APPENDIX C

Incomplete or Unavailable Information

Contents

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Introduction

In accordance with Section 1502.21[1] of the Council on Environmental Quality regulations implementing the National Environmental Policy Act (NEPA), when an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement (EIS) and there is incomplete or unavailable information, the agency shall make clear that such information is lacking.

Given the substantial geographic and temporal scale of the cumulative impacts analysis for the Revolution Wind Farm (RWF) and Revolution Wind Export Cable Project (Project), some information regarding ongoing activities is unavailable or only available in qualitative or summary form—in particular, for many offshore resources. Concerning reasonably foreseeable construction and operations plans (COPs), specific information is available only for COPs that have been submitted for Bureau of Ocean Energy Management (BOEM) review and are publicly available (see Appendix E of the EIS). Given that information is lacking for other offshore wind activities considered reasonably foreseeable, and several of the COPs submitted are currently under review to determine whether they contain complete and sufficient information for environmental review, a series of assumptions were necessary to conduct the cumulative impacts analysis as outlined in Appendix E3, Table E3-1. Although these assumptions were necessary to allow the analysis to proceed with a reasonable degree of certainty, it is not known whether or to what extent future offshore wind activities will proceed according to these assumptions.

In addition to the uncertainty regarding future activities contemplated in the cumulative analysis, there is also incomplete or unavailable information regarding the likely consequences of various activities on the resources analyzed. When incomplete or unavailable information was identified, BOEM considered whether the information was relevant to the assessment of impacts and essential to a reasoned choice among alternatives. 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 unreasonable. If information could not be obtained within the time frame needed for this analysis or because of exorbitant costs, BOEM applied acceptable scientific methodologies to inform the analysis in light of this incomplete or unavailable information. For example, conclusive information on many impacts of the offshore wind industry may not be available for years and would therefore not be available within the contemplated time frame of this NEPA process. In its place, subject matter experts have used the scientifically credible information available and accepted scientific methodologies for proxy indicators or data to evaluate impacts on the resources while this information is unavailable.

Incomplete or Unavailable Information Analysis for Resource Areas

Air Quality

Any action alternative for the Project would lead to air quality impacts that range from **negligible** to **moderate** and **minor** beneficial. Although a quantitative emissions inventory analysis of the region over the next 35 years has not been completed, the EIS does disclose annual emissions that could have been

[1] 40 Code of Federal Regulations 1502.22 in Council on Environmental Quality regulations implementing NEPA prior to September 14, 2020.

avoided by using non–fossil fuel energy sources within the air quality geographic analysis area, as well as the health impacts from those avoided emissions. In addition, the differences among action alternatives with respect to direct emissions due to construction and installation, operations and maintenance (O&M), and decommissioning of the Project would likely be small. For this reason, the analysis provided in the EIS is sufficient to support sound scientific judgements and informed decision making related to the use of onshore and offshore portions of the air quality geographic analysis area. In summary, BOEM did not identify incomplete or unavailable information on air quality that is essential to a reasoned choice among alternatives.

Bats

Habitat use and distribution vary between season and species, and as a result, there will always be some level of incomplete information on the distribution and habitat use of migratory bats in the offshore portions of the bat geographic analysis area. In addition, because U.S. offshore wind is in its infancy, with three offshore wind projects (Block Island Wind Farm, Virginia Commercial Offshore Wind, and Vineyard Wind Farm) having been or currently being 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 geographic analysis area. However, empirical data, including regional bat acoustic studies conducted from coastal, island, vessel, or offshore structure locations and regional telemetry data from recent studies focusing on listed species, were used to assess the likelihood of offshore occurrence, seasonal patterns, and bat species composition.

Information on collision risk to migratory bats is also available from observations collected at land-based U.S. wind facilities, and based on a number of assumptions regarding the applicability to offshore environments, this information was used to analyze and evaluate the potential for collisions associated with the wind turbine generators (WTGs) analyzed in the EIS. In addition, and as described in Section 3.5.1 of the EIS, the likelihood of an individual migratory bat encountering the rotor swept zone of one or more operating WTGs is negligible. For this reason, the analysis provided in the EIS is sufficient to support sound scientific judgments and informed decision making related to the distribution and use of the offshore portions of the geographic analysis area, as well as to the potential for collision risk of migratory bats. Further, the similarity between the layouts analyzed for the different alternatives does not render any of this incomplete and unavailable information essential to a reasoned choice among alternatives. Therefore, BOEM did not identify incomplete or unavailable scientifically based information on bat resources that is essential to a reasoned choice among alternatives.

Benthic Habitat and Invertebrates

Although there is some uncertainty regarding the temporal distribution of benthic resources and periods during which they might be especially vulnerable to disturbance, site-specific benthic habitat mapping by Inspire Environmental (2021) and other broadscale studies (e.g., Fugro 2019, 2021; Guida et al. 2017; Stantec 2020) provided a suitable basis for predicting the species, community composition, and distributions of benthic resources in the geographic analysis area. Some uncertainty also exists about the effects of some impact-producing factors (IPFs) on benthic resources. For example, the available information on invertebrate sensitivity to electromagnetic fields (EMFs) is equivocal (Hutchinson et al. 2020), and sensitivity to sound pressure and particle motion effects is not well understood for all species (e.g., squid sensitivity to vibration effects transmitted through sediments). However, information from monitoring studies of European wind facilities and, more recently, the Block Island Wind Farm in the United States provides no indication of biologically significant adverse effects. There is broader uncertainty about the long-term effects of changes in biological productivity resulting from the creation of new habitat types on the mid-Atlantic Outer Continental Shelf (OCS) in the form of a distributed network of artificial reefs. The widespread development of offshore renewable energy facilities would, however, create a distributed network of artificial reefs on the mid-Atlantic OCS. These reefs form biological hotspots that could support species range shifts and expansions, nonnative species, and changes in biological community structure (Degraer et al. 2020; Methratta and Dardick 2019; Raoux et al. 2017). The nature and significance of secondary synergistic effects, such as changes in diet and predator-prey interactions resulting from habitat modification in combination with other IPFs, are not fully known. Lastly, the nature, extent, and significance of potential spillover effects on broader ecosystem functions, such as larval dispersal, are not fully understood (van Berkel et al. 2020).

As stated, ongoing monitoring studies at European wind facilities and the Block Island Wind Farm in the United States provide a useful basis for evaluating the combined effects of these IPFs on the biological community as a whole, even if effects on individual species cannot be predicted with specificity. On balance, the current scientific information is sufficient to support sound scientific judgements and informed decision making because relevant studies monitoring changes at wind farms have not observed significant changes to finfish over years of study. Further, the similarity between the layouts analyzed for the different alternatives does not render any of this incomplete and unavailable information essential to a reasoned choice among alternatives. Therefore, BOEM did not identify incomplete or unavailable information that is essential to a reasoned choice among alternatives. There is uncertainty regarding the spatial and temporal occurrence of invertebrates throughout the entire benthic habitat and invertebrates geographic analysis area. However, broadscale information is available from sources such as federal fisheries management plans (FMPs) and surveys completed to support COP submission. There is also uncertainty regarding behavioral effects from each IPF individually and cumulatively. Again, BOEM is able to draw on existing scientific findings, as presented in Section 3.6 of the EIS and references therein. The available information is suitable for characterizing the likely effects of each IPF and has been used to analyze potential impacts resulting from the proposed Project and past, present, and reasonably foreseeable actions. Therefore, BOEM concludes that the available information about potential impacts on benthic habitats supports a reasoned choice among alternatives.

Birds

Habitat use and distribution of birds vary 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 birds in the offshore portions of the birds geographic analysis area. However, survey findings for the Project (see COP Appendix K [*Onshore Natural Resources and Biological Assessment*] [VHB 2023]) were used to inform the predictive models and analyze the potential adverse impacts on bird resources in the EIS. In addition, because U.S. offshore wind is in its infancy, as described above for bats, 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.

Bird mortality data are available for onshore wind facilities, and based on a number of assumptions (described in Section 3.7 of the EIS) regarding their applicability to offshore environments, these data 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 offshore bird mortality rate because of differences in species groups present, the life history and behavior of species, and the differences in the offshore marine environment compared to onshore habitats. Similarly, the U.S. Fish and Wildlife Service biological assessment (BA) (BOEM 2022, 2023a) also provides an estimate of potential mortality using the Band (2012) collision risk model for Endangered Species Act species. Modeling is commonly used to predict the potential mortality rates for marine bird species in Europe and the United States (BOEM 2015, 2022). Because of inherent data limitations, these models often represent only a subset of species potentially present. However, the datasets used by both Revolution Wind, LLC (Revolution Wind), and BOEM to assess the potential for exposure of birds to offshore wind activities represent the best available data and provide context at both local and regional scales. Further, 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 Project (e.g., Petersen et al. 2006; Skov et al. 2018). For this reason, the analysis provided in the EIS is sufficient to support sound scientific judgements and informed decision making related to distribution and use of the offshore portions of the analysis area, as well as to the potential for collision risk and avoidance behaviors in bird resources. Further, the similarity between the layouts analyzed for the different alternatives does not render any of this incomplete and unavailable information essential to a reasoned choice among alternatives. Therefore, BOEM did not identify incomplete or unavailable information on bird resources that is essential to a reasoned choice among alternatives.

Coastal Habitats and Fauna

Although the preferred areas of coastal habitats and associated fauna are generally known, exact abundances and distributions of various fauna are likely to remain unknown for the foreseeable future. However, the species inventories and other information from nearby areas provide an adequate basis for evaluating the fauna likely to inhabit the coastal habitat and fauna geographic analysis area. Additionally, the onshore activities proposed involve only common, industry-standard activities for which impacts are generally understood. For this reason, BOEM identified no incomplete or unavailable information required to conduct the impact assessment or to make a reasoned choice among alternatives.

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 fisheries information used in this assessment has limitations. For example, vessel trip report data are only an approximation because they are self-reported, and available historical data lack consistency, making comparisons challenging. However, these data do represent the best available data, and sufficient information exists to support the findings presented herein.

A second limitation is that aggregated geographic information system (GIS)–based data is necessary to fully update the revenue intensity figures. EIS Figures G-CF1 through G-CF13 in Appendix G provide low-resolution images of revenue intensity by FMP and provide graphic representations of the distribution of fishing efforts near the Lease Area for the years shown. However, similar revenue intensity figures are not available for ports or gear. Although the analysis in EIS Section 3.9 refers to these figures, annual vessel trip report data for 2008 to 2019 from the Greater Atlantic Regional Fisheries Office (GARFO) (2021) were the primary sources of data used in the tables throughout the assessment. These tables in EIS Section 3.9 summarize harvests and revenues by FMP, by ports, and by gears within the RWF and Revolution Wind Export Cable. Although additional revenue intensity figures would augment information provided in the analysis, BOEM determined this information is not essential to a reasoned choice among alternatives.

Cultural Resources

BOEM is applying NEPA Substitution for the steps in the National Historic Preservation Act Section 106 process under 36 Code of Federal Regulations 800.8, facilitating BOEM's good faith effort to identify historic properties and assess effects prior to construction. The record of decision (ROD) will apply to the alternative(s) selected by BOEM. BOEM will execute a memorandum of agreement before issuing the ROD and would require that the memorandum of agreement specify that measures for avoiding, minimizing, and mitigation adverse effects to historic properties be implemented for the selected alternative following ROD issuance. Therefore, BOEM has not identified incomplete or unavailable information on cultural resources that is essential to a reasoned choice among alternatives.

Demographics, Employment, and Economics

Estimates of local employment and income resulting from development and construction of the Project may be underestimated because the broadly used model to project the employment impacts of offshore wind energy development—the Jobs and Economic Development Impact Offshore Wind Model (JEDI-OWM) developed by the National Renewable Energy Laboratory (NREL)—has not been updated to include recent developments within the U.S. offshore wind component manufacturing and fabrication industry, despite NREL's recent updates to capital cost estimation portions of the JEDI-OWM.[2]

The COP and COP appendices do provide estimates of a capital and operating cost of a single configuration of RWF (with 89 8-megawatt [MW] WTGs and a nameplate capacity of 712 MW) along with an estimate of economic impacts to the United States and local economies of Rhode Island and Connecticut based on the 2017 version of the JEDI-OWM. It is presumed that Revolution Wind provided specific guidance to their economic analysts with respect to technical and cost parameters, as well as United States and local spending coefficients for this assessment. However, most of the specific technical details of the assessment were not provided to BOEM or to the authors of the EIS. Therefore, estimates of economic impacts of the development and construction of RWF under the range of EIS alternatives rely heavily on the economic impacts developed in the COP relative to estimates of capital and operating costs of the single configuration provided.

Because Revolution Wind provided the baseline estimates of economic impacts of the Project, and because other information from NREL's updated JEDI-OWM model[2] provides current estimates of

[2] An updated version of JEDI-OWM was made available in 2021. The portions of the JEDI-OWM used to estimate capital operational costs have been updated and include cost estimates of large WTGs (12 MW and 15 MW) that are likely to be employed in future offshore windfarms. However, the 2021 version of the model does not provide local purchase coefficients that are needed to estimate economic impacts. In addition, NREL has not yet published a user manual or a methodological report for the 2021 version. The economic impact estimates used in the demographic, employment, and economics section of the EIS are augmented by improved capital cost estimates in the new release, but continue to employ U.S. and local spending patterns included in the 2017 version of the JEDI-OWM.

capital costs of offshore wind farms with WTGs ranging up to 15 MW, BOEM determined that the lack of directly provided information with respect to other configurations is not essential to a reasoned choice among alternatives.

There is also uncertainty regarding the distribution of economic impacts among geographic areas, income brackets, and other sub-components of the economy. These effects will depend on how the Project supply chain evolves, the contracts that are ultimately entered into, and provisions with the Project's power purchase agreements and state laws. Much of this uncertainty is inherent at this stage of the Project. In addition, BOEM has used appropriate methods to estimate economic impacts given the available information. Therefore, additional information regarding the distribution of impacts among sub-components of the economy is not essential to a reasoned choice among alternatives.

Environmental Justice

Evaluations of impacts on environmental justice communities 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 affect the completeness of the analysis of impacts on environmental justice communities. However, BOEM has determined that the incomplete and unavailable resource information summarized in this appendix was either not relevant to a reasoned choice among alternatives or the alternative data or methods used to predict potential impacts provided the best available information. Therefore, the analysis provided in the EIS is sufficient to support sound scientific judgments and informed decision making related to the proposed uses of the onshore and offshore portions of the environmental justice analysis area.

Finfish and Essential Fish Habitat

Monitoring studies of European and American offshore wind energy facilities to date (Hutchison et al. 2020; Raoux et al. 2017; Reubens et al. 2013, 2014) provide no indication of biologically significant adverse effects on finfish and their habitats. However, broader uncertainty remains about the long-term effects of changes in biological productivity resulting from the creation of new habitat types along the Atlantic OCS in the form of a distributed network of artificial reefs (Degraer et al. 2020). The nature and significance of potential ecological responses, such as changes in diet and predator-prey interactions resulting from changes in habitat productivity, are not fully known. Lastly, the nature, extent, and significance of potential spillover effects on broader ecosystem functions, such as seasonal stratification of the Cold Pool and larval dispersal patterns, are not fully understood (Johnson et al. 2021; van Berkel et al. 2020). Targeted modeling studies suggest that the effects of offshore wind development in the RI/MA and MA WEAs on water column stratification and larval dispersal patterns are unlikely to be ecologically significant (Johnson et al. 2021). However, this study considered only two out of several WEAs in the geographic analysis area, meaning that the potential effects resulting from full build-out of all WEAs within the geographic analysis area remain to be studied.

As stated, ongoing monitoring studies at European wind facilities and the Block Island Wind Farm in the United States provide a useful basis for evaluating the combined effects of these IPFs on the biological community as a whole, even if effects on individual species cannot be predicted with specificity. On balance, the current scientific information is sufficient to support sound scientific judgements and informed decision making because relevant studies monitoring changes at wind farms have not observed significant changes in finfish abundance and distribution at regional scales over years of study. For example, while wind farm installation can displace soft-bottomed habitat in favor of hard substrates, the affected areas usually represent a small fraction of available habitat. Moreover, offshore wind structures provide habitat complexity that generally results in an increase in biological productivity, which in turn can attract fish species that associate with complex habitat types (Degraer et al. 2020). Therefore, while some uncertainty remains, the available information does not suggest that long-term negative effects are likely. The similarity between the layouts analyzed for the different alternatives does not render any of this incomplete and unavailable information essential to a reasoned choice among alternatives.

There is uncertainty regarding the spatial and temporal occurrence of finfish and essential fish habitat (EFH) throughout the entire finfish and EFH geographic analysis area. This is especially true for Atlantic cod (*Gadus morhua*) use of the Coxes Ledge area, which is part of an ongoing study funded by BOEM examining the movements of commercial fish species in southern New England (National Oceanic and Atmospheric Administration [NOAA] 2020a). However, broadscale information is available from sources such as federal FMPs and from surveys completed to support COP submission. There is also uncertainty regarding behavioral effects from each IPF individually and cumulatively (e.g., operational noise effects on Atlantic cod communication during spawning). Again, BOEM is able to draw on existing scientific findings, as presented in Section 3.13 of the EIS and references therein, in the RWF EFH assessment (BOEM 2023b, 2023c), and in the National Marine Fisheries Service (NMFS) BA (BOEM 2023d, 2023e). The available information is suitable for characterizing the likely effects of each IPF and has been used to analyze potential impacts resulting from the Project and past, present, and reasonably foreseeable actions. For this reason, the analysis provided in the EIS is sufficient to support sound scientific judgments and informed decision making related to the proposed uses of the offshore portions of the geographic analysis area. Further, the similarity between the layouts analyzed for the different alternatives does not render any of this incomplete and unavailable information essential to a reasoned choice among alternatives. Therefore, BOEM concluded that the available information about potential impacts on finfish and EFH supports a reasoned choice among alternatives.

Land Use and Coastal Infrastructure

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

Marine Mammals

Although there is some uncertainty regarding the temporal distribution of marine mammals and periods during which they might be especially vulnerable to Project disturbance, the NMFS BA (BOEM 2023d, 2023e) provides detailed species descriptions and life history information. NOAA has summarized the most current information about marine mammal population status, occurrence, and use of the region in their 2019 and 2020 stock status reports for the Atlantic OCS and Gulf of Mexico (Hayes et al. 2020, 2021). These studies provide a suitable basis for predicting the species, abundances, and distributions of marine mammals in the geographic analysis area.

Uncertainty also exists with regard to the effects of some IPFs on marine mammals. For example, there is still some uncertainty regarding the impacts on marine mammals from EMF produced by submarine cables. This uncertainty is due in part to difficulties in evaluating population-scale impacts around regional deployments (Taormina et al. 2018), to the large size and high mobility of marine mammals, and to other logistical constraints, which make experimental studies infeasible. As a result, no scientific studies have been conducted to examine the effects of altered EMF on marine mammals. Although scientific studies summarized by Normandeau Associates, Inc., et al. (2011) demonstrate that marine mammals are sensitive to and can detect small changes in magnetic fields, as described in Section 3.15 of the EIS, those potentially detectable impacts would only occur within a few feet of select cable segments. There is no basis to conclude that the potential detection of EMFs would lead to any measurable change in behavior. For this reason, the analysis provided in the EIS is sufficient to support sound scientific judgments and informed decision making related to the proposed uses of the offshore portions of the geographic analysis area.

Some uncertainty also exists regarding the cumulative acoustic impacts associated with pile-driving activities. The available information relative to impacts on marine mammals from pile driving associated with offshore wind development is primarily limited to information on harbor porpoise (*Phocoena phocoena*) and harbor seal (*Phoca vitulina*) because most of this research has occurred at European offshore wind projects, where large whales are uncommon. At this time, it is unclear if marine mammals would cease feeding and when individuals would resume normal feeding, migrating, breeding, etc., behaviors once daily pile-driving activities cease, or if secondary indirect impacts would persist. Certain species, notably North Atlantic right whale (*Eubalaena glacialis*), rely on specialized feeding strategies that appear to be sensitive to disruption (van der Hoop et al. 2019). These findings suggest that short-term behavioral disturbance could contribute to energy deficits that ultimately lead to reduced fitness (Fortune et al. 2013; van der Hoop et al. 2019). Under the cumulative impact scenario, individual whales may be exposed to acoustic impacts from multiple projects in 1 day or to acoustic impacts from one or more projects over multiple days. The consequences of these exposure scenarios have been analyzed with the best available information, but a lack of real-world observations on species' responses to pile-driving results is uncertain. Additionally, it is currently unclear how sequential years of construction of multiple projects would impact marine mammals. Future projects will undergo a project-specific analysis under NEPA, the Endangered Species Act, and the Marine Mammal Protection Act that may reach different impact conclusions from this analysis if warranted based on new scientific and potentially observable information, or if impacts are defined differently from the EIS.

There is also uncertainty about certain potential impacts on marine mammals resulting from the long-term presence of offshore wind structures in the environment. For example, operational WTGs would generate low-frequency underwater noise that may exceed the established minimum threshold for potential behavioral and auditory masking impacts within a short distance (e.g., approximately 120 feet) from each foundation, although detectable noise above ambient levels could extend up to 560 feet or more. These structures would contribute to and potentially increase ambient noise within each WEA, albeit at levels generally not associated with adverse effects on marine mammals. However, the 120 root mean square decibels (dB_{RMS}) threshold may not adequately represent the potential for adverse effects of chronic noise exposure (e.g., Cholewiak et al. 2018; Hatch et al. 2012; Jensen et al. 2009; Putland et al. 2017). The implications of long-term operational noise impacts and structure presence on marine mammal behavior, particularly the behavior of large whale species, are unclear. These potential impacts are topics of ongoing research.

There is broader uncertainty about how large whales will respond to the presence of extensive networks of novel offshore wind structures on the Atlantic OCS. Under the cumulative impact scenario, up to 3,110 new structures (i.e., WTGs and OSSs) could be constructed across the geographic analysis area. Although the planned spacing of structures would not obstruct whale movement between structures, the potential synergistic effects of structure presence and low-level operational noise are uncertain. There is also some uncertainty around reef effect and hydrodynamic impacts on prey and forage availability and predator-prey interactions. Additionally, these impacts could combine and interact with ongoing changes in marine species distribution and community composition driven by climate change. Displacement effects that result in increased interactions between vulnerable populations of marine mammals and commercial shipping and/or fishing activity could have significant long-term cumulative effects. The potential consequences of these impacts on the Atlantic OCS are unknown. Monitoring studies could be able to track these changes and observe how they may influence whale behavior. At present, BOEM has no basis to conclude that these IPFs would result in significant adverse impacts on any marine mammal species.

At present, currently available information suggests that hydrodynamic effects of foundation structures are likely to be localized and not additive when spaced at 1 nm in environments with strong seasonal stratification (van Berkel et al. 2020). Recent modeling of hydrodynamic effects suggests that surface currents could be affected by the presence of multiple wind farms potentially impacting the distribution of larvae (Johnson et al. 2021). There is insufficient information to determine if this conclusion is valid for broader scale development at the levels planned within the geographic analysis area.

BOEM determined that the overall costs of obtaining the missing information for or addressing uncertainty of the above topics for marine mammals are exorbitant or that the means to obtain it are not known. Therefore, BOEM extrapolated or drew assumptions from known information for similar species and/or situations, as presented in Section 3.15 of the EIS and in the BA submitted to NMFS (BOEM 2023d, 2023e). As a result, the information and methods used to predict potential impacts on marine mammals represent the best available information, and the analysis provided in the EIS is sufficient to support sound scientific judgments and informed decision making related to the proposed uses of the offshore portions of the geographic analysis area. Notwithstanding the foregoing, the similarity between the layouts analyzed for the different alternatives does not render any of this incomplete and unavailable information essential to a reasoned choice among alternatives. Therefore, BOEM has not identified incomplete or unavailable scientific information on marine mammal resources that is essential to a reasoned choice among alternatives.

Navigation and Vessel Traffic

The navigation and vessel traffic impact analysis in the EIS is based on automatic identification system (AIS) data for calendar year 2019. Vessel monitoring system (VMS) data for fishing vessels provided by the NMFS were the basis for polar histograms and other analytical outputs used in evaluating commercial and for-hire recreational fishing trips (see EIS Section 3.9). Some smaller recreational and fishing vessels carry an AIS; however, the AIS analysis likely excludes most vessels less than 65 feet (19.8 meters) long that traverse the WEA. In addition, as discussed under Commercial Fisheries and For-Hire Recreational Fishing, above, the VMS data provided by NMFS indicate the number of vessels in each fishery and their direction of travel while actively fishing, which speaks to alignment of the WTG grid. Nonetheless, the combination of AIS and VMS data described above represent the best available vessel traffic data and are sufficient to enable BOEM to make a reasoned choice among alternatives.

The U.S. Coast Guard's (USCG's) final report for the Areas Offshore of Massachusetts and Rhode Island Port Access Route Study (MARIPARS), evaluating the need for establishing vessel routing measures, was published in the *Federal Register* on May 27, 2020 (USCG 2020). The MARIPARS report recommends a standard and uniform grid pattern turbine layout throughout the Rhode Island and Massachusetts Lease Areas as the best way to facilitate predictable safe navigation throughout the contiguous leases. The five Rhode Island and Massachusetts offshore wind leaseholders, including Revolution Wind, have proposed a collaborative regional layout for wind turbines (1 × 1 nm apart in fixed east–west rows and north–south columns, with 0.7-nm theoretical transit lanes oriented northwest–southeast) across their respective BOEM leases (Geijerstam et al. 2019), which meets the layout rules set forth in the MARIPARS report recommendations. Although the USCG attached to the MARIPARS *Federal Register* docket the Responsible Offshore Development Alliance proposal (Hawkins 2020), which recommends additional transit corridors through the Lease Areas, the MARIPARS report concludes that if the layout in the recommendations was implemented, the USCG would likely not pursue additional formal or informal routing measures. As a cooperating agency with BOEM, the USCG would continue to consult over the course of the NEPA process for the Project as it relates to navigational safety and other aspects, including the impacts associated with alternatives assessed. Therefore, BOEM has not identified incomplete or unavailable information on navigation and vessel traffic that is essential to a reasoned choice among alternatives.

Other Marine Uses

In the context of this EIS, other marine uses include aviation and air traffic, land-based radar, marine mineral resources and dredged material disposal, military and national security, offshore energy (aside from the proposed Project), scientific research and surveys, and undersea cables. There is no incomplete or unavailable information related to the analysis of marine mineral resources and dredged material disposal, military and national security, aviation and air traffic, offshore energy (aside from the aspects described in this appendix for the proposed Project, and the reasonably foreseeable offshore wind projects for which BOEM has not received COPs), undersea cables, and land-based radar uses.

As discussed in Section 3.17 of the EIS for scientific research and surveys, analysis in the EIS discloses both Project-specific and cumulative impacts to NMFS's ability to continue conducting scientific research and surveys for the purpose of fisheries management and protected species management. Despite the foregoing, BOEM has concluded that the information provided by NOAA in Section 3.17 regarding scientific research and surveys is sufficient to support the impact findings presented in the EIS. Therefore, BOEM has not identified incomplete or unavailable information on scientific research and surveys that is essential to a reasoned choice among alternatives.

Recreation and Tourism

There is a lack of quantitative data related to recreational not-for-hire fishing in the recreation and tourism geographic analysis area; therefore, quantitative analysis for this resource is not possible at this time. BOEM is considering how best to approach this issue for future similar projects. *Fisheries Economics of the United States 2018* (NMFS 2021) is a comprehensive summary document and the data presented discuss the overall economic level for not-for-hire recreational anglers in the offshore New England region (Maine, New Hampshire, Rhode Island, Connecticut, and Massachusetts). However, the document does not relate to how projects such as the RWF are likely to affect not-for-hire recreational fishing and is not detailed enough in geographic extent to discuss specific recreational angling locations.

However, BOEM has determined that incomplete and unavailable resource information was either not relevant to a reasoned choice among alternatives or alternative data or methods used to predict potential impacts provided the best available information. Therefore, the analysis provided in the EIS is sufficient to support sound scientific judgments and informed decision making related to the proposed uses of the onshore and offshore portions of the geographic analysis area.

Sea Turtles

Sea turtles are difficult to observe in the open ocean, and there is some uncertainty about the distribution of some turtle species (e.g., the green sea turtle [*Chelonia mydas*]) in relation to the Lease Area. The NMFS BA (BOEM 2023d, 2023e) 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. For example, sea turtle sensitivity to potential EMF effects from the Project is not fully understood. Sea turtles are known to use the earth’s magnetic field to orient in space and navigate between habitats (Irwin and Lohmann 2005; Courtillot et al. 1997). However, the available research has not examined how sea turtles respond to lower strength EMF levels on the order of those likely to result from the Project. Although there are no direct data on impacts on sea turtles from EMFs generated by underwater cables, the preponderance of evidence summarized in the BOEM-sponsored report by Normandeau et al. (2011) indicates that sea turtles are unlikely to detect most of the EMF impacts resulting from the Project. Potentially detectable EMF effects would be limited to within 5 feet of the short segments of cable laid on the seafloor that are not buried. Section 3.19 of the EIS and the NMFS BA (BOEM 2023d, 2023e) allowed BOEM’s subject matter experts to estimate the potential risk to other species of sea turtles based on the assumption of similar anatomical, behavioral, and life history similarities, related to EMFs. Although the thresholds for EMF disturbance to the behavior of all potential species of sea turtles are not known, no adverse effects on sea turtles from the numerous submarine power cables around the world have been documented, and modeling of the anticipated EMFs generated by Project components suggests the majority of induced field strengths would likely be below detection levels. Similar to marine mammals, data are also not available to evaluate potential changes to normal movements of juvenile and adult sea turtles due to short-term elevated suspended sediments. Although some exposure may occur, total suspended sediment impacts would be limited in magnitude and duration and within the range of natural exposures periodically experienced by these species. On this basis, any resulting impact on behavior would likely be too small to be biologically meaningful, and no adverse impacts would be expected (NOAA 2020b).

There is also uncertainty relative to sea turtle responses to construction activities on the Atlantic OCS. Some potential for displacement from areas exposed to noise and disturbance exists. However, should displacement of individuals occur, 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 unclear whether concurrent construction of multiple projects, increasing the extent and intensity of impacts over a shorter duration or spreading out project construction, and associated 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. At this time, it is unclear if sea turtles that have ceased feeding during multiple construction activities would resume normal feeding, migrating, breeding, etc., behaviors once daily pile driving ceases or if secondary indirect impacts would continue. Under the cumulative impact scenario, individual sea turtles may be exposed to acoustic impacts from multiple projects in 1 day or to acoustic impacts from one or more projects over multiple days. The consequences of these exposure scenarios have been analyzed with the best available scientific information in EIS Section 3.19, although some level of uncertainty remains due to the lack of observational data on species responses to pile driving. In addition, modeled predictions of operational sound for large turbines (10 MW) indicate that sound levels could be greater than observed for existing wind turbines; actual sound levels are still predicted to be well below levels that could cause harm.

Some uncertainty exists in regard to the potential for sea turtle responses to Federal Aviation Administration hazard lights and navigation lighting associated with offshore wind development. Given the placement of the new structures far from nesting beaches and within the OCS, no impacts to nesting female or hatchling sea turtles would be expected. Revolution Wind has incorporated BOEM's guidance (BOEM 2021; Orr et al. 2013) for avoiding and minimizing artificial lighting impacts on aquatic life into the Project design. This environmental protection measure would limit WTG and electrical service platform lighting to minimum levels required by regulation for worker safety, navigation, and aviation. Sea turtle sensitivity to these minimal light levels is unknown. However, given that 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 (BOEM 2023d, 2023e), this IPF is not expected to have any measurable impacts (adverse or beneficial) on sea turtles in the offshore environment.

More broadly, considerable uncertainty remains about how sea turtles would interact with long-term changes in biological productivity and community structure resulting from the development of an extensive network of artificial reefs 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. These IPFs are expected to interact with the ongoing influence of climate change on species distribution and behavior over broad spatial scales, but the nature and significance of these interactions are unclear. 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 and/or the associated costs would be exorbitant. Where appropriate, BOEM inferred conclusions about the likelihood of potential biologically significant impacts from available information for similar species and/or situations. These methods are described in detail in EIS Section 3.19 EIS and in the NMFS BA (BOEM 2023d, 2023e). The approaches and methods used are based on the best available scientific information, and the analysis provided in the EIS is sufficient to support sound scientific judgements and informed decision making related to the proposed uses of the offshore portions of the analysis area. Notwithstanding the foregoing, the similarity between the layouts analyzed for the different 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 sea turtle resources that is essential to a reasoned choice among alternatives.

Visual Resources

There is no incomplete or unavailable information related to the analysis of impacts on visual resources.

Water Quality

There is no incomplete or unavailable information related to the analysis of impacts on water quality.

Wetlands and Non-tidal Waters

There is no incomplete or unavailable information related to the analysis of impacts on wetlands and non-tidal waters.

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