Upper Bay, in the vicinity of the onshore portions of the Projects, is classified by the NWI as an excavated subtidal estuarine system with an unconsolidated bottom and by NYSDEC wetland data as a littoral zone; the NWI classification is not considered wetland because it is a deepwater habitat that lacks vegetation. NWI mapping indicates that a small portion of the Upper Bay would overlap the interconnection cable route, the onshore substation, and the O&M facility. NYSDEC mapping indicates that the littoral zone of the Upper Bay would partially overlap the onshore substation. However, based on observations during the preliminary site reconnaissance, the bank is mainly composed of industrial properties with bulkheaded marine terminals and the Upper Bay terminates at the bulkhead. It is anticipated that any regulated adjacent area associated with the Upper Bay would be truncated along the banks at the seaward edge of all manmade structures (e.g., bulkheads, riprap, roads). Based on desktop analysis and observations made during the preliminary site reconnaissance, field delineations were not completed for the export cable landfall location, the EW 1 onshore interconnection cable route, the onshore substation, or the O&M facility due to the developed nature of the area and lack of wetland resources identified (Empire 2023).

EW 2

The EW 2 submarine export cable routes would extend across the New York Bight before they make landfall. The Great South Bay-Atlantic Ocean subwatershed (HUC 020302020901) encompasses the submarine export cables' approaches/landfalls and a portion of the onshore export cable routes on Long Beach Barrier Island. The Reynolds Channel-East Rockaway Inlet (HUC 020302020206) and Milburn Creek-Middle Bay subwatershed (HUC 020302020205) encompass the remaining EW 2 onshore Project elements, including the onshore substation locations and the interconnection location in the Reynolds Channel-East Rockaway Inlet (HUC 020302020206). Four export cable landfall options (Landfalls A, B, C, and E) are currently under review for EW 2. The NWI does not map any wetlands in the Landfall A, B, and C footprints, but does map 1.59 acres of estuarine and marine deepwater in Landfall C footprint. The estuarine and marine deepwater classification is not considered wetland because it is a deepwater habitat and lacks vegetation. NYSDEC wetland data do not map any wetlands in the Landfall A, B, C, or E footprints. There are also small areas of estuarine and marine wetland (less than 0.01 acre) within the LB-A and LB-G cable corridors, but these wetland areas would be outside of the actual cable disturbance area because these cable segments would be placed in already disturbed road rights-of-way.

A total of nine onshore export cable route segments are under review to traverse the island of Long Beach from the export cable landfall options to the Reynolds Channel crossing. These routes would travel along existing roads and the Long Island Rail Road right-of-way in areas dominated by high-intensity development with no mapped wetlands crossed (see COP Volume 2, Figure 5.2-5 and Table 5.2-3; Empire 2023). At the Reynolds Channel crossing options, the NWI maps the channel as estuarine and marine deepwater and estuarine and marine wetland (on the south side of the channel) in the cable crossing corridor and NYSDEC maps the channel as a littoral zone and coastal shoals, bars, and mudflat in the cable crossing corridor. The NWI estuarine and marine deepwater habitats are not considered wetland because they are deepwater habitats that lack vegetation. It should be noted that the NWI does not map any wetlands in the cable crossing corridor at the western Reynolds Channel crossing option; the estuarine and marine wetland is within the eastern cable crossing corridor option.

Based on a review of aerial imagery, the banks of Reynolds Channel are highly modified, with the southern bank consisting of a mix of riprap and natural shoreline that quickly transitions to industrial properties, and the north bank consisting of bulkheading and docks associated with an active marina. After crossing the Reynolds Channel into Island Park, a total of eight cable route segments under review would traverse Island Park to the onshore substation. These cable route segments travel along existing roads in areas dominated by high- and medium-intensity development (see COP Volume 2, Figure 5.1-5; Empire 2023). The NWI identifies estuarine and marine wetland at cable segment IP-C’s crossing corridor of Barnums Channel. The NWI identifies estuarine and marine wetland at cable segment IP-F’s crossing corridor of Barnums Channel where the cable would be placed on a constructed above-water cable bridge. The NWI identifies palustrine emergent/scrub-shrub, palustrine emergent, and estuarine and marine wetland at cable segment IP-G’s crossing corridor of Barnums Channel where the cable would be placed on an above-water cable bridge (similar to IP-F) or attached to the existing Long Beach Road bridge. In addition, cable segment IP-E (only needed if IP-G is constructed) would cross NWI-mapped estuarine and marine deepwater and riverine waters, and NYSDEC-mapped littoral zone waters associated with a channel that runs under Daly Boulevard through a bridge or large culvert that spans the distance of the road corridor (approximately 175 feet). The IP-E cable segment would be placed just off the road and above the bridge/large culvert and, therefore, would avoid these resources.

No wetlands are mapped by the NWI or NYSDEC at the Onshore Substation A site. NWI and NYSDEC data indicate that Reynolds Channel would extend into the EW 2 Onshore Substation C site by a maximum of 40 feet (12 meters); however, a review of aerial imagery indicates that historical alterations to the shoreline, including bulkheading, have resulted in a more artificial and linear bank than portrayed by NWI and NYSDEC mapped boundaries. The result of these shoreline alterations is that the current bank of Reynolds Channel appears to approximately align with the boundary of the EW 2 Onshore Substation C site (Empire 2023).

3.22.2 Impact Level Definitions for Wetlands

As described in Section 3.3, this EIS uses a four-level classification scheme to characterize potential beneficial and adverse impacts of alternatives, including the Proposed Action. The definitions of impact levels are provided in Table 3.22-2. There are no beneficial impacts on wetlands.

Table 3.22-2 Impact Level Definitions for Wetlands

Impact Level	Impact Type	Definition
Negligible	Adverse	Impacts on wetlands would be so small as to be unmeasurable and impacts would not result in a detectable change in wetland quality and function.
Minor	Adverse	Impacts on wetlands would be minimized and would be relatively small and localized. If impacts occur, wetlands would completely recover.
Moderate	Adverse	Impacts on wetlands would be minimized; however, permanent impacts would be unavoidable. Compensatory mitigation required to offset impacts on wetland functions and values and would have a high probability of success.
Major	Adverse	Impacts on wetlands would be minimized; however, permanent impacts would be regionally detectable. Extensive compensatory mitigation required to offset impacts on wetland functions and values would have a marginal or unknown probability of success.

3.22.3 Impacts of the No Action Alternative on Wetlands

When analyzing the impacts of the No Action Alternative on wetlands, BOEM considered the impacts of ongoing activities, including non-offshore wind and ongoing offshore wind activities, on the baseline conditions for wetlands. The cumulative impacts of the No Action Alternative considered the impacts of the No Action Alternative in combination with the other planned non-offshore wind activities as described in Appendix F, *Planned Activities Scenario*.

3.22.3.1. Impacts of the No Action Alternative

Under the No Action Alternative, baseline conditions for wetlands described in Section 3.22.1, *Description of the Affected Environment for Wetlands*, would continue to follow current regional trends and respond to IPFs introduced by other ongoing non-offshore wind and offshore wind activities. Ongoing non-offshore activities within the geographic analysis area that may contribute to impacts on wetlands are associated with onshore construction and development activities. These activities and associated impacts are expected to continue and have the potential to affect wetlands through temporary and permanent loss of wetlands, which can affect the functions wetlands provide (e.g., water quality improvement) in the watershed. All projects would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. If impacts would not be entirely avoided, mitigation would be anticipated for projects to compensate for lost wetlands.

There are no ongoing offshore wind activities within the geographic analysis area for wetlands.

3.22.3.2. Cumulative Impacts of the No Action Alternative

The cumulative impact analysis for the No Action Alternative considers the impacts of the No Action Alternative in combination with the other planned non-offshore wind activities and planned offshore wind activities (without the Proposed Action).

Other planned non-offshore wind activities that may affect wetlands primarily include onshore development activities (see Appendix F, Section F.2.13 for descriptions). These activities could permanently (e.g., permanent fill placement) and temporarily (e.g., temporary fill placement or vegetation clearing) affect wetlands or areas near wetlands. All projects would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. If impacts would not be entirely avoided, mitigation would be anticipated for projects to compensate for lost wetlands. See Table F1-24 for a summary of potential impacts associated with ongoing and planned non-offshore wind activities by IPF for wetlands.

Impacts on wetlands from planned offshore wind projects may occur if onshore activity from these projects overlaps with the geographic analysis area. BOEM is not currently aware of any planned offshore wind projects other than the Proposed Action that would overlap the geographic analysis area for wetlands. However, there is potential for planned offshore wind projects to site landfalls and onshore infrastructure within the same subwatersheds that are intersected by Proposed Action onshore infrastructure. If any planned offshore wind activities occur within the highly urbanized landscape of the geographic analysis area, BOEM expect that impacts would be similar to those under the Proposed Action (Section 3.22.5), including impacts related to land disturbance.

BOEM expects planned offshore wind activities to affect wetlands through the following primary IPF.

Land disturbance: The locations of onshore components for planned offshore wind projects are not known at this time. However, given the proximity to Long Island, export cables from other lease areas (particularly lease areas in the New York Bight) could landfall within the geographic analysis area. Construction of onshore components (e.g., export cables, onshore substation) for planned offshore wind

projects is anticipated to require clearing, excavating, trenching, fill, and grading, which could result in the loss or alteration of wetlands, causing adverse effects on wetland habitat, water quality, and flood and storage capacity functions. Fill material permanently placed in wetlands during construction would result in the permanent loss of wetlands, including any habitat, flood and storage capacity, and water quality functions that the wetlands may provide. If a wetland were partially filled and fragmented or if wetland vegetation were trimmed, cleared, or converted to a different vegetation type (e.g., forest to herbaceous), habitat would be altered and degraded (affecting wildlife use) and water quality and flood/storage capacity functions would be reduced by changing natural hydrologic flows and reducing the wetland's ability to impede and retain stormwater and floodwater. On a watershed level, any permanent wetland loss or alteration could reduce the capacity of regional wetlands to provide wetland functions.

Temporary wetland impacts may occur from construction activity that crosses or is adjacent to wetlands, such as rutting, compaction, and mixing of topsoil and subsoil. Where construction leads to unvegetated or otherwise unstable soils, precipitation events could erode soils, resulting in sedimentation that could affect water quality in nearby wetlands. The extent of wetland impacts would depend on specific construction activities and their proximity to wetlands. These impacts would occur primarily during construction and decommissioning; impacts during O&M would only occur if new ground disturbance was required, such as to repair a buried component.

Given that the geographic analysis area is within urbanized landscapes in the New York metropolitan area and onshore project components associated with planned offshore wind projects would likely be sited in disturbed areas (e.g., along existing roadways), BOEM anticipates wetland impacts to be minor. In addition, BOEM expects planned offshore wind projects would be designed to avoid wetlands to the extent feasible, and would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. This would include compliance with the New York State Pollutant Discharge Elimination System General Permit for Stormwater Discharges from Construction Activities and implementation of sediment controls and a SWPPP to avoid and minimize water quality impacts during onshore construction. Any in-wetland work would require a CWA Section 404 permit from USACE and a Section 401 Water Quality Certification from NYSDEC, as well as authorization from NYSDEC under the Tidal Wetlands Act. If impacts would not be avoided or minimized, mitigation would be anticipated for projects to compensate for lost wetlands.

3.22.3.3. Conclusions

Impacts of the No Action Alternative. Under the No Action Alternative, wetlands would continue to be affected by existing environmental trends and ongoing activities. Land disturbance from onshore construction periodically would cause temporary and permanent loss of wetlands. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts. If impacts would not be entirely avoided or minimized, mitigation would be anticipated for projects to compensate for lost wetlands. Therefore, the No Action Alternative would result in **minor** impacts on wetlands.

Cumulative Impacts of the No Action Alternative. Under the No Action Alternative, existing environmental trends and ongoing activities would continue, and wetlands would continue to be affected by natural and human-caused IPFs. Planned activities could cause impacts that would be similar to the impacts of the Proposed Action. Currently, there are no planned offshore wind activities proposed in the geographic analysis area. If any were to occur, they would have some potential to result in temporary disturbance and permanent loss of wetlands. All activities would be required to comply with federal, state, and local regulations related to the protection of wetlands, thereby avoiding or minimizing impacts. If impacts would not be entirely avoided, mitigation would be anticipated for projects that would allow wetlands to recover to the extent possible. Considering the IPFs and regulatory requirements for avoiding,

minimizing, and mitigating impacts on wetlands, BOEM anticipates the No Action Alternative would result in **minor** cumulative impacts in the geographic analysis area, primarily through land disturbance.

3.22.4 Relevant Design Parameters & Potential Variances in Impacts of the Action Alternatives

This EIS analyzes the maximum-case scenario; any potential variances in the proposed Project build-out as defined in the PDE would result in similar or lesser impacts than those described in the sections below. The following proposed PDE parameters (Appendix E) would influence the magnitude of the impacts on wetlands:

- The onshore export cable routing variants within the Onshore Project area

An onshore export cable route with less wetlands within or adjacent to the right-of-way would have less potential for direct and indirect impacts on wetlands.

3.22.5 Impacts of the Proposed Action on Wetlands

The Proposed Action could affect wetlands through the following primary IPF.

Land disturbance: Based on NWI data, there is little actual wetland within most of the affected area of the onshore Project components due to the developed nature of the Onshore Project area and the siting of onshore components in mostly previously disturbed areas (e.g., existing road rights-of-way). NYSDEC data do not map any wetlands within the footprints of the EW 1 onshore Project components. No NWI wetlands are mapped within the footprints of the EW 1 or EW 2 onshore substations, the O&M facility, or landfalls. While there would be NWI-mapped deepwater habitats crossed by the EW 2 onshore cable routes, there are only a few areas where wetlands are present (Table 3.22-3). Most of the wetland area is related to nearshore and adjacent areas to Reynolds Channel and Barnums Channel. As previously stated, there are small areas of estuarine and marine wetland (less than 0.01 acre) within the LB-A and LB-G cable corridors, but these wetland areas would be outside of the actual cable disturbance area because these segments would be placed in already disturbed road rights-of-way. The areas of NYSDEC-mapped wetlands within the onshore Project footprint and cable corridors are listed in Appendix I, Section I.3, *Wetlands*, Table I-25.

Table 3.22-3 NWI Wetland Communities Potentially Affected by the EW 2 Project

Route Feature	Wetland Community	Acres
LB-A	Estuarine and Marine Wetland	<0.01
LB-G	Estuarine and Marine Wetland	<0.01
Reynolds Channel Crossing	Estuarine and Marine Wetland	0.39
IP-C ¹	Estuarine and Marine Wetland	0.12
IP-F ¹	Estuarine and Marine Wetland	0.30
IP-G ¹	Palustrine emergent/scrub-shrub	7.20
	Estuarine and Marine Wetland	5.21
	Palustrine emergent	0.27
Total		13.64

Source: Empire 2023.

Note: The table presents wetland areas within the cable corridor that could be susceptible to potential impacts and not necessarily the area of wetland that would actually be affected during construction and operations. For example, segment IP-C could cross Barnums Channel via open trench or trenchless (e.g., HDD) methods, which would have very different impacts on wetlands.

¹ Includes Barnums Channel crossing.

Empire is evaluating both open cut and HDD methods to cross Reynolds Channel. If HDD is used, then the wetland would likely be avoided and there would be no direct impact on the wetland from cable installation; the cable would be installed approximately 52 feet below the bed of Reynolds Channel. If open cut is employed at the Reynolds Channel crossing, then up to 0.39 acre of the wetland would be affected. Similarly, for the IP-C Barnums Channel crossing, if HDD is employed then wetland impacts would be avoided, and if trenching is employed then there would be a small area of wetland temporarily affected (up to 0.12 acre). With either method, impacts would be short term and BOEM does not anticipate any long-term or permanent impacts on the wetlands or their functions, and the total temporary impact of 0.51 acre would represent less than 0.01 percent of this wetland type in the geographic analysis area. The IP-F cable segment that crosses Barnums Channel would consist of a 25-foot-wide by 300-foot-long cable bridge over the channel that would use up to four support columns (pile caps) within the channel to support the truss system that would hold the cables above the waters. These supports would include up to six 1.5-foot (0.5-meter) diameter steel pipe piles per pile cap, for a total of 12 steel pipe piles within the channel. The IP-G cable corridor crossing of Barnums Channel has over 12 acres of wetland in the crossing corridor. Any crossing solution (whether open cut, HDD, or cable bridge) would result in a greater potential for impacts on wetlands compared to the IP-C and IP-F crossings. Empire assessed several crossing methods of Barnums Channel along the IP-G cable corridor and determined that HDD was not practicable as a crossing method, and that trenching and a cable bridge would be feasible. Details of Empire's alternatives analysis for the Barnums Channel crossing are presented in Appendix O, *Alternatives Analysis for Corps Permit Application*.

The installation of permanent support columns in Barnums Channel to support a cable bridge would constitute a permanent impact on the channel. If access is required through wetlands during construction at EW 2, Empire would install temporary matting to protect vegetation root systems, reduce compaction, and minimize ruts (APM 64). Temporary workspaces would be restored to pre-construction conditions to the extent possible. Revegetation monitoring at EW 2 would be conducted consistent with a landscaping restoration plan, which will be provided for agency review and approval, as applicable, within wetlands and adjacent areas that were temporarily disturbed during Project construction to ensure that functionality is restored in these areas (APM 71).

In addition to the potential wetland impacts from the channel crossings, Empire has proposed to fill three existing boat slips in Reynolds Channel by the proposed new bulkhead that would be constructed for Onshore Substation C. These boat slips in Reynolds Channel do not include wetlands (i.e., are open-water areas that are not vegetated or mudflats) but would be considered jurisdictional waters under the CWA. Based on Empire's Department of the Army Permit application and USACE's public notice, approximately 395 cubic yards of clean fill would be discharged into the boat slips and behind the new bulkhead over approximately 3,040 square feet (Appendix O; USACE 2022).

Excavation, soil stockpile, and grading may increase the potential for erosion and sedimentation to wetlands down gradient, which could affect wetland water quality. Empire would develop and implement a SWPPP that would use erosion and sedimentation controls and BMPs to avoid and minimize these impacts during onshore construction (APMs 59, 60, 69, and 73). Additionally, during onshore construction, dewatering may be required. If dewatering is needed, Empire would develop a site-specific dewatering plan to protect nearby wetlands in accordance with a Project-specific SWPPP, approved by the applicable agencies, as necessary (APMs 59 and 60). Dewatering activities would be temporary and water drawdown would be minimal. In addition to the aforementioned measures to avoid and minimize wetland impacts, Empire has committed to implementing various other APMs to reduce wetland impacts (APMs 57 through 73). Therefore, potential adverse impacts on wetlands from construction activities would be short term and localized.

All earth disturbances from construction activities would be conducted in compliance with the New York State Pollutant Discharge Elimination System General Permit for Stormwater Discharges from

Construction Activities and implementation of sediment controls and a SWPPP to avoid and minimize water quality impacts during onshore construction. If ground-based delineations identify wetlands within the footprint of an onshore facility, permanent wetland impacts would require a CWA Section 404 permit from USACE and a Section 401 Water Quality Certification from that would be authorized by New York Public Service Commission through the Article VII process. If permanent impacts would not be avoided or minimized, mitigation would be anticipated to compensate for lost wetlands. Empire would comply with all requirements of any issued permits.

BOEM would not expect normal O&M activities to involve further wetland alteration. The onshore cable route and associated facilities generally have no maintenance needs unless a fault or failure occurs; therefore, O&M is not expected to affect wetlands. In the event of a fault or failure, impacts would be expected to be short term and negligible. Decommissioning of the onshore Project components would have similar impacts as construction.

3.22.5.1. Impact of the Connected Action

As described in Section 3.22.3.1, the NWI and field reconnaissance did not identify any emergent, vegetated wetlands around the EW 1 Onshore Project area, including the SBMT where the connected action activities would occur. However, NYSDEC littoral zone wetlands and an area of SAV do exist in the vicinity of the connected action. The connected action would affect wetlands through the following IPFs: discharges and presence of structures.

Discharges: Localized increases in total suspended sediment resulting in localized turbidity would be expected during dredging and during installation of the bulkheads and piles. While there are no emergent, vegetated wetlands within the Project site, there is an area of SAV approximately 700 feet downstream of the site near the shoreline between the 40th Street and 42nd Street piers, and NYSDEC littoral zone tidal wetlands are present on site. BMPs used during construction would minimize total suspended sediment increases in the water column. These measures include use of turbidity curtains during dredging in the basins, use of an environmental bucket, and slow withdrawal of the bucket through the water column. Pile driving would result in minimal and localized increases in turbidity (i.e., 5 to 10 mg/L above ambient within 300 feet of the activity) that would not be expected to reach the area of SAV to the south. Because the SAV is in a relatively protected location between two piers and the Project would use BMPs during construction to minimize sediment resuspension, the Project would not be expected to result in significant impacts on wetlands or SAV. Turbidity associated with the Project activities would be minimal and temporary in nature and would result in localized, short-term, and minor impacts on NYSDEC littoral zone tidal wetlands, as resuspended sediments would dissipate relatively quickly with the tidal currents.

Presence of structures: NYSDEC littoral zone tidal wetlands are primarily located along the riprap slopes on the northern and southern faces of the 35th Street Pier and at the end of the interpier basin between the 35th and 39th Street Piers. These areas are currently covered by a layer of bedding stone and riprap armor stone, which would remain in place with the connected action. Installation of piles associated with the proposed wharves would result in the loss of less than 0.02 acre of these littoral zone tidal wetlands, and the installation of deck surfaces atop these piles would result in shading of 0.22 acre over the same tidal wetlands. Impacts on NYSDEC littoral zone tidal wetlands would be minor.

3.22.5.2. Cumulative Impacts of the Proposed Action

The cumulative impacts of the Proposed Action considered the impacts of the Proposed Action in combination with other ongoing and planned non-offshore wind activities, other planned offshore wind activities, and the connected action at SBMT. Ongoing and planned non-offshore wind activities related to onshore development activities would contribute to impacts on wetlands through the primary IPF of land disturbance. The connected action could affect wetlands through discharges and presence of

structures (shading). The construction, O&M, and decommissioning of onshore infrastructure for offshore wind activities in the geographic analysis area would also contribute to the primary IPF of land disturbance. Temporary disturbance and permanent loss of wetland may occur as a result of offshore wind development. BOEM is not aware of any planned offshore wind activities other than the Proposed Action that would overlap the geographic analysis area for wetlands. If wetland alteration or loss is anticipated, it would likely be minimal, the overall scale of impacts is expected to be small, and any activities that would result in these impacts would be required to comply with federal, state, and local regulations related to the protection of wetlands by avoiding or minimizing impacts.

The cumulative impact on wetlands would likely be minor, mostly driven by land disturbance. In context of reasonably foreseeable environmental trends, the impacts on wetlands under the Proposed Action may add to the impacts of ongoing and planned land disturbance. Impacts due to onshore land use changes are expected to include a gradually increasing amount of wetland alteration and loss, although a significant portion of the geographic analysis area is highly urbanized and developed with few wetlands. The future extent of land disturbance from ongoing activities and planned non-offshore wind activities over the next 35 years is not known with as much certainty as the extent of land disturbance that would be caused by the Proposed Action, but based on regional trends is anticipated to be similar to or greater than that of the Proposed Action.

If a planned project were to overlap the geographic analysis area or even be co-located (partly or completely) within the same right-of-way corridor that the Proposed Action would use, then the impacts of those planned projects on wetlands would be of the same type as those of the Proposed Action alone; the degree of impacts may increase, although the location and timing of planned activities would influence this. For example, repeated construction in a single right-of-way corridor would be expected to have less impact on wetlands than construction in an equivalent area of undisturbed wetland. All earth disturbances from construction activities would be conducted in compliance with the New York State Pollutant Discharge Elimination System General Permit for Stormwater Discharges from Construction Activities and implementation of sediment controls and a SWPPP to avoid and minimize water quality impacts during onshore construction. Any work in wetlands would require a CWA Section 404 permit from USACE and a Section 401 Water Quality Certification that would be authorized by New York Public Service Commission through the Article VII process; any wetlands permanently lost would require compensatory mitigation. Therefore, in context of reasonably foreseeable environmental trends, combined land disturbance impacts on wetlands from ongoing and planned activities, including the Proposed Action, would likely be minimal.

3.22.5.3. Conclusions

Impacts of the Proposed Action. The activities associated with the proposed Projects may affect wetlands through short-term disturbance from activities within or adjacent to these resources. Considering the avoidance, minimization, and mitigation measures required under federal and state statutes (e.g., CWA Section 404), construction of the Proposed Action would likely have **negligible to minor** impacts on wetlands. The connected action activities would have no effect (i.e., **negligible**) on emergent, vegetated wetlands due to the lack of that type of wetlands in the area where activities are proposed and minor effects on NYSDEC littoral zone wetlands and SAV.

Cumulative Impacts of the Proposed Action. BOEM anticipates that the cumulative impacts on wetlands in the geographic analysis area would be **minor**. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by the Proposed Action to the cumulative impacts on wetlands would be undetectable. The Proposed Action would contribute to the overall impact rating primarily through short-term impacts on wetlands from onshore construction activities in and adjacent to these resources. Measurable impacts would be small and the resource would likely recover

completely when the affecting agent (e.g., temporary construction activity) is gone and remedial or mitigating action is taken.

3.22.6 Impacts of Alternatives B, E, and F on Wetlands

Impacts of Alternatives B, E, and F. Alternatives B and E would alter the turbine array layout compared to the Proposed Action; however, each of these alternatives would allow for installation of up to 147 WTGs as defined in Empire's PDE. Under Alternative F, a maximum of 138 WTGs could be constructed compared to up to 147 WTGs under the Proposed Action (reduction of 9 WTGs). The impacts on wetlands of Alternatives B, E, and F would be the same as those of the Proposed Action because these alternatives would differ only with respect to offshore components, and offshore components of the proposed Projects have no potential impacts on wetlands. The impacts resulting from the land disturbance IPF associated with onshore construction under Alternatives B, E, and F on wetlands are expected to be minimal and would be the same as those of the Proposed Action.

Cumulative Impacts of Alternatives B, E, and F. The cumulative impacts on wetlands would be minor for the same reasons described for the Proposed Action. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B, E, and F to the cumulative impacts on wetlands would be the same as those described for the Proposed Action for the reason described above.

3.22.6.1. Conclusions

Impacts of Alternatives B, E, and F. As discussed above, the expected **negligible to minor** impacts associated with the Proposed Action would not change under Alternatives B, E, and F because the alternatives would only differ in offshore components, and offshore components would not contribute to impacts on wetlands; the same construction, O&M, and decommissioning activities would still occur.

Cumulative Impacts of Alternatives B, E, and F. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternatives B, E, and F to the cumulative impacts on wetlands would be undetectable. Because the impacts of the Proposed Action would not change under Alternatives B, E, or F, BOEM anticipates that cumulative impacts of Alternatives B, E, and F would be the same as described for the Proposed Action. Therefore, cumulative impacts of Alternatives B, E, and F would be **minor**.

3.22.7 Impacts of Alternative C on Wetlands

Impacts of Alternative C. Wetland impacts under Alternative C would be the same as those of the Proposed Action because submarine export cable route options that would traverse Gravesend Anchorage (Alternative C-1) or the Ambrose Navigation Channel (Alternative C-2) have no potential impacts on wetlands. The impacts resulting from the land disturbance IPF associated with onshore construction under Alternative C on wetlands would be the same as those of the Proposed Action.

Cumulative Impacts of Alternative C. The cumulative impacts on wetlands would be minor for the same reasons described for the Proposed Action. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative C to the cumulative impacts on wetlands would be the same as those described for the Proposed Action.

3.22.7.1. Conclusions

Impacts of Alternative C. As discussed above, the expected **negligible to minor** impacts associated with the Proposed Action would not change under Alternative C because the alternative would only differ in

offshore components, and offshore components would not contribute to impacts on wetlands; the same construction, O&M, and decommissioning activities would still occur.

Cumulative Impacts on Alternative C. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative C to the cumulative impacts on wetlands would be undetectable. Because the impacts of the Proposed Action would not change under Alternative C, BOEM anticipates that cumulative impacts of Alternative C would be the same as described for the Proposed Action. Therefore, cumulative impacts of Alternative C would be **minor**.

3.22.8 Impacts of Alternative D on Wetlands

Impacts of Alternative D. The impacts resulting from the land disturbance IPF associated with construction and installation, O&M, and decommissioning of the Projects under Alternative D would be the same those described under the Proposed Action. Landfall and onshore export cable route options to avoid within 500 meters of the sand borrow area (Alternative D) are already covered under the Proposed Action as part of the PDE approach, and narrowing the landfall and onshore export cable route options under Alternative D would not materially change the analyses of the land disturbance IPF. All other onshore Project components would be the same as under the Proposed Action and selection of a submarine export cable route option to avoid the sand borrow area (Alternative D) would not affect wetlands.

Cumulative Impacts of Alternative D. The cumulative impacts on wetlands would be minor for the same reasons described for the Proposed Action. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative D to the cumulative impacts on wetlands would be the same as those described for the Proposed Action.

3.22.8.1. Conclusions

Impacts of Alternative D. As discussed above, the expected **negligible to minor** impacts associated with the Proposed Action would not change under Alternative D.

Cumulative Impacts of Alternative D. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative D to the cumulative impacts on wetlands would be undetectable. Because the impacts of the Proposed Action would not change under Alternative D, BOEM anticipates that cumulative impacts of Alternative D would be the same as described for the Proposed Action. Therefore, cumulative impacts of Alternative D would be **minor**.

3.22.9 Impacts of Alternative G on Wetlands

Impacts of Alternative G. Under Alternative G, the Barnums Channel cable crossing would be limited to cable segment IP-F, which would consist of an elevated cable bridge across Barnums Channel adjacent to the Long Island Rail Road railway bridge in order to avoid tidal wetlands. Analysis completed for Empire's USACE permit application determined that crossing Barnums Channel with a cable bridge adjacent to the Long Island Rail Road railway bridge would reduce impacts within the tidal channel itself compared to other EW 2 route options for the Barnums Channel crossing or alternate construction methods (details of Empire's alternatives analysis for the Barnums Channel crossing are presented in Appendix O, *Alternatives Analysis for Corps Permit Application*). The IP-F cable bridge crossing would require installation of support footings within the channel; however, this would occur along a corridor already containing both the railroad bridge and another utility bridge on the eastern side of the railroad crossing. Because the northern and southern sides of the crossing comprise an existing parking lot and a tank farm, respectively, impacts on wetlands and natural habitats on either side of the crossing would be avoided. Compared to the Proposed Action's IP-C crossing option, segment IP-F would have less wetland impact because IP-C could be constructed using the open trench method across Barnums Channel under

the PDE, which could directly affect the estuarine and marine wetland at the crossing. Compared to the Proposed Action's IP-G crossing of Barnums Channel, segment IP-F is anticipated to have less impact on wetlands. Although IP-G could also cross Barnums Channel with an elevated cable, either via attachment to the existing Long Beach Road bridge or a newly constructed elevated cable bridge (similar to segment IP-F), there are greater areas of wetland along the IP-G cable corridor around Barnums Channel compared to the IP-F cable corridor (see Table 3.22-3). Therefore, the IP-G cable crossing presents a greater potential for wetlands to be affected during construction and operations.

Cumulative Impacts of Alternative G. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative G to the cumulative impacts on wetlands would be less than the Proposed Action because, under the PDE approach of the Proposed Action, other crossing options for Barnums Channel could result in greater potential impacts on tidal wetlands. The impacts under Alternative G would still be undetectable, like those of the Proposed Action. Even though there would be less potential impact on tidal wetlands, BOEM does not anticipate the overall impact on wetlands for Alternative G to differ substantially from those of the Proposed Action. Therefore, BOEM anticipates that cumulative impacts of Alternative G would be the same as described for the Proposed Action: minor.

3.22.9.1. Conclusions

Impacts of Alternative G. Wetland impacts under Alternative G would be reduced compared to those of the Proposed Action, which includes other crossing options of Barnums Channel that could result in greater wetland impacts. The expected **negligible** to **minor** impacts associated with the Proposed Action would not change under Alternative G because while impacts on wetlands would be minimized, wetland impacts would still occur at the Barnums Channel crossing. BOEM expects that wetland impacts would be small and localized and would not result in a detectable change in wetland quality or function.

Cumulative Impacts of Alternative G. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative G to the cumulative impacts on wetlands would be the same as those of the Proposed Action. Offshore wind projects would contribute to wetland impacts in the geographic analysis area but the overall scale of impacts is expected to be small, and compliance with mitigation measures and regulations would minimize these impacts. Because the impacts of the Proposed Action would not substantially change under Alternative G, BOEM anticipates the cumulative impacts of Alternative G would be the same as the Proposed Action. Therefore, the cumulative impacts of Alternative G would be **minor**.

3.22.10 Impacts of Alternative H on Wetlands

Impacts of Alternative H. The impacts resulting from the land disturbance IPF associated with construction and installation, O&M, and decommissioning of the Projects under Alternative H would be the same those described under the Proposed Action. An alternate method of dredge and fill activity at the SBMT would not change the analysis of the IPF. All other offshore and onshore Project components of Alternative H would be the same as under the Proposed Action.

Cumulative Impacts of Alternative H. The cumulative impacts on wetlands would be minor for the same reasons described for the Proposed Action. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative H to the cumulative impacts on wetlands would be the same as those described for the Proposed Action.

3.22.10.1. Conclusions

Impacts of Alternative H. As discussed above, the expected **negligible** to **minor** impacts associated with the Proposed Action would not change under Alternative H.

Cumulative Impacts of Alternative H. In context of reasonably foreseeable environmental trends, the incremental impacts contributed by Alternative H to the cumulative impacts on wetlands would be undetectable. Because the impacts of the Proposed Action would not change under Alternative H, BOEM anticipates that cumulative impacts of Alternative H would be the same as described for the Proposed Action. Therefore, cumulative impacts of Alternative H would be **minor**.

3.22.11 Comparison of Alternatives

The **negligible to minor** impacts on wetlands under the Proposed Action would be the same under Alternatives B, E, and F because these alternatives would differ only with respect to offshore components, and offshore components of the proposed Projects have no potential impacts on wetlands and are outside of the wetlands geographic analysis area.

Alternative C or D would not change the analysis compared to the Proposed Action because the cable route options that would be constructed under these alternatives are already covered under the Proposed Action as part of the PDE approach and the specific cable route options that would be constructed under Alternative C or D have no potential impacts on wetlands. Therefore, the impact level on wetlands would not change: **negligible to minor**.

Alternative G would not change the analysis compared to the Proposed Action because while impacts on wetlands would be minimized, permanent wetland impacts are still not anticipated and short-term wetland impacts are still likely to occur at inland crossings. BOEM expects that wetland impacts would be small and localized and would not result in a detectable change in wetland quality or function. Therefore, the impact level on wetlands would not change: **negligible to minor**.

Under Alternative H, an alternative method of dredge and fill activity would occur around the SBMT, which would not materially change the analysis of any IPF compared to the Proposed Action, and any potential indirect effects on wetlands in the vicinity would be temporary. Therefore, the overall impact level on wetlands would not change: **negligible to minor**.

While impacts on wetlands would be reduced under the Preferred Alternative, overall impacts due to construction, O&M, and decommissioning of the Preferred Alternative are expected to be the same as those of Alternative A: **negligible to minor**.

3.22.12 Summary of Impacts of the Preferred Alternative

The Preferred Alternative is a combination of Alternatives C-1, D, F, G, and H. Therefore, the EW 1 submarine export cable route would traverse the Gravesend Anchorage Area (USCG Anchorage #25) (Alternative C-1); EW 2 cable route options would avoid impacts within 500 meters of the sand borrow area offshore Long Island (Alternative D); the wind turbine layout would be optimized to maximize annual energy production and minimize wake loss while addressing the presence of glauconite deposits across the Lease Area (Alternative F); the EW 2 export cable route would use an above-water cable bridge to construct the onshore export cable crossing at Barnums Channel (Alternative G); and the construction of the EW 1 export cable landfall would use a method of dredge or fill activities (clamshell dredging with environmental bucket) that would reduce the discharge of dredged material compared to other dredging options considered in the Empire Wind PDE (Alternative H). Modifications to the wind turbine layout in the Preferred Alternative would be the same as those in the Proposed Action because these alternatives would differ only with respect to offshore components, and offshore components of the proposed Projects have no potential impacts on wetlands. Alterations to the submarine export cable routes and impacts resulting from the land disturbance IPF associated with construction and installation, O&M, and decommissioning of the Projects under the Preferred Alternative would be the same as those of the Proposed Action. Under the Preferred Alternative, the Barnums Channel cable crossing would reduce

impacts within the tidal channel itself compared to other EW 2 route options and is anticipated to have less impacts on wetlands than Alternative A. By changing the method of dredging in the Preferred Alternative, impacts resulting from the land disturbance IPF associated with construction and installation, O&M, and decommissioning of the Projects would be the same those described under the Proposed Action.

While impacts on wetlands would be reduced under the Preferred Alternative, overall impacts due to construction, O&M, and decommissioning of the Preferred Alternative are expected to be the same as those of the Proposed Action: **negligible** to **minor**.

3.22.13 Proposed Mitigation Measures

One mitigation measure is proposed to minimize impacts of the connected action on wetlands (Appendix H, Table H-1). If the measure analyzed below is required by NYSDEC, some adverse impacts would be further reduced.

Table 3.22-4 Proposed Measures: Wetlands

Measure	Description	Effect
Wetland Mitigation	NYSDEC will mitigate for impacts to mapped tidal littoral zone wetlands from fill and shading associated with the Connected Action, as required in consultation with NYS agencies.	This mitigation would ensure no net loss of tidal littoral zone wetland function.

NYS = New York State

3.22.13.1. Effect of Measures Incorporated into the Preferred Alternative

Mitigation measures recommended for incorporation into the Preferred Alternative are listed in Table 3.22-4 and Table H-1 in Appendix H, *Mitigation and Monitoring*. Mitigation measures would reduce impacts on NYSDEC littoral zone wetlands and an area of SAV in the vicinity of the connected action from discharges occurring during construction and from shading of vegetation from structures constructed for the Projects. This mitigation would ensure no net loss of tidal littoral zone wetland function. While mitigation efforts would reduce overall impacts on wetlands, it would not reduce the impact level of the Preferred Alternative from what is described in Section 3.22.12.

This page intentionally left blank.