New England Wind

AVANGRID RENEWABLES

Construction and Operations Plan

Lease Area OCS-A 0534

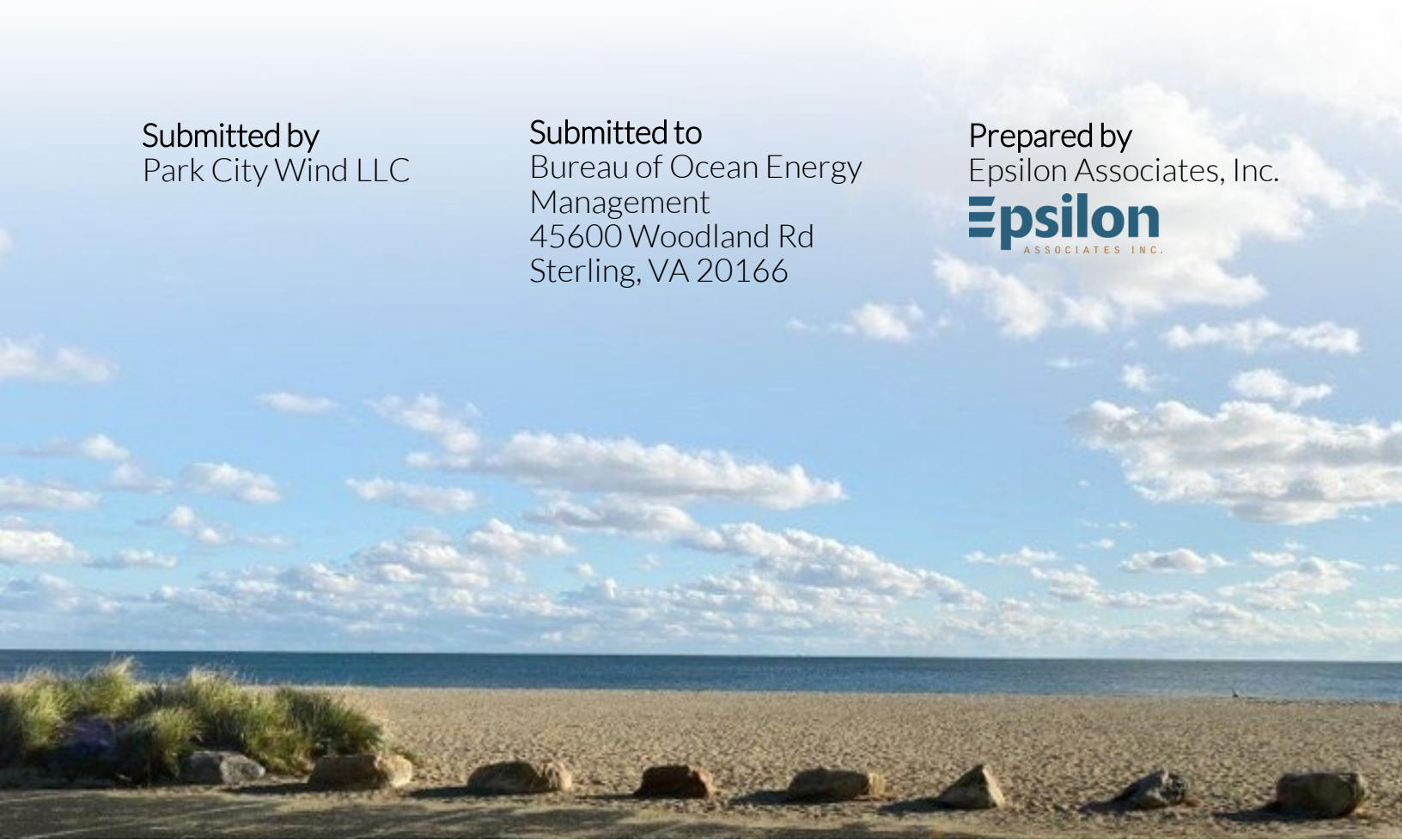
Volume III Appendices

June 2022

Submitted by
Park City Wind LLC

Submitted to
Bureau of Ocean Energy Management
45600 Woodland Rd
Sterling, VA 20166

Prepared by
Epsilon Associates, Inc.



New England Wind

AVANGRID RENEWABLES

New England Wind Construction and Operations Plan for Lease Area OCS-A 0534

Volume III Appendices

Submitted to:
BUREAU OF OCEAN ENERGY MANAGEMENT
45600 Woodland Rd
Sterling, VA 20166

Submitted by:
Park City Wind LLC

Prepared by:
Epsilon ASSOCIATES INC.

In Association with:

Baird & Associates
Biodiversity Research Institute
Capitol Air Space Group
Geo SubSea LLC
Geraldine Edens, P.A.
Gray & Pape
JASCO Applied Sciences
Public Archaeology Laboratory, Inc.
RPS
Saratoga Associates
SEARCH, Inc.
Wood Thilsted Partners Ltd

June 2022

Appendix III-N – Draft Economic Exposure of Commercial Fisheries

The Proponent has also identified two variations of the Phase 2 Offshore Export Cable Corridor (OECC)— the Western Muskeget Variant and the South Coast Variant—in the event that technical, logistical, grid interconnection, or other unforeseen issues arise during the engineering and permitting processes that preclude one or more Phase 2 offshore export cables from being installed within all or a portion of the OECC (see Section 4.1.3 of COP Volume I). This Appendix considers the potential impacts associated with the Western Muskeget Variant; an assessment of the South Coast Variant in federal waters is provided separately in the COP Addendum.

Economic Exposure of Commercial Fisheries to the New England Wind Offshore Wind Energy Development

Prepared for:

Park City Wind LLC

Prepared by:

Dennis M. King, Ph.D.
KING AND ASSOCIATES, LLC
24 Trillium Rise
Plymouth, MA 02360

December 2021

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

List of Figures

List of Tables

EXECUTIVE SUMMARY

Context

New England Wind is the proposal to develop offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0534 along with associated offshore and onshore cabling, onshore substations, and onshore operations and maintenance (O&M) facilities. New England Wind will be developed in two Phases with a maximum of 130 wind turbine generator (WTG) and electrical service platform (ESP) positions. Four or five offshore export cables installed within an Offshore Export Cable Corridor (OECC) will transmit electricity generated by the WTGs to onshore transmission systems in the Town of Barnstable, Massachusetts (see Figure 1). Park City Wind LLC, a wholly owned subsidiary of Avangrid Renewables, LLC, is the Proponent and will be responsible for the construction, operation, and decommissioning of New England Wind.

New England Wind's offshore renewable wind energy facilities are located immediately southwest of Vineyard Wind 1, which is located in Lease Area OCS-A 0501. New England Wind will occupy all of Lease Area OCS-A 0534 and potentially a portion of Lease Area OCS-A 0501 in the event that Vineyard Wind 1 does not develop "spare" or extra positions included in Lease Area OCS-A 0501 and Vineyard Wind 1 assigns those positions to Lease Area OCS-A 0534. For the purposes of the Construction and Operations Plan (COP), the Southern Wind Development Area (SWDA) is defined as all of Lease Area OCS-A 0534 and the southwest portion of Lease Area OCS-A 0501, as shown in Figure 1.

The SWDA may be approximately 411–453 square kilometers (sq km) (101,590– 111,939 acres) in size depending upon the final footprint of Vineyard Wind 1. At this time, the Proponent does not intend to develop the two positions in the separate aliquots located along the northeastern boundary of Lease Area OCS-A 0501 as part of New England Wind (see Figure 1). The SWDA (excluding the two separate aliquots that are closer to shore) is just over 32 kilometers (km) (20 miles [mi]) from the southwest corner of Martha's Vineyard and approximately 38 km (24 mi) from Nantucket. The WTGs and ESPs in the SWDA will be oriented in an east-west, north-south grid pattern with one nautical mile (NM) (1.85 km) spacing between positions.

While the Proponent intends to install all four or five New England Wind offshore export cables within the OECC that travels from the SWDA northward through the eastern side of Muskeget Channel towards landfall sites in the Town of Barnstable, the Proponent is reserving the fallback option to install one or two Phase 2 cables along the western side of Muskeget Channel, referred to as the Phase 2 OECC Western Muskeget Variant[1] (see Section 4.1.3.2 of COP Volume I). Throughout this section, unless the Western Muskeget Variant is specified, "the OECC" refers to the OECC that travels along the eastern side of Muskeget Channel.

Commercial fishing vessels using fixed and mobile gear operate in and around the SWDA and OECC, and transit through these areas as they travel between fishing ports and fishing grounds. Nearly all commercial fishing vessels that operate in the SWDA and the OECC are based at ports

in Massachusetts, Rhode Island, Connecticut, New York, and New Jersey, and land their harvests for processing or resale at ports in these five states (referred to as the "Offshore Development Region").

During construction and installation, fishing vessels will not be precluded from operating in or transiting through the SWDA or the OECC (including the Western Muskeget Variant) other than where temporary safety buffer zones are established around construction and installation vessels. During O&M of New England Wind, fishing vessels will not be restricted in the SWDA or OECC (including the Western Muskeget Variant), although some commercial fishing operations will need to be modified in the SWDA to account for the presence of WTGs and ESPs. New England Wind may also result in some fishing effort shifting from the SWDA to other areas.

Within the OECC (including the Western Muskeget Variant), the target burial depth for offshore export cables will be 1.5 to 2.5 meters (m) (5 to 8 feet [ft]) below the seafloor which the Proponent's engineers have determined is more than twice the burial depth that is required to protect the cables from fishing activities and prevent them from interfering with fishing activity. While every effort will be made to achieve this target burial depth and avoid the need for cable protection, the Proponent conservatively estimates that approximately 6% of the offshore export cables within the OECC for both phases could require cable protection (or up to 7% of the offshore export cables within the OECC for both Phases if the Western Muskeget Variant is used for one or two Phase 2 export cables). This results in the possibility that mobile bottom fishing gear, such as bottom trawl nets, could snag on cable protection resulting in gear damage, lost fishing time, and associated economic losses. Since little bottom trawling or dredging occurs along the OECC, it is expected that the potential for these types of economic losses in the OECC (including the Western Muskeget Variant) is low.

New England Wind's potential to affect commercial fishing in the SWDA and OECC in ways that reduce fishing revenues, increase fishing costs or risks, or result in fishery-related shoreside economic impacts is the primary focus of the economic analysis presented in this report. This analysis is based on the maximum envelope or impact area for New England Wind and addresses the maximum potential loss of fishing revenues in the SWDA and OECC, which is referred to as "economic exposure." The report also addresses the likelihood that economic impacts on commercial fishing will be lower than estimated economic exposure.

The report also addresses the following potential indirect economic impacts that New England Wind may have on commercial fishing and fishery-dependent shoreside businesses: (1) increased fishing vessel transit times, (2) fishing effort diverted from the SWDA causing "fishing congestion impacts" in other areas, and (3) New England Wind causing reduced fishing effort and fish landings resulting in shoreside economic impacts in industries that either support commercial fishing (upstream economic impacts) or rely on commercial fish landings (downstream economic impacts).

Focus

This report develops estimates of the economic exposure of commercial fisheries and fishery-related shoreside businesses to New England Wind based on data related to historical fishing revenues generated in and around the SWDA and OECC (including the Western Muskeget Variant) and data related to impacts of changes in ex-vessel fish landings on shoreside businesses that support commercial fishing or rely on commercial fish landings.

Following BOEM guidance, the estimates of economic exposure developed in this report are measures of maximum potential losses based on the following assumptions:

- New England Wind would result in the total cessation of fishing activity in the SWDA and in parts of the OECC where cable installation is taking place with all related fishing revenues and fish landings from those areas being lost.

- Lost fishing revenues and fish landings from the SWDA and OECC would not be recouped as a result of fishing effort shifting from those areas to other fishing areas.

The report also addresses expected economic impacts of New England Wind, which may be significantly less than economic exposure for the following reasons:

- New England Wind will result in changes in fishing effort, but not an overall decline in fishing effort with some fishermen continuing to fish in the SWDA.

- New England Wind is aligned in a 1 x 1 NM layout to accommodate continued fishing in the SWDA. As detailed in the Commercial Fisheries Center of Rhode Island's (CFCRI) affidavit filed with BOEM during the review of Vineyard Wind 1, fishermen stated the 1 NM spacing and fixed east-to-west rows and north-to-south columns would allow fishing to continue in the wind development area (CFCRI 2018).

- At least some of any declines in commercial fish landings and related losses in fishing revenues in the SWDA and OECC will be recouped as a result of fishing effort shifting from those areas to nearby fishing areas.

As used in this report, "fishing values" refers to the ex-vessel dollar value of commercial fish landings and "economic exposure" refers to the maximum potential loss of fishing values that would result if New England Wind caused all fishing effort in the SWDA and in the OECC (during export cable installation) to stop and not be diverted to other fishing areas. "Expected economic impacts" refers to losses in fishing values based on the assumption that historical fishing effort in the SWDA and in the OECC will continue in those areas or in nearby areas throughout the construction and operation of New England Wind. This results in estimates of expected economic impacts being significantly less than estimates of economic exposure.

Findings

Estimates of Economic Exposure and Economic Impacts

Economic Exposure in the SWDA

Each of the five data sources listed in Table 1 provide useful fishing revenue estimates for the SWDA or areas that include the SWDA. However, one of those sources (NOAA 2021) is a NOAA-Fisheries website opened to the public in October 2020 which provides annual fishing revenue data for the SWDA and other Atlantic offshore wind lease and project areas for years 2008-2019, presented in 2019 dollars. This is by far the most current and reliable source of fishing revenue data for the SWDA and is the basis for most fishing revenue estimates and estimates of economic exposure used in this report. Based on fishing revenues presented in that source, adjusted upward to account for some lobster and Jonah crab revenues that were not included, the best available estimate of annual fishing revenues in the SWDA is $685,692.

Economic Exposure in the OECC

From the landfall site(s)[2] to the SWDA boundary (excluding the two separate aliquots that are closer to shore), the OECC is approximately 42 NM (78 km), with approximately 22.4 NM (41.4 km) passing through federal waters and 19.5 NM (36.1 km) passing through Massachusetts state waters. Based upon careful consideration of multiple technical, environmental, and commercial factors, the Proponent identified the OECC for New England Wind that is largely the same OECC included in the approved Vineyard Wind 1 COP, but it has been widened by approximately 300 m (984 ft) to the west along the entire corridor and by approximately 300 m (984 ft) to the east in portions of Muskeget Channel, for a total width of approximately 3,100 feet (950 m) to 5,500 feet (1,700 m) and the average width is 3,500 feet (1,100 m). Within the OECC four or five offshore export cables will be installed—two cables for Phase 1 and two or three cables for Phase 2. Unless technical, logistical, grid interconnection, or other unforeseen issues arise, all New England Wind offshore export cables will be installed within a shared OECC that will travel from the northwestern corner of the SWDA along the northwestern edge of Lease Area OCS-A 0501 (through Vineyard Wind 1) and then head northward along the eastern side of Muskeget Channel toward landfall the southern shore of Cape Cod.

Typical cable laying speeds are expected to range from 328 ft to 656 ft per hour (100 meters to 200 meters per hour) and cable laying is expected to occur 24 hours per day. That results in cable laying taking place at an approximate rate of 1.5 miles to 3.0 miles per day. However, as described in Section 4.5.1, cable installation will also require several “pre-lay activities” such as a survey of the cable alignment, a pre-lay grapnel run of the cable alignment, and boulder relocation, and other “post-lay activities” such as cable splicing and the placement of cable protection. It is currently expected that cable installation in the entire OECC, inclusive of pre-lay and post-lay activities, will occur over a period of approximately nine months for installation of two cables during Phase 1 and approximately 13.5 months for installation of three cables during Phase 2 with overall cable installation for both phases taking place over a period of approximately 1.875 years.

Analysis of anticipated cable installation activities also provides estimates of the size of the temporary safety buffer zones that may be established around where each cable installation activity will take place. These temporary safety buffer zones are the only areas within the OECC where commercial fishing may be temporarily precluded. The typical radius of the temporary safety buffer zone around vessels involved in cable installation activities is estimated to be up to 1 km, which results in an area of approximately 3.14 sq km where fishing may be temporarily precluded around where cable installation activities are taking place. The temporary safety buffer zones will be adjusted as construction work areas change along the OECC, allowing fishermen to use portions of the OECC where cable installation is either completed or planned, but is not underway (Figure 2). While safety buffer zones typically have a radius of 500 m, a radius of 1 km is used for the purposes of this economic analysis to account for the multiple vessels that may be used for cable laying and/or possible variations in the size of the safety buffer zones.

Based on fishing revenue intensity data generated by BOEM and NOAA-Fisheries for years 2007-2018, average annual fishing revenues in the OECC is $218,152, or $2,611 per sq km (2019 dollars).

Estimates of economic exposure in the OECC during cable installation are generated by multiplying the three factors described above that are referred to below as A, B, and C. That is,

EE_{OECC} = Annual Economic Exposure in the OECC (measured in 2019 Dollars)

where:

$EE_{OECC} = A \times B \times C$

and

A = expected annual fishing revenues per sq km of the OECC ($2,611);

B = sq km of area precluded to fishing during an ongoing cable installation activity (3.14 sq km); and

C = the duration of cable installation activities for both Phases expressed as a portion of a year (1.875 years).

Therefore:

$EE_{OECC} = A \times B \times C = \$2,611 \times 3.14 \times 1.875 = \$15,372.$

Based on the analysis described above, economic exposure is approximately $6,149 during the nine months (75% of a year) when two cables are being installed during Phase 1 and $9,223 during the 13.5 months (112.5% of a year) when one to three cables are being installed during Phase 2, resulting in overall economic exposure in the OECC of approximately $15,372 during both Phase 1 and Phase 2. However, $15,372 is the economic exposure for the maximum design scenario of

three cables being installed for Phase 2. If only one cable was installed for Phase 2, the economic exposure would be approximately $3,075 during the 4.5 months of cable installation for Phase 2 and the overall economic exposure would be $9,223 for both Phases.

The analysis described above was also conducted for the Western Muskeget Variant. Based on fishing revenue intensity data generated by BOEM and NOAA-Fisheries for years 2007-2018, average annual fishing revenue in the Western Muskeget Variant is $1,846 per sq km (2019 dollars), which is less than the OECC value of $2,611 per sq km. This analysis therefore uses the estimate of economic exposure for the OECC as the maximum design scenario.

Potential Fishing Congestion Impacts

Fishing congestion impacts occur when a high concentration of vessels operating in a fishing area causes fishing vessels and gear to interfere with one another resulting in increases in fleetwide or vessel-specific fishing costs or reductions in fishing revenues, or both. The sections below summarize potential fishing congestion impacts associated with SWDA and OECC development.

OECC Fishing Congestion Impacts

The OECC (including the Western Muskeget Variant) represents a very limited portion of the available fishing grounds in the areas it passes through in Nantucket Sound and areas south of Nantucket Sound and Martha's Vineyard. For each Phase of New England Wind, offshore export cable installation along the OECC will occur over a period of months with commercial fishing impacted in less than 3.14 sq km of the OECC at any one time. Therefore, there is no reason to expect that construction and installation activities along the OECC will result in a meaningful shift in fishing effort from the OECC to other areas. During O&M of New England Wind, the cable protection along approximately 6% of the OECC for both phases (or up to 7% of the OECC for both phases if the Western Muskeget Variant is used for one or two Phase 2 export cables) may have some impacts on the limited amount of bottom fishing that takes place along the OECC. However, there is no reason to expect that will result in enough fishing effort shifting away from the OECC (including the Western Muskeget Variant) to cause fishing congestion impacts in other areas.

SWDA Fishing Congestion Impacts

Automated Identification System (AIS) data indicate relatively low levels of fishing effort in the SWDA. During years 2016–2019, for example, the average annual number of unique AIS-equipped fishing vessels that fished in the SWDA during at least one trip was 33. During each of six months of any year, fewer than two AIS-equipped unique fishing vessels operated in the SWDA, and fewer than six operated in the SWDA during 10 months of any year (excludes August and September). During these years, the average number of unique AIS-equipped vessels fishing in the SWDA only rose to 10 or above in the months of August (10 vessels) and September (19 vessels). The average number of unique fishing tracks per month by these vessels in the SWDA peaked in September at

72 tracks, which is approximately four fishing tracks per vessel per month. Even if all fishing effort in the SWDA was diverted to nearby areas, this level of fishing effort in the SWDA is not sufficient to induce fishing congestion impacts outside the SWDA.

Also, as indicated in Section 4.2, during 2011-2017 a very high percentage (approximately 64%) of fishing revenues generated on fishing trips that intersect either Lease Area OCS-A-0501 or Lease Area OCS-A-0534 was generated outside of those areas and based on an analysis of AIS data that is also described in Section 4.2, on average, approximately 75% of time spent on unique fishing tracks that intersect the SWDA is spent outside the SWDA. These numbers indicate that the fishing vessels that currently operate in the SWDA are already part of the fishing fleet that operates in nearby areas and do not pose a potential source of new fishing effort that could introduce fishing congestion problems in those areas.

Fishing Vessel Transit Costs

OECC Impacts on Fishing Vessel Transit Costs

Offshore export cable installation activities are expected to have little to no impact on fishing vessel transit times. As noted above, temporary safety buffer zones established around cable installation vessels are expected to be less than 3.14 sq km and are the only areas where cable installation activities will impact commercial fishing vessels that are either fishing or transiting in the OECC (including the Western Muskeget Variant). Based on the analysis presented in Section 3.2, there is no reason to expect that the temporary closure of such small segments of the OECC (including the Western Muskeget Variant) to fishing vessel transits will have any meaningful impact on fishing vessel transit times or costs.

SWDA Impacts on Fishing Vessel Transit Costs

From 2016 to 2019, the average number of annual AIS-equipped fishing vessel transits through the SWDA was 422 (Baird 2021). During construction and installation of New England Wind, fishing vessels will be allowed to continue transiting through the SWDA but may need to avoid temporary safety buffer zones in the immediate vicinity of construction and installation vessels. Operators of fishing vessel that transit through the SWDA may need to reroute around these temporary safety buffer zones; other fishing vessels may elect to reroute around the SWDA entirely.

The proposed WTG/ESP layout for New England Wind will facilitate ongoing fishing vessel transits through the SWDA. The WTGs and ESPs will be oriented in fixed east-to-west rows and north-to-south columns with one nautical mile (NM) (1.85 km) spacing between WTG/ESP positions. This layout provides 1.85 km (1 NM) wide corridors in the east-west and north-south directions as well as 1.3 km (0.7 NM) wide corridors in the northwest-southeast and northeast-southwest directions. In its recent *Massachusetts and Rhode Island Port Access Route Study* (MARIPARS), the U.S. Coast Guard (USCG) determined that the proposed configuration for New England Wind provides for safe and efficient vessel transits and, as stated in the Federal Register notice for the

final Port Access Route Study, that "while these navigation corridors would be smaller than those suggested by some commenters, the USCG believes they should be sufficient to maintain navigational safety and provide vessels with multiple straight-line options to transit safely throughout the MA/RI WEA."[3]

Despite the availability of safe and efficient transit lanes in the SWDA, the possibility remains that some fishermen may opt to transit around rather through the SWDA during extreme weather events and, possibly, at other times.

The average number of annual AIS-equipped fishing vessel transits through the SWDA range from 339 to 487 transits and averaged 422 transits (Baird 2021). This is a reasonable estimate of the number of transits per year that could potentially be impacted by New England Wind activities in the SWDA.

During most of these 422 annual AIS-equipped fishing vessel transits through the SWDA, vessel operators may need to make minor adjustments to the most direct transit route through the SWDA in order to maintain course through north/south, east/west 1 NM wide transit/fishing lanes. However, despite the existence of 1 NM transit/fishing lanes, some fishermen may opt to reroute transits around the SWDA, especially during extreme weather.

As shown in Figure 10, using a vessel transit speed of 7.6 knots, the expected increase in transit time around the Lease Area (between major fishing ports and major fishing areas) ranges from 6 minutes to 46 minutes (a 1% to 7% increase in total transit time). If all of the 422 annual transits through the SWDA were rerouted around the Lease Area, and those transits experienced the maximum increase in transit time of 46 minutes, the annual increase in fleetwide transit time would be 324 hours. Based on diesel fuel consumption rates at standard steaming speeds (25 gallons per hour) and fuel prices of $3.00 per gallon, this would add approximately $57.50 to fuel costs during a typical transit and add $24,265 to annual fleet-wide fuel-based transit costs for AIS-equipped fishing vessels.

This estimate of $24,265 in annual fleetwide transit costs does not reflect operating costs other than fuel costs or the opportunity cost of any lost fishing time resulting from added transit time. However, increases in transit times associated with rerouting around the Lease Area result in such minor increases in total transit time that they are likely to have very small impacts on fishing time or revenues per trip. And, from a fleetwide perspective, such impacts are likely to be offset by the fact that most of the 422 annual transits through the SWDA can be expected to continue to transit through rather than around the Lease Area and experience no increase in transit times or costs.

Shoreside Indirect and Direct Impacts

Potential fishery-related indirect and induced shoreside economic impacts associated with New England Wind can be characterized as being either upstream (related to businesses that supply inputs used in fishing) or downstream (related to businesses that buy fish for processing or distribution).

Upstream economic impacts would result if New England Wind caused a reduction in fishing effort, which would lead to related reductions in shoreside purchases of fishing inputs (e.g., fuel, bait, ice). For purposes of estimating full economic exposure, it is reasonable to assume that New England Wind will result in decreases in fishing effort in the SWDA and in the OECC (during cable installation) and no increase in fishing effort in other areas and, therefore, will result in less overall fishing and fewer purchases of fishing inputs resulting in upstream economic impacts. However, it is more reasonable to assume that New England Wind will not result in commercial fishing vessels reducing fishing effort (i.e., spending more time in port or idle at sea) and that the same amount of fishing inputs will be purchased with or without New England Wind. As a result, it can be expected that New England Wind will result in no shoreside upstream economic impacts. It is important to note that potential impacts of shifting fishing effort on vessel fishing revenues and associated vessel owner profits and crew-shares and related household spending are associated with the success of fishing effort (e.g., fishing revenues) and are not related to purchases of fishing inputs or upstream impacts.

Downstream or forward-linked shoreside economic impacts are associated with sales, incomes, and jobs in businesses that purchase fish from fishermen and process or package it for resale. Downstream impacts could result if New England Wind caused a reduction in fish landings that led to these seafood businesses facing supply shortages or higher prices for raw fish or resulted in reduced production and sales of seafood products. New England seafood buyers, in general, have many alternatives to fish harvested in the SWDA, including fish harvested by vessels that divert fishing effort from the SWDA to other areas, and other domestic and foreign seafood suppliers.

Based on estimated "economic exposure," the maximum potential decline in the annual ex-vessel value of fish landings from the SWDA is $685,692. Actual impacts of New England Wind on ex-vessel fish landings should be expected to be significantly lower than that value and well within the typical range of annual fluctuations in the landed value of fish from any particular fishing area. Expected reductions in ex-vessel landings from the SWDA and nearby fishing areas resulting from New England Wind, therefore, are not likely to be enough to cause significant shoreside downstream impacts. For example, longfin squid (*Doryteuthis pealeii*) is the highest value species harvested in the SWDA, with an average annual ex-vessel value during 2008-2019 of $148,865, in 2019 dollars (NOAA 2021). However, in 2019, the $89,358 of longfin squid landings from the SWDA accounted for approximately 0.32% of the more than $28.2 million annual dockside value of longfin squid landed in New England, and approximately 0.44% of the more than $20.1 million longfin squid landed in Rhode Island (NOAA 2020b).

Overall, the potential decline in the ex-vessel value of fish landed in New England as a result of SWDA development represents a relatively insignificant share of the overall annual ex-vessel value of seafood landings in the five-state Offshore Development Region examined in this report. It represents an even less significant share of all seafood supplies available to seafood processors, wholesalers, retailers, and restaurants in that region. However, some downstream impacts may result if primary processors and dealers that rely primarily on locally caught fish lose revenues and incomes because of reduced supplies of fish from the SWDA. These potential revenue losses reflect economic exposure associated with downstream impacts and can be measured as a reduction in what is called "margin" or "markup", which is the difference between the value of seafood products sold and the cost of raw fish purchased. As described in Section 4.8.6, the "markup" on the types of fish harvested from the SWDA is approximately $0.565 which includes processor profit plus the cost of inputs used to process fish. That is, New England fish processors that buy the typical species of fish harvested in the SWDA generate $1.565 in seafood revenues for every $1.00 in raw fish they purchase. As shown in Section 4.8.6, that means an estimate of $685,692 as the maximum potential decline in the ex-vessel value of fish landed from the SWDA because of New England Wind could be expected to result in an estimated potential decline of $387,416 in "markup" earned in the primary seafood processor/distributor sector. Because declines in the annual value of landings from the SWDA and nearby areas can be expected to be significantly less than $685,692 expected declines in the "markup" earned by the New England primary seafood processors/distributor sector can be expected to be significantly less than $387,416.

Other Potential Impacts

Concern has been expressed that WTG/ESP foundations may function as fish aggregation devices (FADs) that will attract fish to the SWDA and make them less accessible to commercial fishing. While this is possible, commercial fishing is expected to continue in the SWDA during O&M of New England Wind and fish in the SWDA, including those attracted to the SWDA because of WTG/ESP foundations functioning as FADs, are expected to continue to be accessible to commercial fishing. While these FADs may provide advantages and disadvantages to different types of fishing methods, there is no reason to expect that they will result in significant adverse overall economic impacts on commercial fisheries.

Concern has also been expressed that development of the SWDA could affect fish population dynamics and result in permanent declines in the abundance of fish in the SWDA. Other studies of Lease Areas OCS-A 0501 and OCS-A 0534 (Kirkpatrick et al. 2017; Epsilon Associates, Inc. 2018; BOEM 2018) indicate that these types of potential long-term biological impacts are highly unlikely and not significant. It is also important to note, however, that this report focuses on developing estimates of economic exposure that are based on the assumption that average annual historical revenues from fishing in the SWDA will be lost and not replaced by fishing effort shifting from the SWDA to other fishing areas. This means that economic exposure, as defined by BOEM and measured in this report, is not affected by changes in the abundance or availability of fish inside or outside the SWDA. This does not imply that potential biological impacts are unimportant, but

that estimates of maximum potential economic losses based on past fishing revenues, before New England Wind, and the assumption that no fish will be harvested in the SWDA are not affected by any potential future changes in the abundance or availability of fish.

Summary and Conclusions

Annual economic exposure in the SWDA, in 2019 dollars is estimated to be $685,692 and total economic exposure for the OECC during the approximately 1.875 years when cable installation will be taking place during Phase 1 and Phase 2 is estimated to be approximately $15,372.

Tables 6a and 6b summarize the results of the analysis of economic exposure and economic impacts in the SWDA presented in this report.

Table 6a shows direct losses in fishing revenues and related shoreside economic impacts based on full economic exposure. This includes estimates of direct impacts on fishing revenues and upstream and downstream shoreside economic multiplier effects based on the unlikely assumption that all fishing effort in the SWDA ceases and all fishing revenues from the SWDA are lost and not recouped as a result of fishing effort shifting to other areas for the entire life of New England Wind. Based on the very unrealistic assumption that economic impacts equal economic exposure which, annual direct, indirect, and induced economic impacts is shown to total approximately $1.7 million annually or approximately $49.7 million over the 30-year life of New England Wind.

Table 6b shows losses in fishing revenues and related shoreside economic impacts based on the assumption that at least some of the reduced fishing effort in the SWDA will be diverted to other areas where it will generate at least some fishing revenues lost in the SWDA. In Table 6b direct and indirect economic impacts are shown based on the assumption that 25%, 50%, or 75% of fishing revenues lost in the SWDA will be recouped as a result of fishing revenue shifting from the SWDA to other areas. Under these circumstances, annual economic exposure and related direct, indirect, and induced economic impacts would be less than economic exposure and would vary as follows:

- If 25% of fishing revenue lost in the SWDA is recouped, annual economic exposure and related direct, indirect, and induced economic impacts are shown to total approximately $1.2 million annually or $37.3 million over the 30-year life of New England Wind.

- If 50% of fishing revenue lost in the SWDA is recouped, annual economic exposure and related direct, indirect, and induced economic impacts are shown to total $828,659 annually or $24.9 million over the 30-year life of New England Wind.

- If 75% of fishing revenue lost in the SWDA is recouped, annual economic exposure and related direct, indirect, and induced economic impacts are shown to total $414,329 annually or $12.4 million over the 30-year life of New England Wind.

1.0 INTRODUCTION

1.1 Context

New England Wind is the proposal to develop offshore renewable wind energy facilities in BOEM Lease Area OCS-A 0534 along with associated offshore and onshore cabling, onshore substations, and onshore O&M facilities. New England Wind will be developed in two Phases with a maximum of 130 WTG and ESP positions located in the 453 sq km (175 sq mi) of the SWDA (See Figure 1). Four or five offshore export cables installed along the OECC will transmit electricity generated by the WTGs to onshore transmission systems in the Town of Barnstable, Massachusetts. The OECC is the corridor identified for routing both the Phase 1 and Phase 2 offshore export cables between the SWDA and the landfall sites. Each Phase of New England Wind will be developed using a Project Design Envelope that defines and brackets the characteristics of the facilities and activities for purposes of environmental review while maintaining a reasonable degree of flexibility with respect to the selection of key components, such as the WTGs, foundations, offshore cables, and ESPs.

New England Wind's offshore renewable wind energy facilities are located immediately southwest of Vineyard Wind 1, which is located in Lease Area OCS-A 0501. New England Wind will occupy all of Lease Area OCS-A 0534 and potentially a portion of Lease Area OCS-A 0501 in the event that Vineyard Wind 1 does not develop "spare" or extra positions included in Lease Area OCS-A 0501 and Vineyard Wind 1 assigns those positions to Lease Area OCS-A 0534. For the purposes of the COP, the SWDA is defined as all of Lease Area OCS-A 0534 and the southwest portion of Lease Area OCS-A 0501, as shown in Figure 1. The SWDA may be approximately 411–453 sq km (101,590– 111,939 acres) in size depending upon the final footprint of Vineyard Wind 1. At this time, the Proponent does not intend to develop the two positions in the separate aliquots located along the northeastern boundary of Lease Area OCS-A 0501 as part of New England Wind (see Figure 1). The SWDA (excluding the two separate aliquots that are closer to shore) is just over 32 km (20 mi) from the southwest corner of Martha's Vineyard and approximately 38 km (24 mi) from Nantucket. The WTGs and ESPs in the SWDA will be oriented in an east-west, north-south grid pattern with one NM (1.85 km) spacing between positions.

While the Proponent intends to install all four or five New England Wind offshore export cables within the OECC that travels from the SWDA northward through the eastern side of Muskeget Channel towards landfall sites in the Town of Barnstable, the Proponent is reserving the fallback option to install one or two Phase 2 cables along the western side of Muskeget Channel, referred to as the Phase 2 OECC Western Muskeget Variant[1] (see Section 4.1.3.2 of COP Volume I). Throughout this section, unless the Western Muskeget Variant is specified, "the OECC" refers to the OECC that travels along the eastern side of Muskeget Channel. Commercial fishing vessels using fixed and mobile gear operate in and around the SWDA and OECC, and travel through these areas as they transit between fishing ports and fishing grounds (see Figure 3). Fishing vessels will

not be precluded from operating in or transiting through the SWDA or the OECC other than where temporary safety buffer zones are established around where construction and installation vessels are operating.

Sources of Potential Economic Exposure in the SWDA

Construction activity in the SWDA during Phase 1 is expected to take between approximately one and a half and two years. For Phase 2, the duration of offshore construction activity will depend on the final number of WTGs included but is also expected to take between one and a half to two years. As noted above, during construction and installation, fishing vessels will only be precluded from operating in or transiting through temporary safety buffer zones established around where construction and installation vessels are operating. During O&M of New England Wind, fishing vessels will not be restricted in the SWDA other than where temporary safety buffer zones may be established around limited in-water maintenance activities. It is expected that some commercial fishing vessels may need to modify transit routes or fishing tracks in the SWDA to account for the presence of WTGs and ESPs. New England Wind may also result in some fishing effort shifting from the SWDA to other areas. Potential changes in fishing revenues associated with potential changes in commercial fishing practices in the SWDA or fishing effort shifting from the SWDA to other areas are the primary sources of New England Wind's potential economic impacts on commercial fishing.

For the purposes of this report, the maximum envelope or impact area for New England Wind was used to estimate the economic exposure of commercial fishing and related direct economic impacts. It should be noted that due to the varying size of Vineyard Wind 1, the maximum size of the SWDA includes an overlap area with the Vineyard Wind 1 COP boundary, as shown in Figure 4. As a result, the estimated economic exposure described for the SWDA in this report includes a portion of the economic exposure that has already been attributed to Vineyard Wind 1 in the COP for that project and is already addressed in the commercial fishing compensation funds established for that project. More specifically, Vineyard Wind 1 LLC voluntarily established gear loss and revenue compensation funds for Vineyard Wind 1 including:

- The $4.2 million Rhode Island compensation fund, which will compensate Rhode Island vessels or fisheries interests for any claims of direct impacts in the Vineyard Wind 1 COP area.

- The approximately $19.2 million Massachusetts compensation fund, which will compensate Massachusetts vessels or fisheries interests for any claims of direct, downstream, and cumulative (upstream) impacts in the Vineyard Wind 1 COP area.

- The $3.3 million other states' compensation fund, which will compensate Connecticut, New Jersey, and New York vessels or fisheries interests for any claims of direct, downstream, and cumulative (upstream) impacts in the Vineyard Wind 1 COP area.

- The $12.5 million Rhode Island Fisherman's Future Viability Trust, which will be used to further the policies of the Ocean Special Area Management Plan with respect to the continued viability and success of Rhode Island's fishing industry and to support the compatibility of offshore wind and commercial fishing interests within Rhode Island's geographic location description.

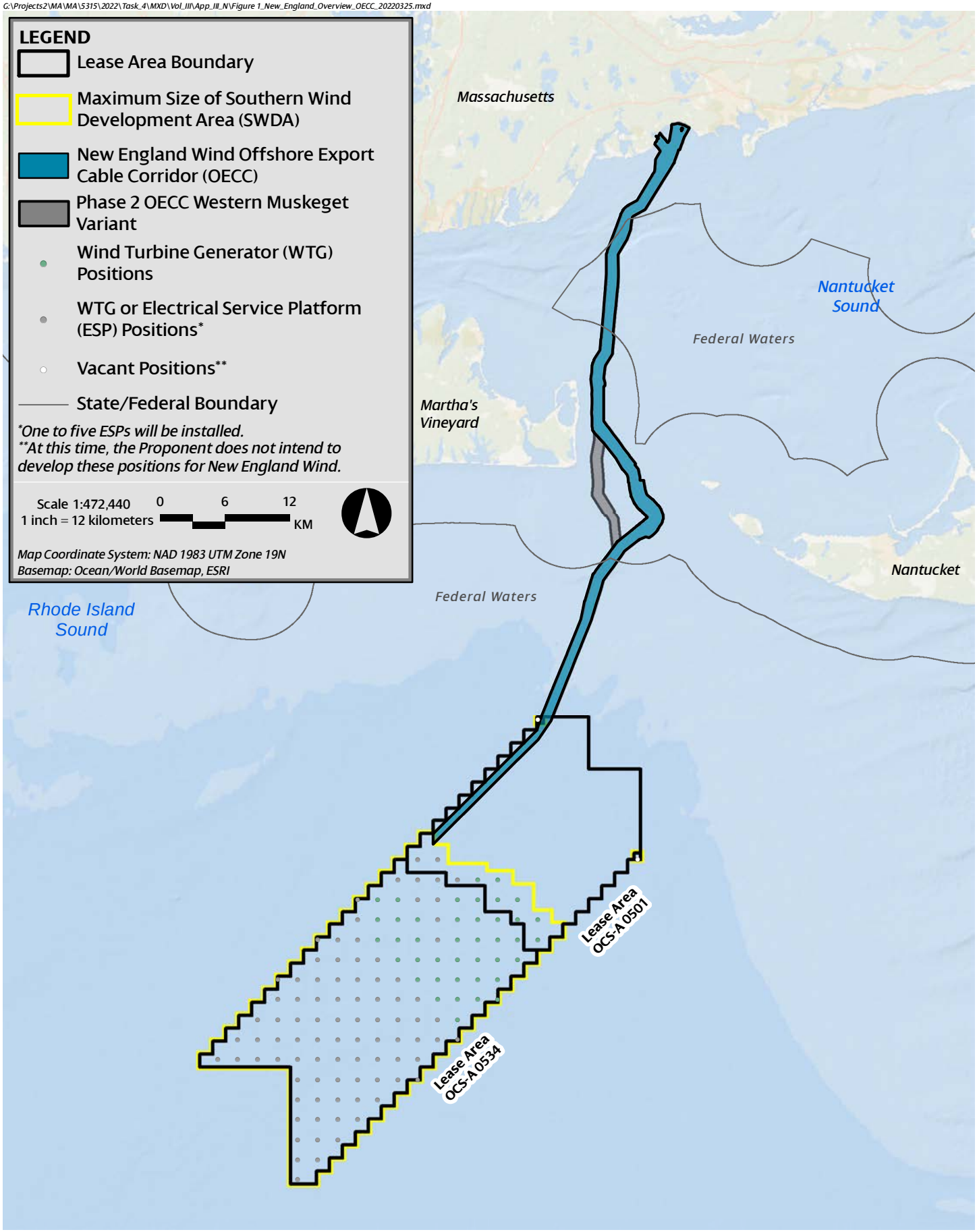
- The $1.75 million Massachusetts Fisheries Innovation Fund, which will support grants for technology and innovation upgrades for fishery participants and vessels.

This report also addresses potential indirect economic impacts that New England Wind may have on commercial fishing and on fishery-dependent shoreside businesses. These are associated with: (1) potential increases in fishing vessel transit times, (2) potential for fishing effort diverted from the SWDA to cause adverse "fishing congestion" impacts in other areas,[4] and (3) potential for reduced fishing effort and fish landings in the SWDA and OECC to cause economic losses in shoreside businesses that either support commercial fishing (upstream economic impacts) or rely on commercial fish landings (downstream economic impacts).

Sources of Potential Economic Exposure in the OECC

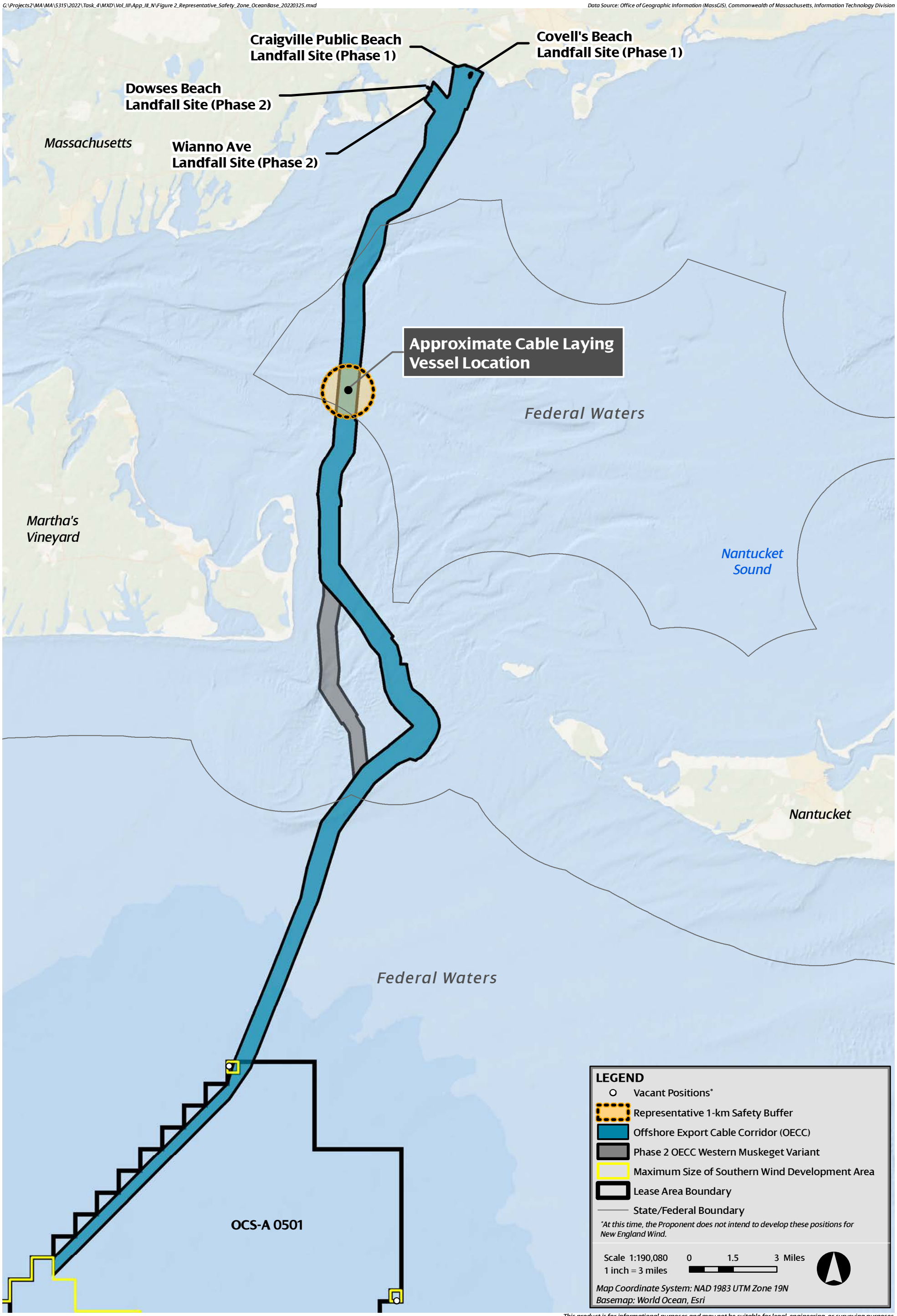
Four or five offshore export cables will be installed in the OECC with two installed over approximately nine months during Phase 1 and three being installed over approximately 13.5 months during Phase 2. Although cable installation may be spread out over up to 1.875 years, it will be taking place along small segments of the OECC (including the Western Muskeget Variant) at any given time and commercial fishing at any given time is expected to be impacted in an area of approximately 3.14 sq km (Figure 2). As a result, the installation of offshore export cables in the OECC is expected to have minimal impact on commercial fishing.

The offshore export cables will have a target burial depth of 1.5 to 2.5 m (5 to 8 ft) below the seafloor, which the Proponent's engineers have determined is more than twice the burial depth required to protect the cables and prevent them from interfering with commercial fishing operations. However, while the Proponent will make every effort to achieve that target burial depth, it is conservatively estimated that bottom conditions may prevent achieving proper cable burial depth along up to approximately 6% of the OECC for both Phases (or up to 7% of the OECC for both Phases if the Western Muskeget Variant is used for one or two Phase 2 export cables), which may require cable protection to be installed on the seafloor. Cable protection will be designed to minimize impacts to fishing gear to the maximum extent practicable, and fishermen will be informed about where cable protection is used. Because the use of mobile bottom fishing gear in the OECC is very limited, potential fishery-related economic losses associated with cable protection in the OECC (including the Western Muskeget Variant) are expected to be very low. The Proponent will also develop and implement procedures to compensate fishermen for any unexpected economic losses associated with gear damage resulting from cable protection.



New England Wind
AVANGRID RENEWABLES

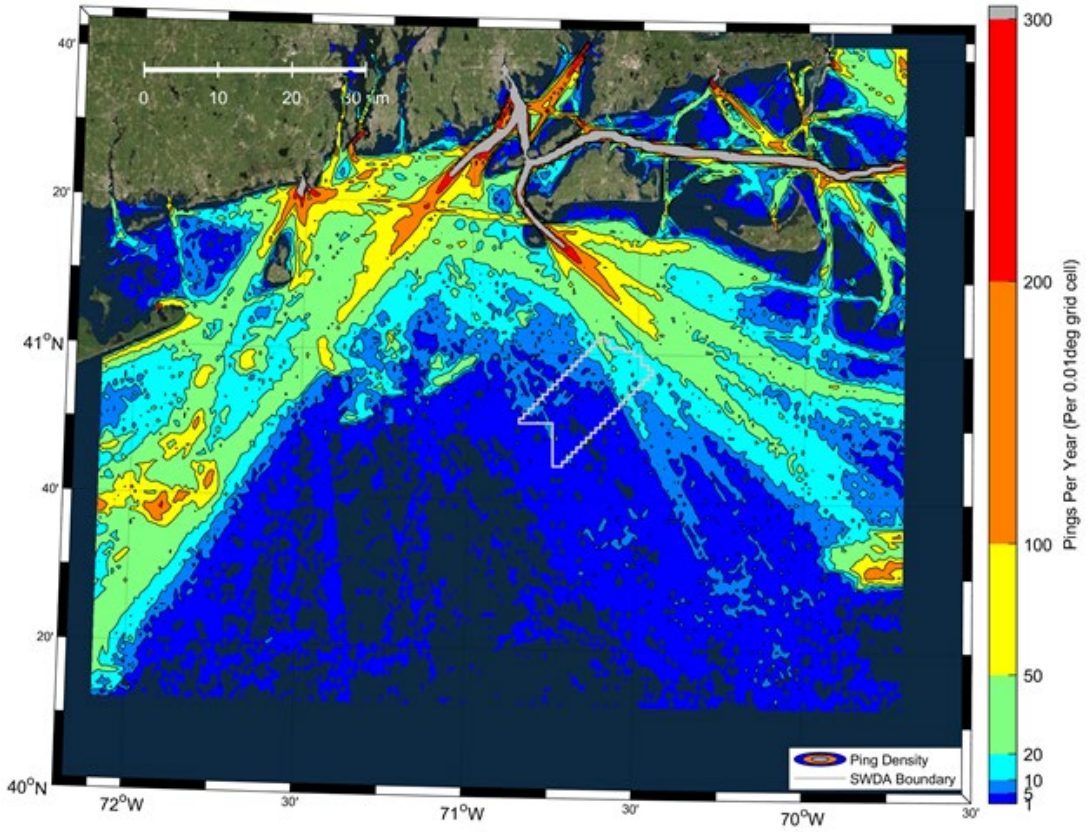
Figure 1
New England Wind Overview



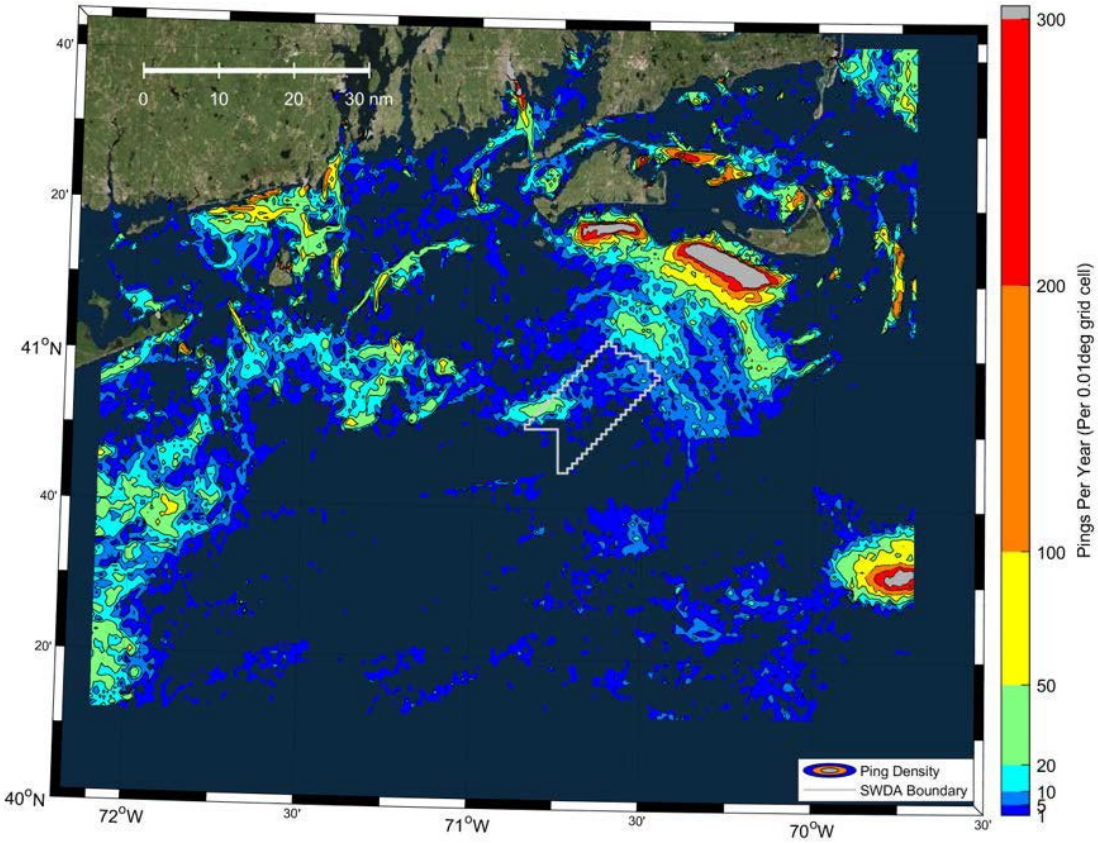
This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

Figure 2

Representative Safety Buffer Zone for Cable Installation in the OECC



AIS Vessel Traffic Density Plot for Transiting Fishing Vessels (>4 knots)



AIS Vessel Traffic Density Plot for Trawling Fishing Vessels (<4 knots)

Figure 3

Fishing Vessel Activity In and Around the SWDA (2016-2019 AIS Data)

1.2 Focus

BOEM states that "*economic exposure* refers to potential economic impacts, not predicted or expected economic impacts" (Kirkpatrick et al. 2017) and refers to it as "a starting point to understanding potential *economic impacts* of future offshore wind project development if a harvester opts to no longer fish in the area and cannot recapture that income in a different location." BOEM emphasizes that "revenue exposure measures should not be interpreted as a measure of economic impact or loss." (BOEM 2021) and that "if alternative fishing grounds are available nearby and may be fished at no additional cost, the *economic impact* will be lower than estimated *economic exposure*" (BOEM 2018).

This report develops estimates of the economic exposure of commercial fisheries to New England Wind and provides guidance for using them "as a starting point" to determine expected economic impacts of New England Wind on commercial fisheries and fishery-related shoreside businesses. Following BOEM guidance, estimates of economic exposure are developed based on the assumption that New England Wind will result in the cessation of all fishing activity in the SWDA and in areas of active construction along the OECC resulting in the loss of all related fishing revenues from those areas with none of those lost revenues recouped as a result of fishing effort shifting from the SWDA and OECC to other fishing areas.

As stated above, however, BOEM guidance indicates that expected economic impacts will be less than economic exposure if fishing vessel operators can adapt and recoup at least some lost revenues by shifting fishing effort from impacted areas to other nearby areas. In the case of New England Wind, both the SWDA and OECC (including the Western Muskeget Variant) will remain open to fishing so fishing vessel operators will have the opportunity to retain at least some fishing revenues by continuing to operate in those areas as well as to recoup at least some lost fishing revenues from those areas by diverting fishing effort to other nearby fishing areas.

Although this report focuses on economic exposure, it is highly unlikely that New England Wind will cause fishing vessels to cease fishing in the SWDA and OECC (including the Western Muskeget Variant) without diverting fishing effort from those areas to other areas or that fishing in those other areas will generate no fishing revenues. This implies that in the case of New England Wind, fishery-related economic impacts should be expected to be significantly lower than economic exposure.

As used in this report, "fishing values" refers to the ex-vessel dollar value of commercial fish landings and "economic exposure" refers to the maximum potential loss of fishing values that would result if New England Wind caused all fishing effort in the SWDA and in areas of active construction along the OECC (including the Western Muskeget Variant) to stop and not be diverted to other fishing areas. The term "expected economic impacts" refers to expected losses in fishing values under the following two assumptions: (1) some of the fishing effort in the SWDA and OECC (including the Western Muskeget Variant) prior to New England Wind will continue in those areas or be diverted to nearby areas over the life of New England Wind, and (2) continued fishing effort in and around the SWDA and OECC will experience an average catch per unit fishing

effort (CPUE) greater than zero. That is, fishing effort in the SWDA with New England Wind will continue to generate at least some of the fishing values that were generated in the SWDA prior to New England Wind which will result in expected economic impacts being less than economic exposure.

This report focuses on commercial fisheries, not recreational fisheries, and potential impacts of New England Wind on fishing activity and related shoreside businesses, not potential New England Wind impacts on fish resources.[5] This focus limits the range of potential economic impacts that are addressed in the report to direct economic impacts related to commercial fishing and indirect impacts related to industries that either supply inputs to commercial fishing (e.g., bait, fuel, dockage) or rely on commercial landings (e.g., seafood processors and dealers). No attempt is made to trace potential impacts of New England Wind on fish population dynamics or impacts related to purchases and sales by businesses and households in sectors of the United States (US) economy that are not directly related to or dependent on New England-based commercial fishing.[6]

This report focuses primarily on the most significant source of economic exposure and economic impact from New England Wind, which is:

- **Potential losses in fishing values in the SWDA** as a result of commercial fishing being potentially impaired by the presence of WTGs and ESPs in the SWDA during the approximately 30-year operational life of New England Wind and being precluded from parts of the SWDA during approximately one and a half to two years of offshore construction activity during each Phase.

The report also addresses four less significant categories of potential economic impacts, including:

- **Potential losses in fishing values in the OECC** resulting from commercial fishing being precluded from small segments of the OECC (including the Western Muskeget Variant) during cable installation.[7]

- **Potential costs associated with increased fishing vessel transit times** if New England Wind results in fishing vessels that typically steam through the SWDA using less direct routes through or around the SWDA as they transit between fishing ports and fishing areas.

- **Potential costs associated with increased fishing congestion** outside the SWDA and OECC (including the Western Muskeget Variant) if enough fishing effort is diverted from those areas to other fishing areas to cause "fishing power penalties" that result in lower fishing revenues, higher fishing costs, or both.[8]

- **Potential economic losses in shoreside businesses** that either support fishing activity in the SWDA and OECC (referred to as upstream impacts) or purchase, process, and/or trade fish landed from the SWDA and OECC (including the Western Muskeget Variant) (referred to as downstream impacts).

Nearly all commercial fishing vessels that operate in the SWDA and the OECC (including the Western Muskeget Variant) are based at ports located in Massachusetts, Rhode Island, Connecticut, New York, and New Jersey and land and sell their harvests at ports in those five states (referred to as the "Offshore Development Region"). This report provides estimates of economic exposure related to fishing industries in each of these states and does not address occasional harvests of very small amounts of fish from the SWDA and OECC (including the Western Muskeget Variant) by fishing vessels based in other states.[9]

1.3 Format

After this introduction (Section 1.0), this report contains the following four sections:

Section 2.0—Approach and Assumptions

Section 2.0 summarizes data sources and research reports that provide the basis for estimating fishing values in the SWDA and the OECC (including the Western Muskeget Variant). It also describes why fishing revenue data for the New England Wind area that was posted recently on NOAA-Fisheries website titled *Socio-economic Impacts of Atlantic Offshore Wind Development* is used in this report to form the basis of the analysis of economic exposure presented in Section 3.0 and the analysis of expected economic impacts presented in Section 4.0.

Section 2.0 also explains why potential impacts on fish resources are not addressed in this report as well as why certain other potential impacts were determined to be insignificant and are not addressed in this report.[10]

Section 3.0—Estimates of Economic Exposure and Baseline Fishing Values

Section 3.0 uses the most reliable fishing revenue data available from the recently published NOAA-Fisheries website to estimate annual fishing values for the SWDA ($685,692) and for areas of cable installation in the OECC during periods of cable installation ($15,372). These values are expressed in 2019 dollars and are used in Section 3.0 as measures of economic exposure and in Section 4.0 as baseline fishing revenue values for estimating expected economic impacts which are significantly less than full economic exposure.

Section 4.0—Expected Economic Impacts

Section 4.0 assesses fishery-related economic impacts based on the assumption that New England Wind will not result in an overall decline in fishing effort but may require modifications of fishing practices that could result in fishing revenue losses that will be 25%, 50%, or 75% of estimated economic exposure. This section also includes assessments of economic impacts associated with potential increases in fishing vessel transit times, potential increases in fishing congestion, and potential impacts on shoreside businesses that rely on commercial fishing.

Section 5.0—Summary and Conclusions

This final section of the report presents a summary of results from previous sections and draws conclusions about the difference between maximum potential fishing revenue and shoreside business losses based on full economic exposure and expected fishing revenue and shoreside business losses that could result from New England Wind.

2.0 APPROACH

2.1 Background

There are two sources of potential fishery-related economic impacts from New England Wind: those associated with construction and operation of WTGs and ESPs in the SWDA and those associated with the installation and use of submarine cables within the OECC (see Figure 1).

Temporary safety buffer zones will be established around where construction and installation vessels are operating in the SWDA and OECC which will require some commercial fishing vessels to alter their fishing patterns or navigation routes. These temporary safety buffer zones will be imposed only during construction and installation and will not affect the entire SWDA or OECC (including the Western Muskeget Variant) at any given time. During the O&M phase of New England Wind there are expected to be no restrictions on commercial fishing vessels operating in or transiting through the SWDA or the OECC other than where temporary safety buffer zones may be established around ships engaged in limited in-water maintenance activities.

Based on established fishery economic theory, each Phase of New England Wind could result in fishery-related economic impacts along two distinct pathways: (1) effects on fish resources that reduce the abundance, availability, or catchability of fish, and (2) effects on fishing activity that result in reduced fishing effort in the form of lost fishing time or reduced fishing power. For the purpose of estimating economic exposure, it is not necessary to assess potential impacts on fish resources because economic exposure assumes all fishing values from the SWDA and OECC will be lost and not replaced by fishing effort shifting to other areas. Since estimates of economic exposure are based on fishing values in past years when New England Wind did not exist, they cannot be affected by any estimates of potential future impacts of New England Wind on fish resources inside or outside these areas.[11]

2.2 Data Sources

Until 2020 four reliable sources of fishing revenue data were available for the SWDA or for larger ocean areas that include the SWDA. These are listed and described in Table 1 as Source 1 through Source 4. Also listed in Table 1 as Source 5 is a new website called *Socio-economic Impacts of Atlantic Offshore Wind Development* that was developed and opened to the public by GARFO/NOAA-Fisheries in October 2020.[12] This website includes what are now the most reliable and current estimates of annual fishing revenues in each offshore wind lease and project area in New England and Mid-Atlantic waters, including the New England Wind area, which NOAA-Fisheries refers to on the website as Vineyard Wind 2 or Park City Wind (0501 remainder). The new NOAA-Fisheries website contains tables that present annual fishing revenues in the Vineyard Wind 2 area during 2008 through 2019 by species, gear-type, port, and state based on a combined analysis of vessel trip reports (VTRs) and dealer reports.

Two sets of upward adjustments were made to the fishing revenue estimates for the Vineyard Wind 2 area presented on the NOAA-Fisheries website. The first was to account for harvests of American lobster and Jonah crab by vessels that land only those two species and are not required to file VTRs. These adjustments are explained in Section 3.1.2 and were based on imputing average annual lobster and Jonah crab revenues for vessels that do not file VTRs using data related to numbers of traps permitted to those vessels and fishing revenues from those two species per permitted trap for vessels that do file VTRs.

The second adjustment was based on differences between the size of the SWDA, which is the focus of this report, and the Vineyard Wind 2 area as reported in NOAA-Fisheries' July 2021 update to its Commercial Fishing/Offshore Wind website. The July 2021 update to the website summarizes fishing activity and fishing revenue data within two separate geographic study areas, which NOAA-Fisheries refers to as Vineyard Wind 1 and Vineyard Wind 2 (NOAA 2021). However, the SWDA occupies an area larger than the area designated as Vineyard Wind 2 on the NOAA-Fisheries website. As shown on Figure 4, the SWDA includes the entire 369 sq km (143 sq mi) of NOAA-Fisheries' Vineyard Wind 2 study area plus an approximately 84 sq km (32 sq mi) overlap area along the southern boundary of NOAA-Fisheries' Vineyard Wind 1 study area. The overlap area [which is shaded on Figure 4] also includes two vacant positions in the separate aliquots along the northeastern boundary of Lease Area OCS-A 0501. At this time, the Proponent does not intend to develop this position as part of New England Wind). For this reason, estimates of revenue exposure and landings values for the SWDA used in this report are based on combining NOAA-Fisheries' Vineyard Wind 2 study area estimates of revenue and commercial landings with those in the approximately 84 sq km (32 sq mi) of the Vineyard Wind 1 study area that are part of the SWDA. As described in Section 1.1, Vineyard Wind 1 LLC voluntarily established gear loss and revenue compensation funds for this 84 sq km (32 sq mi) overlap area as part of the Vineyard Wind 1 review and approval process.

The estimates of annual fishing revenues for the SWDA in this report, as shown in Tables 2, 3a, 3b, 6a, and 6b, and referenced throughout the text, are sums of the average fishing values per sq km within NOAA's Vineyard Wind 1 study area multiplied by the approximately 84 sq km (32 sq mi) of overlapping area (Figure 4), plus fishing revenues reported by NOAA-Fisheries for the Vineyard Wind 2 study area. Fishing revenue estimates are based on NOAA's analysis of combined data from VTRs and dealer reports for years 2008 through 2019 submitted by vessels with permits for managed species in federal waters (i.e., outside of three nautical miles from shore). All values reported in these tables are deflated to 2019 dollars.

Vessel Trip Report Data

NOAA-Fisheries requires nearly every federally permitted fishing vessels to submit vessel trip reports (VTRs) for all fishing trips. VTRs provide data about when and where "the majority of fishing effort occurred" and each report includes the trip date, number of crew on board the vessel, species and quantities caught, and the trip location. Vessel permit data associated with each VTR includes additional information about a vessel's "principal port" as well as other

LEGEND

- Maximum Size of Southern Wind Development Area (SWDA)
- Lease Area
- Wind Turbine Generator (WTG)
- Wind Turbine Generator or Electrical Service Platform (ESP) Positions
- Vacant
- NOAA Fisheries Vineyard Wind 1 (0501) Study Area Boundary
- NOAA Fisheries Vineyard Wind 2/Park City Wind (0501 remainder) Study Area Boundary
- NOAA Fisheries Vineyard Wind 1 (0501) Study Area Boundary and Maximum SWDA Overlap Area

**At this time, the Proponent does not intend to develop these positions for New England Wind.*

Scale 1:335,164
1 inch = 9 km

0 4.5 9 Km

Map Coordinate System: NAD 1983 UTM Zone 19N
Basemap: 2018 World Imagery, Esri

Lease Area OCS-A 0501

Lease Area OCS-A 0534

SWDA Boundary

NOAA Fisheries Vineyard Wind 1 (0501) Study Area Boundary

NOAA Fisheries Vineyard Wind 2/Park City Wind (0501 remainder) Study Area Boundary

NOAA Fisheries Study Area Boundaries

Source: https://www.fisheries.noaa.gov/resource/data/socioeconomic-impacts-atlantic-offshore-wind-development

Vineyard Wind 1

Overlap Area
84 square kilometers

New England Wind Phase 1 (Park City Wind) and New England Wind Phase 2 (Commonwealth Wind)

NOAA Fisheries Vineyard Wind 1 (0501) Study Area Boundary

Lease Area OCS-A 0501

NOAA Fisheries Vineyard Wind 2/Park City Wind (0501 remainder) Study Area Boundary

Lease Area OCS-A 0534

Overlay of SWDA and NOAA Fisheries Study Area Boundaries

New England Wind
AVANGRID RENEWABLES

Figure 4
NOAA Fisheries 2021 Study Area Boundaries for Vineyard Wind 1 and Vineyard Wind 2

variables describing the vessel itself (e.g., length, horsepower, and age). VTR databases maintained by NOAA-Fisheries provide a comprehensive overview of fishing activity for most commercial fisheries active in the Offshore Development Region and are available, with all confidential data removed or concealed, to fishery researchers outside of NOAA-Fisheries.

Vessel Monitoring System Data

Vessel monitoring system (VMS) data are collected through a satellite monitoring system that is used primarily for monitoring the location of commercial fishing vessels working in US federal waters. According to NOAA-Fisheries (NOAA 2020a), the system uses satellite-based communications from onboard transceiver units, which certain vessels are required to carry. The transceiver units typically send position reports once per hour. These reports include vessel identification, time, date, and location, and are mapped and displayed on the end user's computer screen. These data make it possible to calculate the approximate speed that the vessel is travelling. The data can then be filtered by estimated vessel-speed, depending on the gear and fishery, to indicate whether it is likely that a vessel in a particular area is fishing rather than transiting. Such filtering does not provide an absolute indication of fishing activity as vessels may transit through harbors and other confined waters at slower speeds that are consistent with fishing activity.

Landings Data

Commercial landings data maintained by NOAA-Fisheries and by individual states are compilations of federal and state landings reports submitted by dealers. These data represent a census of the volume and value of finfish and shellfish landed and sold at the dock. Statistics included in landings data provide information on the pounds and ex-vessel dollar value of landings identified by species, year, month, state, county, port, and fishing gear. Most states obtain their landings data from seafood dealers who submit monthly reports of the weight and value of landings by vessel. However, landings data may also be based on mandatory trip-tickets that are filled out by seafood dealers and fishermen at the end of every fishing trip, indicating the volume and value of landings by species.

2.3 Assumptions

In order to use fishing revenue data to estimate the economic exposure of commercial fishing to New England Wind assumptions must be made about thresholds or minimum standards for defining what BOEM refers to as fishing values that "may be impacted"[13] (Kirkpatrick et al. 2017). For the purposes of this report, it is assumed that all fishing values in the SWDA and in areas of cable installation in the OECC (including the Western Muskeget Variant) "may be impacted." It is also assumed that fishing values outside the SWDA and OECC "may be impacted" if New England Wind can be expected to result in either increased fishing vessel transit times, which add to transit costs and potential lost fishing time, or increased fishing congestion impacts in areas outside the SWDA.[14]

The annual fishing revenue data for the SWDA provided for years 2008 through 2019 in the new GARFO/NOAA-Fisheries website provide a basis for detecting any significant trends in annual landings values in the SWDA that should be considered when projecting fishing values and revenue exposure in future years based on past year fishing revenues. While a time series analysis of annual fishing revenues in the SWDA related to some species showed typical inter-annual fluctuations and some slight trends, they differed in direction and magnitude from one species to another and no significant upward trends were observed in overall fishing revenues, except those related to fish prices.[15] This report, therefore, uses average fishing values during 2008-2019, expressed in 2019 dollars, as a basis for estimating economic exposure and expected economic impacts in future years.[16]

2.4 Indicators of Economic Exposure in the SWDA

BOEM (2020) publishes single-year revenue-intensity rasters, which are digital maps that use VTR data merged with at-sea fisheries observer data, to display what is called the Fishing Revenue Density (FRD) in various Atlantic Ocean areas. These FRD rasters display how average annual fishing revenues per ¼ square kilometer differ from one ocean location to another and from year to year. FRD rasters available for the area that includes the SWDA express mean annual revenues based on all species covered by fishery management plans from 2013 to 2018.

Figure 5 through Figure 7 show FRDs for the SWDA and surrounding waters and provide two types of useful general indicators: how much fishing revenues might be exposed to impacts from New England Wind; and how much fishing revenues lost in the SWDA might be recouped as a result of fishing effort shifting from the SWDA to adjacent and very nearby fishing areas.[17] The figures show relatively low FRDs inside the SWDA and significantly higher FRDs outside the SWDA. This provides context for assessing the magnitude of potential fishing revenue impacts presented in this report by confirming three observations:

- The SWDA is not a high value fishing area.
- The SWDA is surrounded by many high value fishing areas.
- Fishing revenues are uniformly distributed within the SWDA.

2.5 Indicators of Economic Exposure Along the OECC

2.5.1 During OECC Construction

As described in Section 6.6 of COP Volume III, potential impacts of the OECC on fish resources and fishing activity are expected to be minor and short-term because:

- Installation of offshore export cables in the OECC will take place over an average period of just less than one year (approximately 9 months) during Phase 1 and just over 1 year (approximately 13.5 months) during Phase 2; cable installation for each Phase may or may

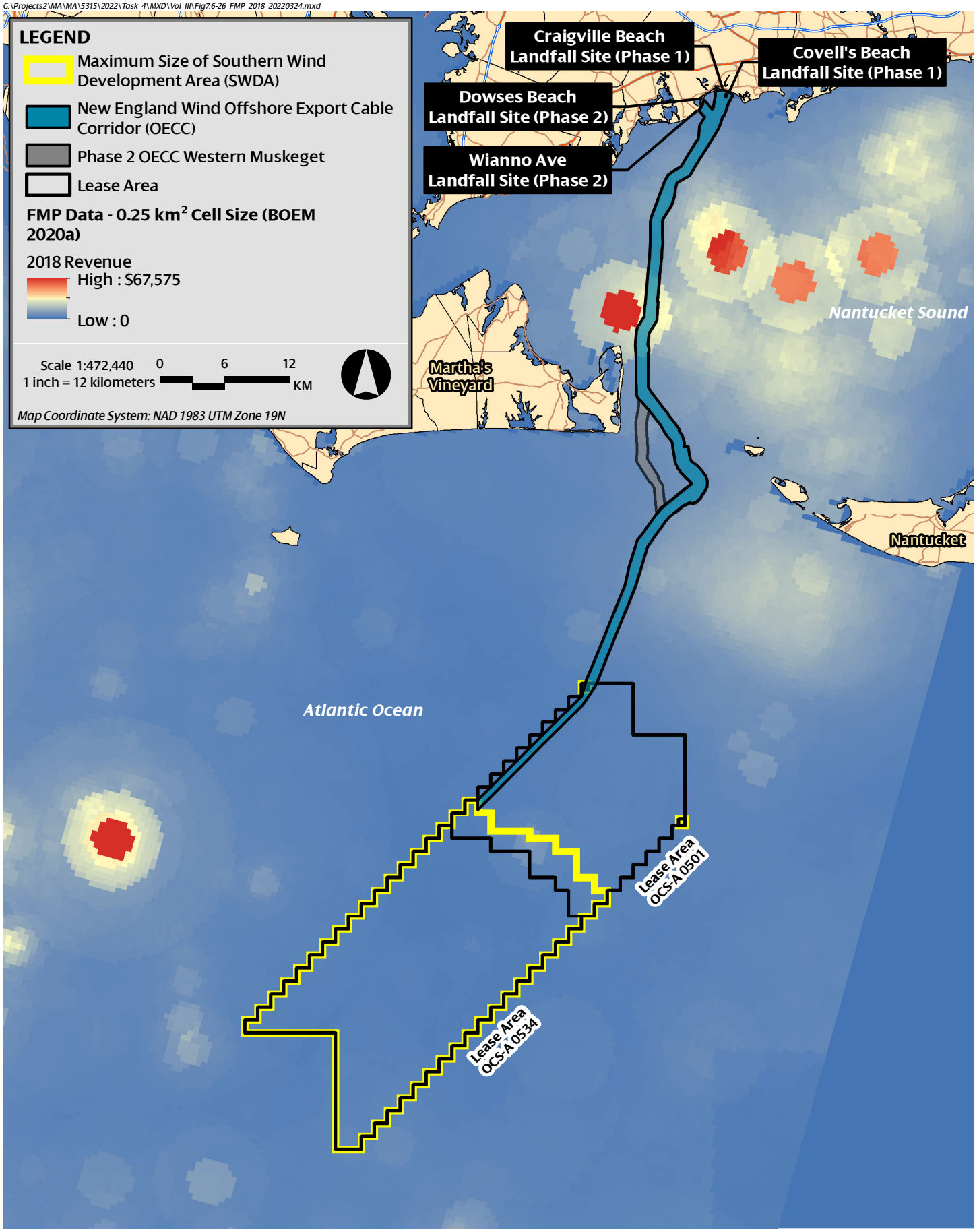


Figure 5

Fishing Revenue Density, All Fishery Management Plans, 2018

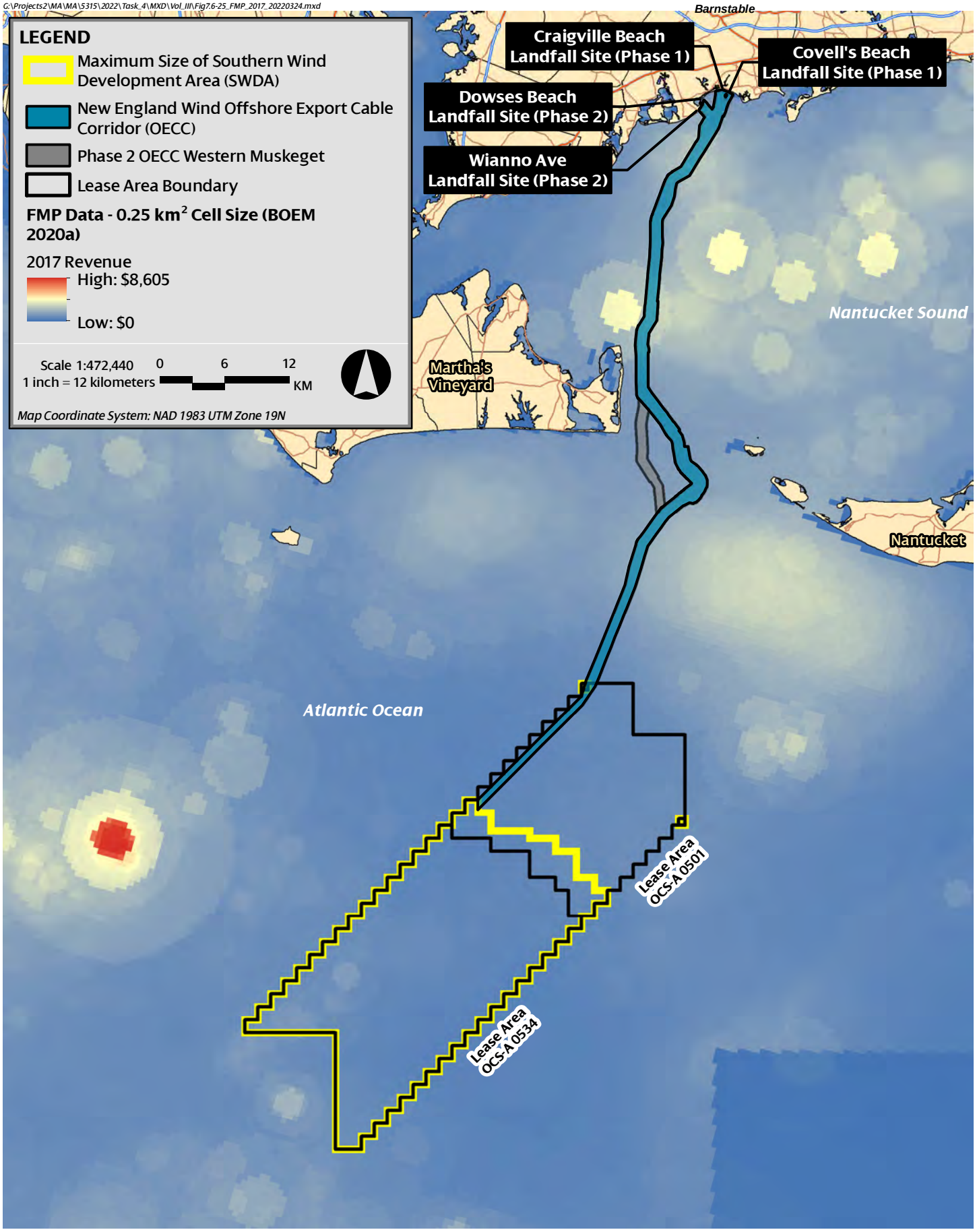
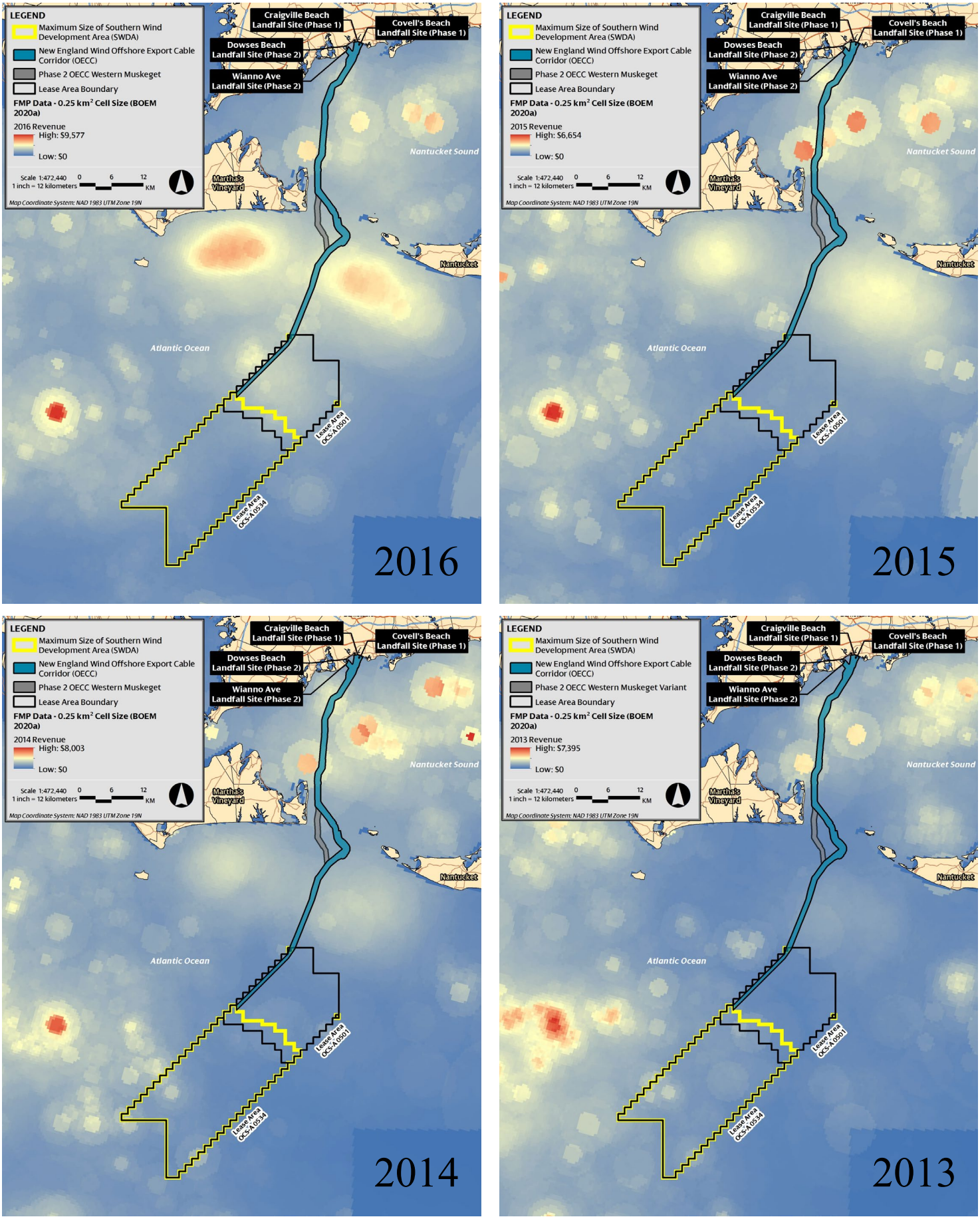


Figure 6

Fishing Revenue Density, All Fishery Management Plans, 2017



New England Wind
AVANGRID RENEWABLES

Figure 7

Fishing Revenue Density, All Fishery Management Plans, 2013-2016

not be continuous and may occur over one or two years. Cable installation activity will take place along small segments of the OECC at any given time (including the Western Muskeget Variant).

- During cable installation, fishing vessels will not be precluded from operating within the OECC (including the Western Muskeget Variant) except where temporary safety buffer zones are established around where construction and installation vessels are operating. Based on an expected safety buffer of 1 km (0.62 mi), these safety zones are expected to preclude fishing in an area of approximately 3.14 sq km (1.21 sq mi).

2.5.2 After OECC Construction

The offshore export cables will have a target burial depth of 1.5 to 2.5 m (5 to 8 ft) below the seafloor, which the Proponent's engineers have determined is more than twice the burial depth that is required to protect the cables and prevent them from interfering with fishing activity. After installation, therefore, fully buried cables in the OECC (including the Western Muskeget Variant) can be expected to have no impact on commercial fishing. However, while the Proponent will make every effort to achieve sufficient burial depth, it is estimated that seafloor conditions may prevent achieving proper burial depth along up to approximately 6% of the OECC for both Phases (or up to 7% of the OECC for both Phases if the Western Muskeget Variant is used for one or two Phase 2 export cables), which may require cable protection to be installed on the seafloor. It is not possible at this time to determine the likelihood or potential magnitude of gear damage or loss along the OECC or related losses in fishing time that could result from mobile bottom- fishing gear snagging on cable protection. However, based on VTR and VMS data and other fishing records, there is very little bottom fishing in the OECC area (including the Western Muskeget Variant), so it is reasonable to expect that risks and potential losses in fishing values in the OECC after construction will be very small. The Proponent is expected to establish a protocol to address any economic losses associated with gear loss/damage or lost fishing time related to New England Wind on a case-by-case basis if and when they occur.

3.0 ESTIMATES OF ECONOMIC EXPOSURE

3.1 Economic Exposure in the SWDA

A three-step process was used to estimate fishing values in the SWDA.

- Step 1 - Estimate the average annual dollar value of the SWDA harvest during 2008-2019 based on data from NOAA (2021), as described in Section 2.2. These values do not include the value of American lobster (*Homarus americanus*) and Jonah crab (*Cancer borealis*) harvested by vessels that only land those two species and are not required to file VTRs.

- Step 2 - Estimate the dollar value of annual harvests of lobster and Jonah crab in the SWDA by vessels that do not file VTRs based on an analysis of fishing revenues per permitted trap for vessels that file VTRs, and numbers of traps permitted to vessels that do not file VTRs.

- Step 3 - Add the results of Step 1 and Step 2 to arrive at final estimates of annual fishing values, expressed in 2019 dollars, to provide a measure of annual economic exposure in the SWDA and a basis for estimating expected economic impacts.

3.1.1 Unadjusted Estimates of Fishing Values for the SWDA

Table 2 presents annual fishing revenues generated in the SWDA (i.e., the Vineyard Wind 2 area and the overlapping portion of Vineyard Wind 1) during 2008-2019, valued in 2019 dollars, based on NOAA (2021). These annual values range from $310,023 to $1,096,868 and average $569,360 and are referred to in this report as "unadjusted" because they do not include the value of lobster and Jonah crab landings harvested in the SWDA by vessels that fish only for those two species and do not file VTRs.[18]

3.1.2 Adjustments for Lobster and Jonah Crab

VTR records used to develop annual fishing values presented in Table 2 need to be adjusted to account for lobster and Jonah crab landings by vessels that land only these two species and do not file VTRs. In addition to VTR-reported landings of these two species, federal fishing permit data are available that show how many pots are permitted to fish for lobster and Jonah crab in Lobster Management Area 2 (LMA 2), which includes the SWDA.[19] From the federal permit data, it is possible to identify the number of pots permitted to vessels that file VTRs and to vessels that do not file VTRs. These numbers provide a measure of potential fishing effort on these two species in LMA 2 by both VTR and non-VTR vessels. Based on the assumptions listed below, the annual landed value of lobster and Jonah crab in the SWDA per permitted pot for vessels that do file VTRs was used to impute the annual landed value of those two species per permitted pot for vessels that do not file VTRs.

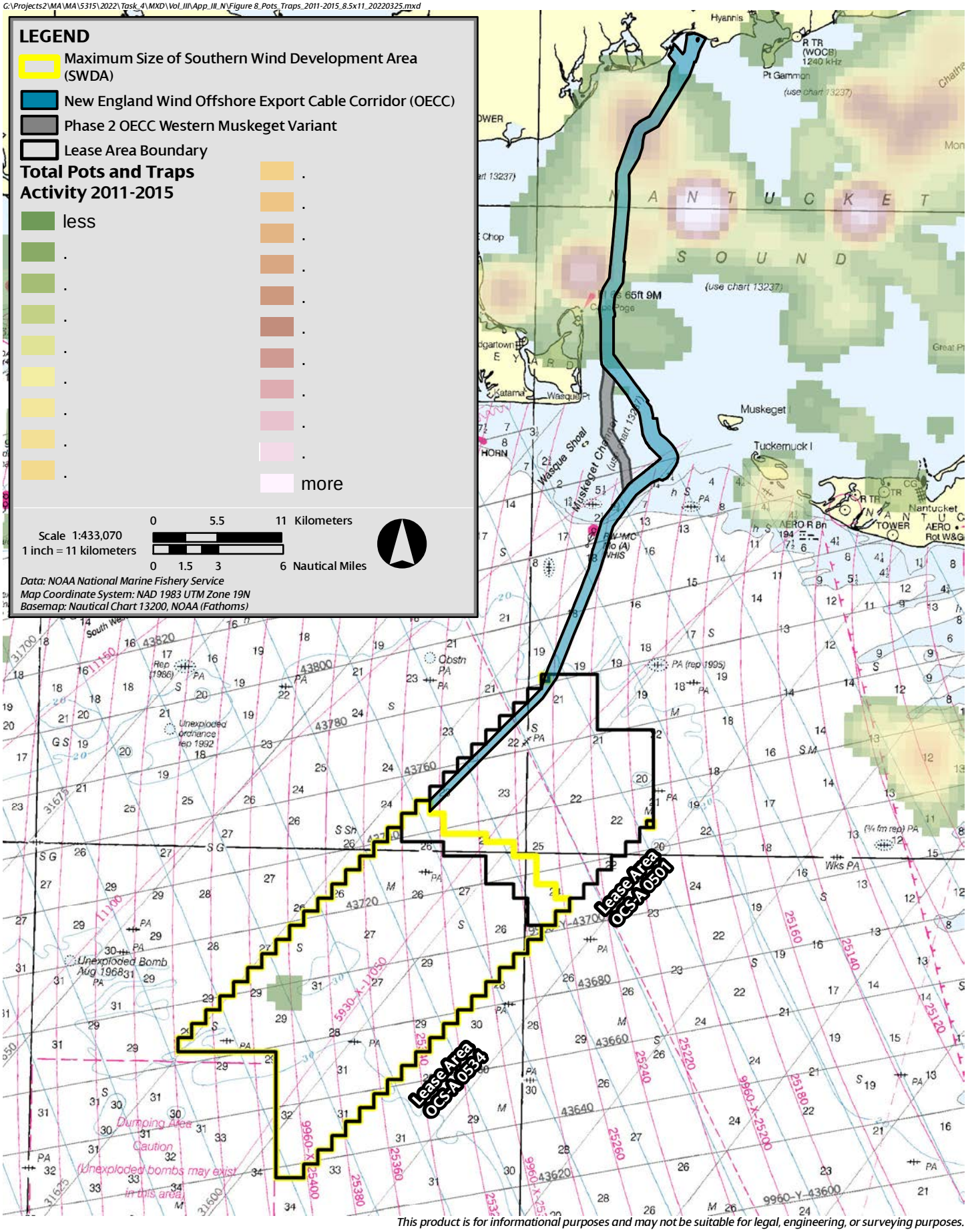
Federal fishing permit data for 2019 show that a total of 55,460 pots are permitted to harvest lobster in LMA 2 with 24,491 of these pots, or 44.2%, fished from vessels that possess only LMA 2 permits to fish for these two species. These are the vessels that are not required to file VTRs. The remaining 30,969 permitted pots in LMA 2, or 55.8% of all permitted pots, are permitted to vessels that fish for species other than lobster and Jonah crab and therefore file VTRs that include their landings of lobster and Jonah crab.

NOAA (2021) (Source 5 in Table 1) shows that the twelve-year total value of fish harvested in the SWDA by vessels that filed VTRs included $415,622 worth of lobster, an average annual value of $34,635, and $487,420 worth of Jonah crab, an average annual value of $40,618. Average annual fishing revenue from both species, therefore, is $75,254, and average annual lobster and Jonah crab revenues per pot permitted in LMA 2 to vessels that file VTRs is $2.43.

If the characteristics of lobster and Jonah crab fishing by vessels that file VTRs were identical to those of vessels that do not file VTRs, the $2.43 in annual lobster and Jonah crab revenues in the SWDA per permitted pot for vessels that file VTRs could be applied equally to pots permitted to vessels that do not file VTRs. However, information received from Massachusetts state lobster fishery experts indicated that vessels that fish only for lobster and Jonah crab and do not file VTRs are more dedicated to fishing for those two species than vessels that harvest those two species along with other species and do file VTRs. That feedback indicated that compared with vessels that do file VTRs, vessels that do not file VTRs are likely to: (1) actively fish a higher percentage of permitted pots, (2) deploy a higher percentage of active pots in the relatively nearshore Lease Areas OCS-A 0501 and OCS-A 0534, and (3) achieve higher catch rates and annual revenues per active pot.

To account for these factors the annual value of lobster and Jonah crab harvested by non-VTR vessels in the SWDA is estimated here by assuming that pots permitted to non-VTR vessels are: 25% more active, spend 25% more active fishing time in the Lease Area OCS-A 0534, and generate 25% more fishing revenues than pots permitted to vessels that file VTRs. In effect, these assumptions result in $4.75 as an estimate of revenues generated in the SWDA per pot permitted to non-VTR vessels. ($2.43 x 1.25 x 1.25 x 1.25). The 24,491 pots permitted to non-VTR vessels, therefore, are estimated to generate approximately $116,332 in annual lobster and Jonah crab revenues from the SWDA that are not included in fishing revenues reported in NOAA (2021).

The combined estimates of the annual value of lobster and Jonah crab harvests from the SWDA based on fishing revenues reported on NOAA-Fisheries website (2021) adjusted as described above to include harvests by vessels that file and do not file VTRs is $191,586. This relatively low estimate of the annual value of lobster and Jonah crab harvested in the SWDA is confirmed by other sources of data that show where fishing effort by pots and traps targeting these two species takes place in and around the Lease Area. Figure 8, for example, displays pot and trap fishing effort by vessels submitting VTRs for 2011 to 2015 and confirms that little of this fishing effort took place in the Lease Area OCS-A 0534 during those years (MARCO 2018).



This product is for informational purposes and may not be suitable for legal, engineering, or surveying purposes.

New England Wind
AVANGRID RENEWABLES

Figure 8

VTR – Pots and Traps 2011-2015

These results are also partly explained by well-documented scientific evidence that rising ocean temperatures are affecting the location and productivity of lobster populations along the US Atlantic coast. As shown in Figure 9, lobster populations have exhibited a significant northward shift away from areas south of Cape Cod as water temperatures in southern New England exceed their biological tolerances. On the other hand, the warming of waters in northern New England have increased American lobster abundance and productivity in those regions (Dupigny-Giroux et al. 2018). These trends are also reflected in NOAA-Fisheries commercial landings statistics for American lobster, which show that, between 2000 and 2016, lobster landings declined by 67.3% at Rhode Island ports and increased by 132% at Maine ports (NOAA 2020b).

3.1.3 Final Estimate of Annual Fishing Revenues (Economic Exposure) in the SWDA

The final estimate of annual fishing revenues in the SWDA, measured in 2019 dollars, is developed in Table 3a and is shown to be $685,692 which is the sum of $569,360 (average annual fishing revenues in the SWDA from NOAA (2021)) plus $116,332 (the estimated annual value of lobster and Jonah crab harvests in the SWDA that are not included in NOAA [2021]). Table 3b presents estimates of annual economic exposure by state based on state shares of fishing revenues in SWDA from NOAA (2021). Commercial fishing fleets from Massachusetts and Rhode Island face the most economic exposure in the SWDA accounting, respectively, for 45.21% and 44.20% of average annual fishing revenues from the SWDA (Table 3b).

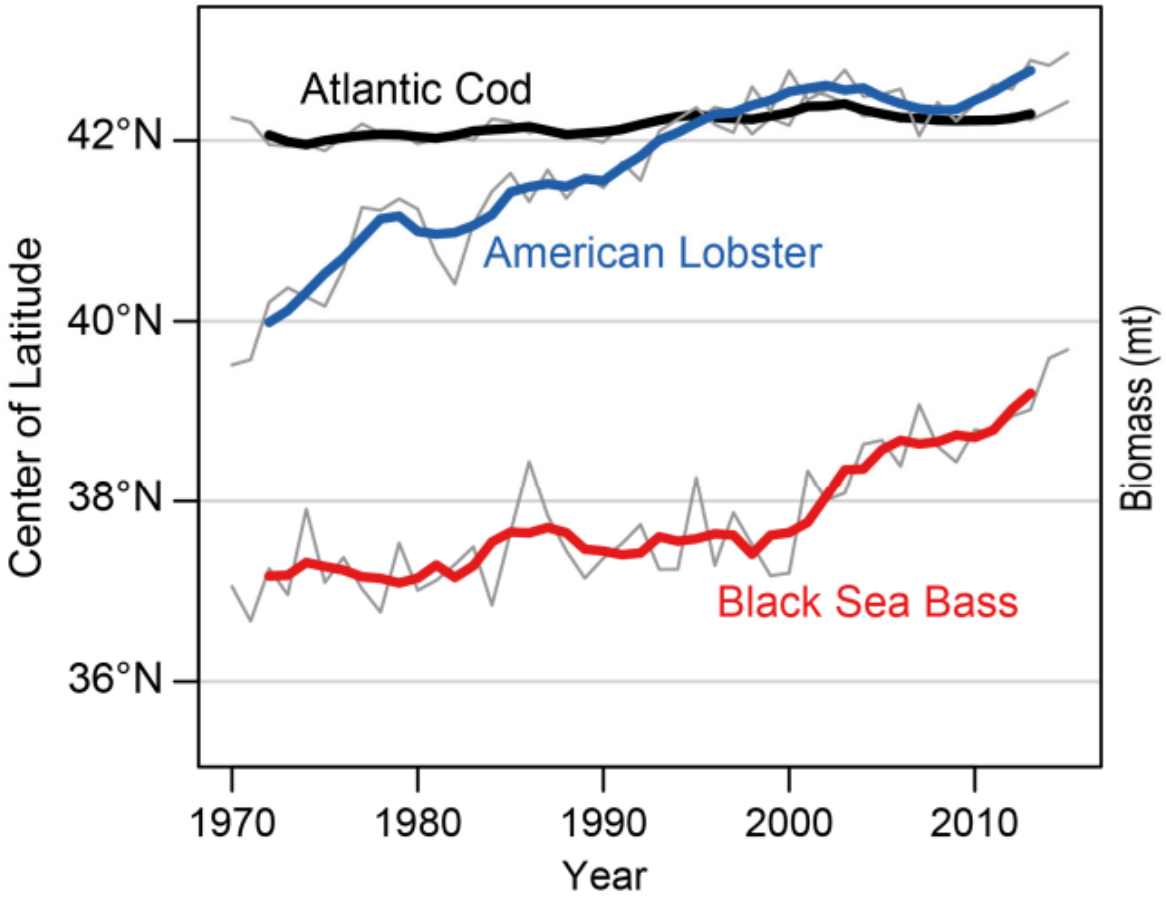
3.2 Economic Exposure in the OECC

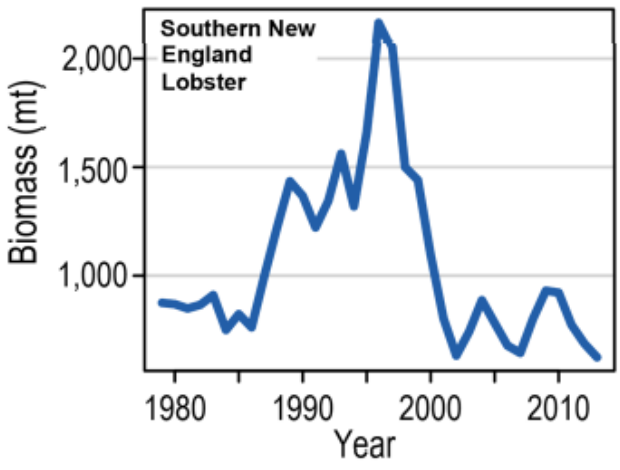
Overview

From the landfall site(s)[2] aboveto the SWDA boundary (excluding the two separate aliquots that are closer to shore), the OECC is approximately 42 NM (78 km), with approximately 22.4 NM (41.4 km) passing through federal waters and 19.5 NM (36.1 km) passing through Massachusetts state waters. The width of the OECC ranges from approximately 3,100 feet (950 m) to 5,500 feet (1,700 m) and the average width is 3,500 feet (1,100 m). The OECC, occupies an area of approximately 83.56 sq km (32.3 sq mi) (See Figure 1).

Within the OECC four or five offshore export cables, two cables for Phase 1 and two or three cables for Phase 2, will be installed. Typical cable laying speeds are expected to range from 328 ft to 656 ft (100 to 200 meters) per hour and cable laying is expected to occur 24 hours per day.

As described in Section 4.5.1, besides laying cable, cable installation will require several “pre-lay activities” such as a survey of the cable alignment, a pre-lay grapnel run of the cable alignment, and boulder relocation, and some “post-lay activities” such as cable splicing and the placement of cable protection. Based on the expected durations of those activities, it is currently expected that installation of two cables during Phase 1 taking place over approximately 9 months, the installation of up to three cables during Phase 2 taking place over approximately 13.5 months,





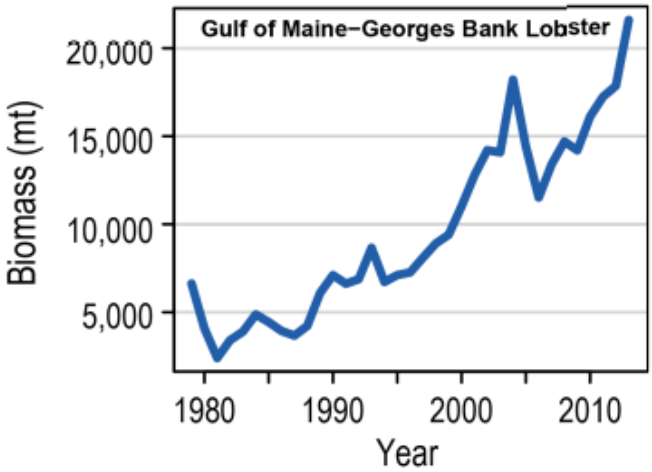


Figure 9

Changes in Distribution and Abundance of Marine Species (Dupigny-Giroux et al. 2018)

and the total duration of cable installation activities during Phase 1 and Phase 2 of approximately 22.5 months (1.875 years). Cable installation for each Phase may or may not be continuous and may occur over one of two years.

Analyses of planned cable installation activities provide estimates of the size of the temporary safety buffer zones that the USCG may establish around where cable installation activity is taking place. These temporary safety buffer zones are the only areas within the OECC where cable installation activities are expected to impact commercial fishing. At this time the radius of these safety buffers is expected to be approximately 1 km (0.62 miles) which will result in an area of approximately 3.14 sq km (1.21 sq mi) around cable installation activities where commercial fishing will be precluded.

As described above, cable installation will result in fishing impacts only in a 3.14 sq km (1.21 sq mi) area defined by a 1 km (0.62 mile) safety buffer around where cable installation is taking place. As Figure 2 illustrates this area of fishing impacts will move along the OECC as cable installation activities take place resulting in fishing impacts at any particular time along 2 km (1.2 miles) or approximately 2.6% of the OECC. Cable installation activity will not impact commercial fishing in the remaining 76 km (41.6 NM) or 97.4% of the OECC where at any particular time cable installation will be either completed or planned.

Disruptions in the rate of cable installation may impact the duration of cable installation impacts on commercial fishing, but the area of fishing impacts at any particular time is expected to be limited to approximately 3.14 sq km (1.21 sq mi). It is also possible that more than one cable installation activity may take place at a particular time which will result in a proportional increase in the area of fishing impacts during those times. However, because this will also result in a proportional decrease in the expected duration of overall cable installation activities, it will result in no net change in overall commercial fishing impacts.

Based on fishing revenue intensity data generated by BOEM and NOAA-Fisheries for years 2007-2018 (BOEM 2020), average annual fishing revenues in the OECC area is $218,152, or $2,611 per sq km (2019 dollars).

A reasonable estimate of economic exposure in the OECC during cable installation can be generated by multiplying the three factors described above. That is,

EE_{OECC} = Annual Economic Exposure in the OECC (measured in 2019 Dollars)

Where:

$EE_{OECC} = A \times B \times C$; and

A = expected annual fishing revenues per sq km of the OECC ($2,611)

B = sq km of area precluded to fishing during an ongoing cable installation activity (3.14 sq km); and

C = the total duration of cable installation activities associated with a total of 5 cables installed during Phase 1 and Phase 2 expressed in years (1.875 years).

And therefore:

EE_{OECC} = A x B x C = $2,611 x 3.14 x 1.875 = $15,372.

Based on the analysis described above, economic exposure is estimated to be $6,149 during the approximately nine months (75% of a year) when two cables are being installed during Phase 1 and $9,223 during the 13.5 months (112.5% of a year) when three cables are being installed during Phase 2 resulting in overall economic exposure of approximately $15,372 during both Phase 1 and Phase 2. However, $15,372 is the economic exposure for the for the maximum design scenario of three cables being installed for Phase 2. If only one cable was installed for Phase 2, the economic exposure would be approximately $3,075 during the 4.5 months of cable installation for Phase 2 and the overall economic exposure would be $9,223 for both Phases.

The analysis described above was also conducted for the Western Muskeget Variant. Based on fishing revenue intensity data generated by BOEM and NOAA-Fisheries for years 2007-2018 (BOEM 2020), average annual fishing revenues in the Western Muskeget Variant is $1,846 per sq km (2019 dollars), which is less than the OECC value of $2,611 per sq km. This analysis therefore uses the estimate of economic exposure for the OECC as the maximum design scenario.

3.3 Final Estimates of Economic Exposure

Based on the analysis of annual fishing revenues described in Section 3.1 and 3.2, annual economic exposure is estimated to be $685,692 in the SWDA and $15,372 in areas of the OECC where cable installation will be taking place. These estimates of direct economic exposure related to commercial fishing are presented in Table 6a which also presents estimates of indirect economic exposure associated with fishery-related shoreside businesses based on analysis presented in Section 4.8.6. As described in Section 4.8.6 and shown in Table 6a, annual economic exposure, including commercial fishing impacts and related shoreside impacts based on the assumption that all fishing revenues from impacted areas will be lost and not recouped in other areas, is $1,657,318.

4.0 FISHERY-RELATED ECONOMIC IMPACTS

4.1 Background

Section 3.0 developed estimates of economic exposure of $685,692 annually in the SWDA and a total of $15,372 during approximately 1.875 years of cable installation activity in the OECC. These represent the maximum potential losses in fishing values if New England Wind caused all fishing effort in the SWDA and in areas of active construction along OECC (including the Western Muskeget Variant) to cease. Following BOEM guidelines, these estimates of economic exposure are based on the assumption that none of the fishing revenues lost in those areas will be recouped by fishing effort shifting from those areas to other areas (Kirkpatrick et al. 2017). However, BOEM guidelines also indicate that economic exposure "should not be interpreted as a measure of economic impact or loss because economic impacts depend on a vessel's ability to adapt by changing where it fishes" and "if alternative fishing grounds are available nearby and may be fished at no additional cost, the economic impact will be lower" (Kirkpatrick et al. 2017).

This section does not attempt to estimate what percentage of fishing vessels will continue to fish within the SWDA or what portion of lost fishing revenues in the SWDA and OECC can or will be recouped by fishing effort shifting from those areas to other fishing areas. However, it does summarize data and analysis indicating that "alternative fishing grounds are available nearby and may be fished at no additional cost." For that reason, it is reasonable to assume that if fishermen were to stop fishing in the SWDA or were precluded from fishing in parts of the OECC, they would act in an economically rational manner and shift fishing effort to other areas. The alternative would be to generate no offsetting fishing revenues by remaining idle at sea or staying in port.[20] That is, while it is reasonable to assume that fishing disruptions in the SWDA may result in modifications to fishing strategies that reduce fishing revenues, it is not reasonable to assume that these disruptions will result in fishing vessels spending more time in port or idle at sea, resulting in reductions in overall fishing effort and fishing revenue losses as high as estimated economic exposure.[21]

Additionally, placement and spacing of the WTGs and ESPs in the SWDA are configured specifically to facilitate safe commercial fishing and efficient transiting of commercial fishing vessels after construction. In an affidavit submitted to BOEM for Vineyard Wind 1, Rhode Island fixed and mobile gear fishermen provided rationale for how the 1 NM spacing and fixed east-to-west rows and north-to-south columns would allow fishing to continue in the wind development area. They specifically stated, "One NM spacing and an E & W layout will allow fishing vessels to pass or tow side by side to avoid hangs, turbines, scour protection, cable protection, and fixed gear in a safe manner" (CFCRI 2018). Therefore, the WTGs and ESPs in the SWDA will be oriented in fixed east-to-west rows and north-to-south columns with 1 NM spacing between positions.

4.2 Context

Results from recent studies on commercial fishing time in the SWDA and fishing revenues generated on commercial fishing trips that intersect Lease Areas OCS-A 0501 and OCS-A 0534 are useful for putting the relationship between economic exposure and expected economic impacts in perspective. These results are summarized briefly below.

- Based on analysis of AIS data for the SWDA from 2016–2019 presented in Baird (2020), an average of 33 unique AIS-equipped fishing vessels per year recorded fishing tracks (travelling at less than or equal to 4 knots) that intersected the SWDA. On average, 25% of time on those trips was spent in the SWDA; the other 75% of vessel time on those trips was spent fishing outside the SWDA.[22]

- Two studies by the Rhode Island Department of Environmental Management (RI DEM) (RI DEM 2017 and RI DEM 2018) used data for years 2011-2016 to estimate fishing revenues generated on trips that intersect Lease Areas OCS-A 0501 and OCS-A 0534, which includes the SWDA. RI DEM 2017 showed that the average fishing revenues generated on trips in both Lease Areas was $1,078,208 and RI DEM 2018 showed that average fishing revenues on those trips overall was $2,966,447. That is, 36.3% of fishing revenues generated on fishing trips with at least one tow that intersects the Lease Areas OCS-A 0501 and OCS-A 0534 was generated inside those areas and 63.7% was generated outside of those areas.

- The similar results from these separate analyses of fishing time and fishing revenues generated inside and outside of Lease Areas OCS-A 0501 and OCS-A0 534 and the SWDA on fishing trips that intersect these areas indicate three things that are important for assessing expected economic impacts of New England Wind on commercial fishing in the SWDA:

    1. Vessels that fish in the SWDA have many nearby fishing options. Even on trips and tows where they fish in the SWDA, these vessels are already fishing primarily in areas outside the SWDA and generating most of their fishing revenues outside the SWDA.

    2. Potential shifts in fishing effort from the SWDA to nearby areas involve primarily small changes in fishing strategy that would not constitute a significant source of new fishing effort entering other fishing areas that could be construed as introducing fishing congestion problems in those areas.

    3. If all fishing ceased in the SWDA, that is if fishing trips that currently intersect the SWDA were modified by eliminating all time spent fishing in the SWDA, trip revenues and the ex-vessel landings from those trips would not be zero. Therefore, economic impacts can be expected to be less than estimated economic exposure.[23]

4.3 Focus

Section 3.0 estimated fishing revenue losses assuming that none of the fishing revenues lost in the SWDA would be recouped as a result of fishing effort shifting from the SWDA to other areas. This section develops estimates of economic impacts related to the potential loss of fishing values in the SWDA assuming that 25%, 50%, or 75% of fishing revenues lost in the SWDA will be recouped by fishing effort shifting from the SWDA to nearby fishing areas. It also develops estimates of three other types of potential fishery-related economic impacts from New England Wind, including:

- Increases in fishing vessel transit times as vessels pass through or around the SWDA.
- Increases in fishing congestion outside the SWDA as fishing vessels divert fishing effort from the SWDA to other areas.
- Economic losses in shoreside businesses that support commercial fishing or rely on commercial fish landings.

4.4 Economic Impacts in the SWDA

4.4.1 Construction and Installation within the SWDA

The annual economic exposure estimate developed for the SWDA in Section 3.3 indicates that if all fishing effort in the SWDA ceased during construction of New England Wind, and was not redirected to other fishing areas, the resulting loss in fishing values and reductions in the ex-vessel landed value of fish during each year of construction would be $685,692. However, the fishing revenue density charts presented in Figure 5 through Figure 7 and summarized above indicate: (1) New England Wind will not result in all fishing effort ceasing in the SWDA during construction of New England Wind with all related fishing revenues from the SWDA being lost; and (2) any reductions in fishing effort and related declines in fishing revenues in the SWDA due to New England Wind are likely to involve fishing effort being diverted to nearby fishing areas where it will recoup some or all of fishing revenues lost in the SWDA. There are only two extremely unrealistic assumptions under which this will not be the case.:

- The first is that New England Wind will result in fishing vessels that cannot fish or choose not to fish in the SWDA generating no offsetting fishing revenues because they will remain in port or idle at sea rather than continuing to fish outside the SWDA.
- The second is that vessels that cannot fish or choose not to fish in the SWDA will continue to fish outside the SWDA and experience a CPUE of zero resulting in no fishing revenues to offset losses in the SWDA.

Because both of these circumstances seem highly unlikely, it is reasonable to assume that fishing revenue losses associated with construction and installation in the SWDA will be less than estimated economic exposure.

4.4.2 Operations and Maintenance within the SWDA

Once construction activities in the SWDA are complete, the SWDA will be open to fishing, leaving fishermen to decide whether to continue to fish or resume fishing in the SWDA or not to fish in the SWDA. In some situations, fishing effort that is diverted from an area to an alternative fishing area that is less familiar or less productive than the original fishing area will experience a lower CPUE and generate lower fishing revenues. However, as shown by the fishing revenue density charts presented in Figure 5 through Figure 7, and further supported by NOAA-Fisheries fishing revenue data, there are many highly productive fishing areas near the SWDA. Moreover, as indicated in Section 4.2, fishing areas adjacent to the SWDA already account for most of the fishing effort and fishing revenues generated on fishing trips that intersect the SWDA.

4.5 Economic Impacts Along the OECC

4.5.1 Construction and Installation within the OECC

Based on the analysis and assumptions presented in Section 3.2, annual fishing revenues per sq km in the OECC average $2,611, the average area within the OECC where fishing will be impaired at any particular time during cable installation is 3.14 sq km, and the total duration of cable installation activity in the OECC will be approximately 1.875 years for both Phases. Based on these factors, estimated economic exposure in the OECC during cable installation is expected to be $15,372, that is $2,611 x 3.14 x 1.875 (Section 3.2). If detailed engineering or other technical issues arise demonstrating that installation of all Phase 2 cables within a portion of the OECC in the Muskeget Channel area is not feasible, and the Proponent has to use the Western Muskeget Variant for one or two Phase 2 offshore export cables, the estimated economic exposure for the Western Muskeget Variant would be less than the estimated economic exposure in the OECC.

4.5.2 Operations and Maintenance within the OECC

While the Proponent will make every effort to achieve sufficient cable burial depth, it is estimated that it may not be possible to achieve the proper cable burial depth along up to approximately 6% of the OECC for both Phases (or up to 7% of the OECC for both Phases if the Western Muskeget Variant is used for one or two Phase 2 export cables), which may require cable protection to be installed on the seafloor. During O&M of New England Wind, therefore, there will be potential that mobile bottom fishing gear, such as bottom trawl nets, could snag on cable protection resulting in gear or vessel damage and/or lost fishing time.[24]

It is not possible at this time to assess the likelihood or potential magnitude of gear damage associated with bottom gear snags along the OECC (including the Western Muskeget Variant). It is known, however, that there is little bottom trawling or dredging along the OECC, so it is reasonable to expect that economic exposure associated with such incidents is low. The Proponent expects to establish a gear loss/damage protocol to respond to such incidents if and when they occur.[25]

4.6 Fishing Congestion Impacts Outside the SWDA and OECC

4.6.1 Background

In fishery economics, the term "congestion externalities" refers to increases in vessel-specific or fleetwide fishing costs and/or reductions in fishing revenues that result when so many vessels are operating in a fishing area that they interfere with one another. This is typically the result of some combination of fish being highly concentrated in an area, the fishery being severely overcapitalized, or regulations that limit fishing times or fishing areas in ways that concentrate fishing effort when and where fishing is allowed.

In general, the likelihood that the introduction of new fishing effort in an area will result in fishing congestion impacts depends on the size of the fishing area, the concentration of fish and existing fishing effort in the area, the amount of new fishing effort entering the area, and whether fleetwide fish harvests in the area are limited by fish stock abundance or fishing regulations, or both. It is uncommon for fishing congestion impacts to be significant in open ocean fisheries or for fishery regulators to be considered creating costly fishing congestion impacts when they close fishing areas or seasons or impose quotas that concentrate more fishing effort in some ocean areas.

4.6.2 Potential OECC Fishing Congestion Impacts

The OECC represents a small portion of the available fishing grounds in the areas it passes through in Nantucket Sound and the areas south of Nantucket Sound and Martha's Vineyard. In addition, for each Phase of New England Wind, construction and installation activities in the OECC will restrict commercial fishing only in temporary safety buffer zones established around where cable installation activity is taking place. These zones are not expected to exceed 3.14 sq km and typically there will not be more than one temporary safety buffer zone associated with more than one cable installation activity taking place at any given time. There is no reason to expect that this limited area of temporary fishing limitations within the OECC (including the Western Muskeget Variant) will cause any meaningful shift in fishing effort from the OECC to other areas or any significant fishing congestion impacts in other areas.

During O&M of New England Wind, the OECC (including the Western Muskeget Variant) will have no impact on commercial fishing, except for some potential impact on the limited amount of bottom fishing that takes place directly within the cable alignment where cable protection has been installed. Therefore, there is no reason to expect that during O&M, the presence of cable protection along short segments of the OECC will result in enough fishing effort by bottom trawlers or other types of fishing vessels shifting away from the OECC to cause fishing congestion impacts in other areas.

4.6.3 SWDA Fishing Congestion Impacts

Table 5a presents a monthly summary of the number of unique AIS-equipped fishing vessels and unique AIS-equipped fishing vessel tracks in the SWDA from 2016 to 2019 as reported in Baird (2021) and Table 5b presents an overall average of the number of unique AIS-equipped fishing vessels and unique AIS-equipped fishing vessel tracks in the SWDA from 2016 to 2019.[26] It shows that, on average, the number of unique AIS-equipped fishing vessels that spend time operating in the SWDA (fishing, not transiting) was fewer than two during each of six months (November–April), and fewer than six during 10 months (all months except August and September), with the total number of AIS-equipped vessels fishing in the SWDA reaching 10 or greater only during the months of August (10 vessels) and September (19 vessels). The summary also shows that the number of unique fishing tracks in the SWDA during 2016-2019 averaged 146 per year and peaked at 50 and 72 per month in August and September, respectively. That amounts to an average of four to five fishing tracks per vessel during August and September. This represents a very modest level of fishing effort and is not a significant enough potential source of new fishing effort to pose fishing congestion threats in other areas. Also, as Section 4.1 indicated, fishing vessels that operate in the SWDA are already spending most of their fishing time in adjacent and nearby fishing areas and are already a part of the fishing fleet operating in those areas.

For example, based on the analyses of AIS data from 2016 to 2019, Baird (2020) concludes:

> *"The analyses of AIS data indicated that historical vessel traffic levels within the SWDA are relatively low. The vessel traffic is seasonal in nature with approximately 0.5 vessels every day on average in the winter months to a peak of 6.4 vessels per day on average in the month of August. An evaluation of vessel proximity revealed that two or more vessels are present within the SWDA simultaneously for only 124 hours per year on average (1.4% of the year). There was one short period (a few hours) in September 2016 in which up to 14 vessels were in the SWDA with most of these vessels sailing at speeds less than 4 knots while trawling."*

In summary, based on the available data there are three reasons why the development of the SWDA should not be expected to result in fishing congestion impacts in nearby fishing areas. First, there is relatively little fishing effort in the SWDA that could be diverted to nearby areas. Second, most fishing time on trips that intersect the SWDA is already spent in adjacent and nearby areas, and most fishing revenues are already generated in those areas. Third, the 33 AIS-equipped fishing vessels that operate in the SWDA and generate average annual fishing revenues of $685,692, or an average of approximately $20,779 per vessel, represent a very small part of a local commercial fishing fleet that is spread across many nearby areas and generates tens of millions of dollars in annual fishing revenues.

Fishing congestion impacts could be a significant source of fishery-related losses associated with other offshore energy projects in other areas and could be a concern when considering cumulative impacts of many offshore projects. However, the available evidence indicates that it is extremely unlikely that the level of potential fishing effort that may be diverted from the SWDA

or the OECC to other areas will ever constitute a significant source of potential fishing congestion impacts. Fishing congestion impacts are not a significant source of economic exposure related to New England Wind.

4.7 SWDA Impacts on Fishing Vessel Transit Costs

Figure 10 shows the proximity of the SWDA to major fishing ports and fishing areas and the most direct (shortest distance) tracks that fishing vessels would normally use to travel between them. Note that a few of these direct tracks transect the SWDA.

After examining options for accommodating fishing and vessel transit lanes in the MA/RI Wind Energy Area (MA/RI WEA), the USCG concluded in its recent *Massachusetts and Rhode Island Port Access Route Study* (MARIPARS) that the standard and uniform grid patterns being planned in wind development areas to facilitate safe and efficient fishing are "sufficient to maintain navigational safety and provide vessels with multiple straight-line options to transit safely through the MA/RI WEA."

During O&M of New England Wind, there will be no restrictions on fishing vessels transiting the SWDA, and the MARIPARS study indicates that the layout of New England Wind will facilitate both continued fishing in and fishing vessel transit through the SWDA. Within the SWDA the WTGs and ESPs will be oriented in fixed east-to-west rows and north-to-south columns with one nautical mile (1.85 km) spacing between WTG/ESP positions. This grid layout provides 1.85 km (1 NM) wide corridors in the east-west and north-south directions as well as 1.3 km (0.7 NM) wide corridors in the northwest-southeast and northeast-southwest directions. As the recent USCG study indicates, this will allow multiple straight-line options for fishing vessels to transit safely through the SWDA.

However, there may still be some vessel operators who will prefer to reroute around the SWDA, especially while construction activity is underway in the SWDA and/or during extreme weather events. Table 5a displays the number of unique AIS-equipped fishing vessels that transited the SWDA and the number of unique fishing vessel transits through the SWDA by month from 2016 to 2019. It shows that during these years, the number of annual fishing vessel transits through the SWDA ranged from 339 to 487 and averaged 422 (Baird 2021). This is a reasonable estimate of the number of transits per year that could be impacted by New England Wind activities in the SWDA.

During construction and installation activities in the SWDA, fishing vessels will be allowed to transit through the SWDA but will need to avoid temporary safety buffer zones in the immediate vicinity of construction and installation vessels. This may require at least some of the 422 average annual fishing vessel transits through the SWDA to implement minor adjustments from the most direct transit route through the SWDA in order to maintain course through the transit/fishing corridors created by the New England Wind WTG/ESP layout.

And, despite the existence of transit/fishing corridors created by the New England Wind WTG/ESP layout, some fishermen may opt to reroute transits around the SWDA, especially during extreme weather. Figure 10 depicts how transiting around, rather than through, the SWDA will affect transit distances and times. It shows "original" routes through the SWDA (solid lines) and "adjusted" routes (dashed lines) around the SWDA and presents associated differences in transit distances (nautical miles) and added transit times (minutes) based on the average fishing vessel transit speed through the SWDA of 7.6 knots.[27]

It is not possible to predict how many of the 422 average annual transits through the SWDA may be rerouted around the SWDA during and after construction. For purposes of illustration, therefore, it is assumed here that 100% of annual fishing vessel transits through the SWDA will reroute around the SWDA.

As shown in Figure 10, at a typical steaming speed of 7.6 knots, the expected increase in transit time around the SWDA (between major fishing ports and important fishing areas) ranges from 6 minutes to 46 minutes, which amounts to a 1% to 7% increase in total transit time. If each of the 422 annual transits through the SWDA were rerouted around the SWDA, and those transits experienced the maximum estimated increase in transit time of 46 minutes, the increase in annual fleetwide transit time would be 324 hours. Assuming the average fishing vessel steaming at 7.6 knots consumes fuel (diesel) at a rate of 25 gallons per hour and purchases diesel fuel at a dockside price of $3.00 per gallon, this additional transit time would add approximately $57.50 to fuel costs per transit and add $24,265 to annual fleet-wide fuel-based transit costs for AIS-equipped vessels.

This estimate of $24,265 in annual increases in fleetwide transit costs associated with all 422 current annual transits through the SWDA detouring around the SWDA is sensitive to assumptions about fuel consumption rates and fuel prices and does not reflect operating costs (other than fuel costs) or the opportunity cost of any lost fishing time resulting from added transit time. However, as Figure 10 illustrates, increases in typical transit times associated with rerouting around the SWDA result in minor increases in overall transit times which are not likely to have significant impacts on fishing time or revenues per trip. From a fleetwide perspective factoring in potential transit cost impacts beyond fuel costs is likely to be offset by also adjusting for the fact that most vessels that currently transit through the SWDA can be expected to continue to transit through rather than around the SWDA and therefore will experience little to no increase in transit times or costs.

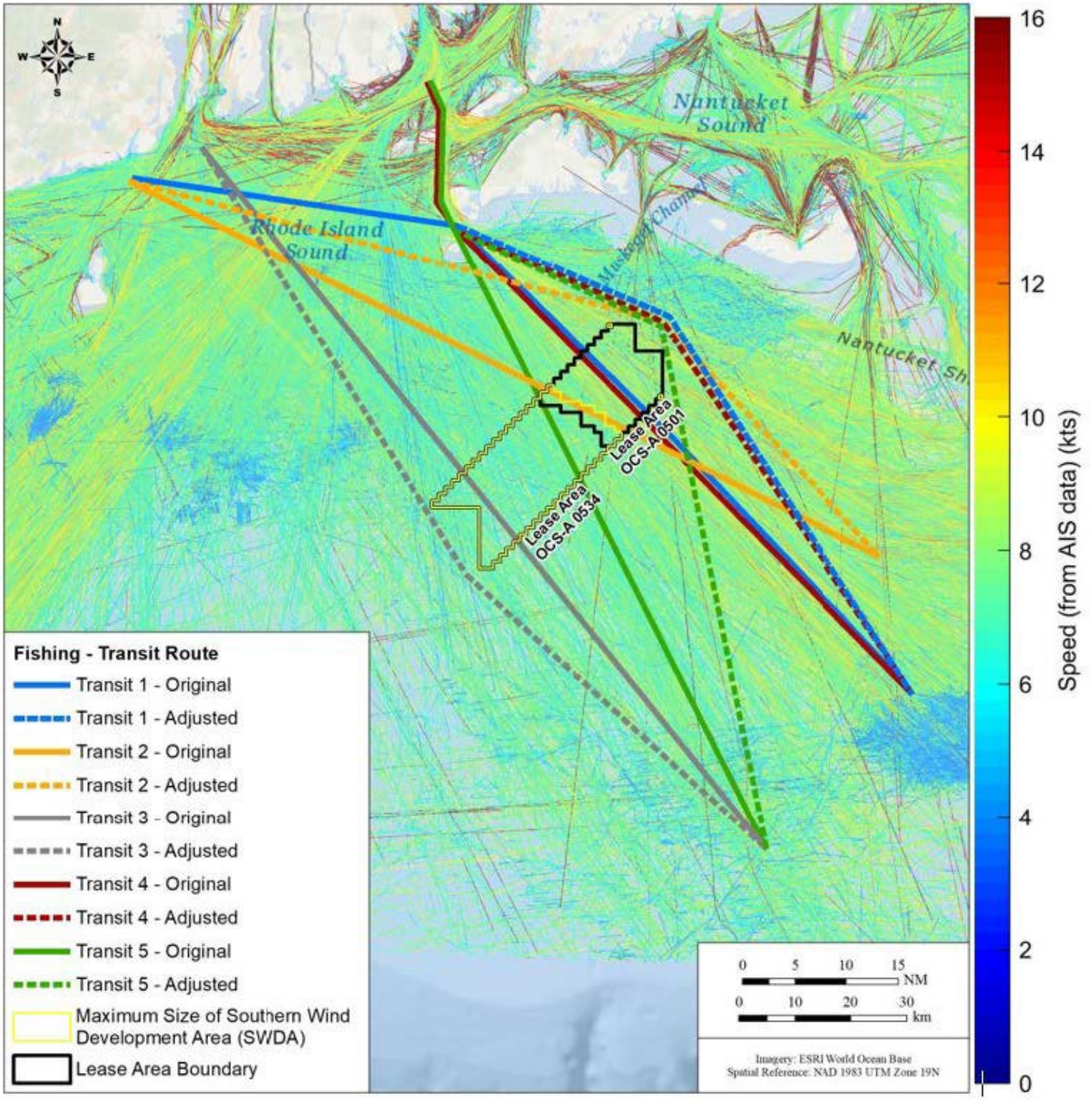


Figure 10

Schematic Showing Possible Fishing Vessel Re-Routing Around the SWDA

4.8 Shoreside Economic Impacts

4.8.1 Background

Any direct impact that New England Wind has on fishing activity or fishing revenues will also be reflected in ex-vessel fish landings which may result in indirect impacts on shoreside businesses that supply fishing inputs or purchase raw fish for processing or resale.

The sections below describe various types of shoreside economic impacts and present estimates of shoreside economic impacts based on several different assumptions. The first assumption is that reductions in the ex-vessel value of fish landings will be equal to economic exposure as estimated in Section 3.0. That is, there will be no fishing effort in the SWDA and no diversion of fishing effort from the SWDA to other fishing areas which will result in a $685,692 decline in the annual landed value of fish. Other assumptions are that 25%, 50%, or 75% of that reduced value of fish landings from the SWDA will be replaced by fish landings from fishing effort shifting from the SWDA to other fishing areas.[28]

4.8.2 Types of Economic impacts

For purposes of assessing shoreside economic impacts, it is useful to consider three types of output (sales) impacts as follows:[29]

- **Direct impacts:** Direct changes in the ex-vessel value of commercial landings.
- **Indirect impacts:** Changes in business-to-business transactions that result from changes in direct impacts.
- **Induced impacts:** Changes in business-to-household transactions that result from direct and indirect impacts.

It is also useful to consider two pathways through which direct impacts can generate indirect and induced impacts:

- **Upstream impacts:** Associated with businesses that support commercial fishing by supplying fishing inputs, such as fuel, ice, bait, and nets, dock space, etc.
- **Downstream impacts:** Associated with businesses that rely on commercial fish landings, such as seafood wholesalers, processors, and traders.

4.8.3 Using Economic Multipliers

Indirect and induced economic impacts that result because of some direct impact (e.g., a decline in fish landings) are usually estimated using economic multipliers generated by inter-industry (input-output) models. NOAA-Fisheries maintains a fishery-based input/output model (the Commercial Fishing & Seafood Industry Input/Output or CFSI I/O Model) that generates economic

multipliers specifically related to US-based commercial fishing industries. The shoreside impact analyses presented in the following sections employ Economic Multipliers generated using the Advanced Inquiry feature of the web-based version of the CFSI I/O Model. [30]

4.8.4 Upstream Economic Multipliers

The CFSI I/O Model, like nearly all input-output models, is based on the assumption that inputs and outputs are linearly related. That is, an X% change in output by an industry (i.e., a direct impact) will be associated with an X% change in inputs used by that sector (indirect impacts). However, in conventional fishery production models, levels of inputs used in fishing are typically assumed to be related to fishing effort (a measure of fishing time and fishing power) and the amount of output (catch) per measure of inputs used (fishing effort) depends on catch per unit of fishing effort or what is referred to as CPUE. [31]

For most purposes, especially where CPUE is relatively constant or predictable, outputs will be linearly related to inputs and for purposes of estimating economic impacts the distinction between input use being related to fishing effort rather than the output of fish is not important. However, the distinction is important when estimating the upstream shore-based impacts of direct impacts on fishing that may affect fishing values (outputs), but not fishing effort (inputs). For example, if restricted fishing in one area (e.g., the SWDA) causes fishing effort to shift from that area to a nearby area it may affect CPUE and fishing revenues (output) but will not affect overall fishing effort (inputs). In this case, an X% decline in CPUE might result in an X% decline in output, but no change in the use of inputs, no resulting reduction in the purchase of fishing inputs, and no associated upstream economic impacts.

For reasons described in Section 3.0 and Section 4.1, it is assumed here that New England Wind may result in a change in the location of fishing effort, and possibly a change in CPUE and fishing revenues, but will not result in a change in the overall level of fishing effort or purchases of fishing inputs. New England Wind, therefore, is not expected to have any adverse shore-based upstream multiplier impacts.

4.8.5 Downstream Economic Multipliers

Downstream impacts from commercial fishing follow a more conventional pathway than upstream impacts because sales of seafood by shore-based processors and traders (output) are, in most cases, linearly related to their purchases of landed fish (inputs). [32] Based on Section 3.3, a reasonable estimate of the maximum annual potential loss in the landed value of fish from the SWDA, assuming that all fishing stops in the SWDA and is not replaced by increased fishing elsewhere, is $685,692. This represents an estimate of the maximum potential direct impacts on the landed value of fish and forms a basis for estimating shoreside downstream impacts assuming full economic exposure. For reasons described in Section 3 and Section 4, using economic exposure as a basis for estimating expected reductions in fish landings results in extremely conservative estimates of shore-based downstream economic impacts. [33]

Economic Impacts on Seafood Processors/Dealers

The "markup" in seafood processing is defined as "the difference between the value of seafood products sold and the dockside or wholesale value for an equivalent weight of fish purchased" (NMFS 2016). The "markup" reflects the portion of revenues from seafood sales that is available to contribute to profits and pay for inputs used to process fish or prepare it for resale. The "markup" is also a useful measure of potential economic losses in the processing sector that may result if a reduction in the ex-vessel supply of fish results in a reduction in processor revenues and a corresponding decline in profits or the ability of processors to recoup fixed and operating costs associated with fish processing.

Several recent government and university studies provide cost, price, or sales data that indicate the typical markup in the US seafood processor/dealer sector ranges from about $0.565 to about $0.691. That is, every dollar of raw fish purchased either at dockside or wholesale results in processor revenues that range from $1.565 to $1.691.

Longfin squid is the most highly valued commercial species harvested in the SWDA and accounts for most seafood products processed from fish harvested in the SWDA. For that reason, a 2020 university study, titled *Economic impacts associated with the commercial fishery for longfin squid in the Northeast U.S.* (Scheld 2020), provides the most recent and most relevant basis for estimating the processor markup on fish harvested in the SWDA.

Survey results presented in Scheld (2020) showed that the cost of fish accounts for 63.9% of squid processor revenues. This results in a processor margin of $1.00 less $0.639 or $0.361 and a markup of ($1.00 - $0.639)/0.639 or $0.565. That is, every $1.00 in fish purchased contributes $0.565 to offset labor and other processing expenses and contribute to processor profits. This is nearly identical to the estimated seafood processor markup based on another recent study by NOAA-Fisheries that showed the cost of fish purchased by US seafood processors from US-based aquaculture average 60.9% of processed fish sales (Lipton et.al. 2019). That implies a margin of 39.1% and a markup of $0.642.

Using results from Scheld (2020), the processor margin on fish harvested in the SWDA is $ 0.565, which represents a reasonable estimate of shoreside downstream impacts per dollar reduction in ex-vessel fish landings expected to result from New England Wind. This processor "margin" is used in Table 6a to estimate seafood processor economic losses based on a decline in ex-vessel fish landings based on 100% of economic exposure. It is also used in Table 6b to estimate seafood processor economic losses assuming 25%, 50%, and 75% of fish landings lost in the SWDA will be recouped in other areas. That is, if the expected decline in fishing revenues and ex-vessel value of fish landings equals 25%, 50%, or 75% of economic exposure.

4.8.6 Estimates of Shoreside Economic impacts

4.8.6.1 Shoreside Impacts based on Economic Exposure

Table 6a presents estimates of shoreside economic impacts based on full economic exposure. Using results from Section 3.3, Table 6a shows the direct impact of New England Wind to be a $685,692 decline in fishing revenues and the ex-vessel value of fish landings. This is based on the assumption that all fishing effort will cease in the SWDA and will not be diverted to other fishing areas.

The resulting decline in fishing activity is shown in Table 6a to result in a corresponding decline in shoreside purchases of fishing inputs and, based on upstream output multipliers, to generate negative indirect upstream impacts of $584,210. The resulting decline in the ex-vessel value of commercial fish landings is also shown in Table 6a to also have downstream economic impacts on seafood processors and traders. Based on the seafood processor margin of $0.565 described in Section 4.8.5, the estimated $685,692 reduction in fish available for processing/distribution, is estimated to result in negative downstream impacts of $387,416.

Overall, based on the assumption of full economic exposure used to produce Table 6a, total annual economic impacts from the development of the SWDA, measured in terms of lost fishing revenues, upstream impacts, and lost processor margins total $1,657,318 annually, and $49,719,540 over 30 years.

4.8.6.2 Shoreside Impacts based on Economic Impacts less than Economic Exposure

Estimates of shoreside economic impacts presented in Table 6b are significantly lower than those based on full economic exposure in Table 6a. They are based on the assumption that fishing revenues lost in the SWDA will be less than full economic exposure and that at least some of fishing revenues lost in the SWDA will be recouped as a result of fishing effort shifting from the SWDA to other fishing areas. For illustrative purposes, shoreside impacts are shown based on the assumption that fishing revenues either not lost in the SWDA or recouped as a result of fishing effort shifting from the SWDA to other fishing areas will be 25%, 50%, or 75% of full economic exposure.

Upstream Impacts in Table 6b are shown to be zero based on the assumption that New England Wind may result in shifts in fishing effort from the SWDA to other areas, but no overall decline in fishing effort and no corresponding decline in purchases of fishing inputs and, therefore, no upstream impacts.[34]

Downstream Impacts in Table 6b are estimated by applying the same 56.5% "markup" factor used in Table 6a to a 25%, 50%, or 75% reduction in ex-vessel fish landings, based on the assumption that 75%, 50%, or 25% of the potential reduction in annual fishing revenues and seafood landings from the SWDA will not be realized as a result of some fishing effort continuing in the SWDA and some displaced fishing effort from the SWDA to other nearby productive fishing areas resulting in more fish being landed from those other fishing areas.

Table 6b shows that total economic impacts include lost fishing revenues (Column 2) plus indirect downstream shoreside impacts associated with lost processor/distributor "markup" (Column 6). Based on the assumption that 25%, 50%, or 75% of potential lost fishing revenues in the SWDA will either not be lost or will be recouped elsewhere total impacts are shown, respectively, to be $1,242,988, $828,659, and $414,329 annually and $37.3 million, $24.9 million, and $12.4 million over 30 years.

5.0 SUMMARY AND CONCLUSIONS

5.1 Economic Exposure

BOEM and NOAA-Fisheries fishing revenue data indicate that the SWDA and the OECC do not include high-value commercial fishing grounds. Based on the most recent and most reliable fishing revenue data available (NOAA 2021), the average annual dockside value of fish harvested commercially in the SWDA in 2019 dollars is estimated to be $685,692. Based on an analysis of fishing revenues in the OECC, fishing revenue in areas impacted by cable installation activities during periods when these activities will be taking place ranges from approximately $9,223 to $15,372, depending on the number of cables used in Phase 2. These figures reflect maximum potential losses in fishing revenues and the ex-vessel value of fish landings if: all fishing effort in the SWDA ceased for a year; all fishing effort ceased in areas of active construction along the OECC for the full 22.5 months (1.875 years) of expected cable installation activity; and none of the associated loss of fishing revenues from those areas were to be recouped as a result of fishing effort being diverted to other areas. These values are estimates of the economic exposure of commercial fishing in the SWDA and OECC. This report describes many reasons why the economic impact of New England Wind on commercial fishing revenues in the SWDA and the OECC should be expected to be significantly less than full economic exposure.

In the OECC

In the OECC (including the Western Muskeget Variant), construction activity is expected to take place over a period of approximately 22.5 months during which time commercial fishing will only be restricted temporarily in safety buffer zones established in the immediate vicinity of where offshore export cable installation activity is underway. Based on estimates of fishing revenue densities in the OECC and the relatively short durations and small impact areas of cable installation activities the analysis described in Section 3.2 results in economic exposure in the OECC during cable installation estimated to be approximately $15,372.

During O&M of New England Wind, the OECC is expected to have nearly no impact on commercial fishing. The only exception would be the possibility that mobile bottom fishing gear, such as bottom trawl nets, could snag on cable protection that may be installed on the seafloor along up to approximately 6% of the OECC for both Phases (or up to 7% of the OECC for both Phases if the Western Muskeget Variant is used for one or two Phase 2 export cables). There is little bottom fishing along most of the OECC, and the Proponent will minimize the use of cable protection and have cable protection designed to the maximum extent practicable to minimize impacts to fishing gear. The Proponent also expects to establish a gear loss/damage protocol to respond to accidents involving fishing gear interacting with cable protection. Therefore, while there is a small possibility that cable protection in the OECC could result in gear loss or damage or lost fishing time, this possibility does not constitute a significant potential source of economic exposure in the OECC and is not likely to result in any net economic losses in commercial fisheries.

In the SWDA

In the SWDA, there are five main reasons why economic impacts are expected to be less than economic exposure.

- First, during construction and installation, fishing vessels will not be precluded from operating in the SWDA other than where temporary safety buffer zones are established around where construction and installation vessels are operating.

- Second, WTG/ESP placement and spacing in the SWDA are configured specifically to facilitate safe commercial fishing and efficient transiting of commercial fishing vessels after construction.

- Third, fishing revenue data described in Section 2.4 indicate that most fishing revenues on fishing trips that intersect the SWDA is generated outside the SWDA and AIS data indicate that most time spent on fishing trips that intersect the SWDA is spent outside the SWDA. The SWDA is less valuable as a commercial fishing area than adjacent areas even on trips that intersect the SWDA and vessels that fish in the SWDA regularly fish in adjacent and nearby areas.

- Fourth, it is highly unlikely that New England Wind will result in an overall reduction in fishing effort with fishing vessels spending more time in port or idle at sea generating no fishing revenues.

- Fifth, the SWDA is located close to highly valued fishing areas, which are already the focus of most fishing effort by fishing vessels that operate in the SWDA. It is reasonable to expect that some, and perhaps all, fishing revenues lost in the SWDA can and will be recouped as a result of fishing effort being diverted from the SWDA to other familiar nearby fishing areas.

Based on the available data, it is reasonable to expect that fishing effort in the SWDA will continue, either inside or outside the SWDA, during the expected life of New England Wind. Therefore, while $685,692 is an estimate of annual economic exposure in the SWDA, it is reasonable to expect that economic impacts associated with lost fishing revenues will be significantly less. Additionally, estimated economic exposure described for the SWDA in this report includes a portion of the economic exposure that has already been attributed to Vineyard Wind 1 in the COP for that project and is addressed in the commercial fishing compensation funds established for that project, as described in Section 1.1. As shown in Table 6b, if it is assumed that 25%, 50% or 75% of potential fishing revenue losses in the SWDA will either not be lost or will be recouped as a result of fishing effort shifting from the SWDA to other areas, estimated annual losses of fishing revenues from New England Wind, respectively, would be $514,269, $342,846, or $171,423.

5.2 Potential Fishing Congestion Impacts

5.2.1 Along the OECC

As described in Section 4.5, the OECC represents a very small portion of the available fishing grounds in the areas it passes through. In addition, for each Phase of New England Wind, construction and installation activities in the OECC (including the Western Muskeget Variant) will restrict commercial fishing only in temporary safety buffer zones established around where cable installation activity is taking place. Based on a safety buffer of 1 km (0.62 miles) these safety buffer zones are expected to average 3.14 sq km (1.21 sq mi) and during the expected 23 months of cable installation there will typically be only one cable installation activity underway and one safety buffer zone established at any given time. There is no reason to expect that these limited areas of temporary fishing restrictions within the OECC during cable installation will cause any meaningful shift in fishing effort from the OECC to other areas.

During O&M of New England Wind, the buried cable within OECC will have no impact on commercial fishing, except for the possibility noted above that along up to approximately 6% of the OECC for both Phases (or up to 7% of the OECC for both Phases if the Western Muskeget Variant is used for one or two Phase 2 cables) it may be necessary to install cable protection on the seafloor which could interfere with the limited amount of bottom trawling that takes place in and around the OECC. This possibility is not significant enough to expect that during O&M phase of New England Wind conditions in the OECC will cause enough fishing effort by bottom trawlers or other types of fishing vessels to shift away from the OECC to cause fishing congestion impacts in other areas.

5.2.2 In the SWDA

As described in Section 4.6.3, an average of 33 unique AIS-equipped fishing vessels per year fished in the SWDA from 2016 to 2019. During these years, an average of fewer than two unique fishing vessels operated in the SWDA during each of six months (November through April), and an average of fewer than six unique vessels operated in the SWDA during 10 months of any year (excludes August and September). Fishing effort in the SWDA is relatively low and fishing vessels that operate in the SWDA are part of the fishing fleet that already operates in nearby areas. The possibility that vessels that fish in the SWDA will shift some fishing effort from inside the SWDA to nearby areas is not a significant potential source of new fishing effort entering those other areas.

5.3 Fishing Vessel Transit Costs

5.3.1 SWDA Impacts on Transit Costs

After examining options for accommodating fishing and vessel transit lanes in the MA/RI WEA, the USCG concluded in its recent MARIPARS that the standard and uniform grid patterns being planned in wind development areas to facilitate safe and efficient fishing are "sufficient to maintain navigational safety and provide vessels with multiple straight-line options to transit safely through the MA/RI WEA."

During O&M of New England Wind, there will be no restrictions on fishing vessels transiting the SWDA other than where temporary safety buffer zones may be established around limited in-water maintenance activities and the layout of New England Wind will facilitate continued fishing vessel transits through the SWDA. The WTGs and ESPs will be oriented in fixed east-to-west rows and north-to-south columns with one nautical mile (1.85 km) spacing between WTG/ESP positions which, as the recent USCG study indicates, will allow multiple straight-line options for fishing vessels to transit safely through the SWDA.

However, there may still be some vessel operators who will prefer to reroute around the SWDA, especially while construction activity is underway in the SWDA and/or during extreme weather events. The average number of annual AIS-equipped fishing vessel transits through the SWDA range from 339 to 487 and averaged 422 (Baird 2021). This is a reasonable estimate of the number of transits per year that could potentially be impacted by New England Wind activities in the SWDA.

As shown in Figure 10, at a typical steaming speed of 7.6 knots, the expected increase in transit time around the SWDA (between major fishing ports and important fishing areas) ranges from 6 minutes to 46 minutes (a 1% to 7% increase in total transit time). If each of the 422 annual transits through the SWDA were rerouted around the SWDA, and those transits experienced the maximum increase in transit time of 46 minutes, the annual increase in fleetwide transit time would be 324 hours. Based on typical diesel fuel consumption rates at standard steaming speeds and typical diesel fuel prices, this would add approximately $57.50 to fuel costs per transit and add $24,265 to annual fleet-wide fuel-based transit costs for AIS-equipped vessels.

This estimate of $24,265 in annual fleetwide fuel-based transit costs does not reflect operating costs other than fuel or the opportunity cost of any lost fishing time resulting from added transit time. However, increased transit times associated with rerouting around the SWDA result in such minor increases in total transit time that it would have very small impacts on fishing time or revenues per trip. From a fleetwide perspective adjusting per transit cost impacts to account for more than just fuel would most certainly be offset by also adjusting for the fact that most of the 422 annual transits through the SWDA can be expected to continue to transit through rather than around the SWDA and will experience little to no increase in transit times or costs.

5.4 Shoreside Indirect and Direct Impacts

Direct impacts of New England Wind on commercial fisheries can have either upstream or downstream indirect shoreside impacts.

Upstream economic impacts could result if New England Wind causes a reduction in fishing effort that results in reductions in purchases of fishing inputs (e.g., fuel, bait, ice) and related economic multiplier effects on shore-based fishing support businesses. For reasons described in Section 4.8.4, it is extremely unlikely that New England Wind will result in owners or operators of commercial fishing vessels that cease operating in the SWDA or OECC to decide not to continue fishing and generating fishing revenues in other areas. The alternative would be to assume that New England Wind will result in those vessels spending more time in port or remaining idle at sea generating no fishing revenues. It is reasonable, therefore, to expect that New England Wind will not result in any reduction in fishing effort or any related reduction in purchases of fishing inputs that would result in any shoreside upstream economic impacts.

Downstream shoreside impacts could result if reductions in fish landings caused by New England Wind led to seafood businesses facing supply shortages or higher prices for raw fish that reduced their profits or resulted in reduced production. Most New England seafood buyers have many alternatives to fish harvested in the SWDA, including fish harvested by vessels that divert fishing effort from the SWDA to other areas as well as many other domestic and foreign seafood supply sources.

As described in Section 3.1, the maximum potential decline in the annual value of fish landings from the SWDA is estimated to be $685,692 and, based on the analysis described in Section 3.2, the potential decline in the annual value of fish landings from the OECC during 23 months of cable installation (Phase 1 and Phase 2) is estimated to be approximately $15,372. Even if it were assumed that these values represent expected lost fish landings from those areas and that none of these lost landings would be replaced as a result of fishing effort shifting to other areas, they represent an extremely small share of the billions of dollars in seafood supplies available to New England seafood processors, wholesalers, retailers, and restaurants from domestic and foreign suppliers. Therefore, it should not be expected that New England Wind will result in any widespread downstream shoreside economic impacts.

However, it is possible that fish supply disruptions caused by New England Wind could result in some localized economic losses among primary processors and dealers that rely primarily on locally caught fish or even on fish caught specifically in and around the SWDA and OECC. Based on the standard New England seafood processor "margin" of $0.565 for the types of fish harvested in the SWDA (See Section 4.8.5), Table 6a indicates that lost processor margins based on a reduction in fish landings equal to 100% of economic exposure in the SWDA ($685,692) would be $387,416. Table 6b uses this same seafood processor margin to show that if 25%, 50%, or 75% of potential lost fish landings from the SWDA were either not lost or were recouped as a result of fishing effort shifting to other areas, the resulting loss in annual seafood processor margins would be $290,562, $193,708, or $96,854, respectively.

TABLES

Table 1 Data Sources

Source 1	RI DEM (2017) RI DEM made use of VMS data for a larger portion of the North Atlantic, as well as VTRs and landings data for New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, and New Jersey for the years 2011 through 2016. RI DEM, acknowledging certain limitations of VTR-based analysis of fishing effort, notably the potential for imprecise location attributes, conducted the analysis of the Massachusetts Wind Energy Area (MA WEA) such that VMS, VTR, and commercial landings datasets were linked. The combined data were additionally divided into subsets by fishery (species, gear, state, and port landings) and mapped as a raster of fishing density by year. In addition to providing more robust locational information through the incorporation of the VMS dataset, RI DEM was able to scale the landings based on the density of fishing activity within the MA WEA during a given year, thereby providing a unique estimate of fishery revenue within specific geographic areas of the MA WEA, including Lease Area OCS-A 0501. RI DEM, assuming all fishing activity is not equal and by using the fishing density rasters described above, was able to scale commercial landings by the amount of fishing activity within the Lease Area per trip. Each individual fishing location point within a trip was weighted by the fishing density map for that fishery that year, placing higher weights on points where the fishing density was higher. According to RI DEM, this strategy assumes that fishermen target areas that are most profitable (i.e., where species abundances are higher). http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/RIDEM_VMS_Report_2017.pdf
Source 2	Kirkpatrick et al. (2017) BOEM funded a study prepared by the NOAA Northeast Fisheries Science Center that characterizes commercial fishing from Maine to North Carolina and provides insight into revenue generated by federally permitted fishermen. The report details the average value of fish harvested over the six-year period between 2007 and 2012 and identifies the ports and fishery sectors (e.g., gear, species) supporting that activity. NOAA-Fisheries also developed a model to estimate the socioeconomic impact of wind energy development on commercial fishermen. Making use of VTR data, spatial data from the Northeast Fisheries Observer Program database, and VMS data, the study provides information on commercial harvest by location, species caught, gear type, and port group. Source 2 is available at: Volume 1: https://espis.boem.gov/final%20reports/5580.pdf Volume 2: https://espis.boem.gov/final%20reports/5581.pdf
Source 3	NOAA-VTR Data (2020c) NOAA-Fisheries provided summaries of VTRs filed between 2008 and 2018 and point locations reported within the SWDA. This dataset includes non-confidential landed weight and value for individual species, gear type, state, and ports.
Source 4	BOEM (2020) BOEM makes available single-year revenue intensity rasters summarized by Fishery Management Plan. These revenue intensity rasters were developed for Source 2, described above, and updated by BOEM to account for additional years of data. Revenue intensity rasters can be accessed at: https://www.boem.gov/renewable-energy/mapping-and-data/renewable-energy-gis-data.
Source 5	NOAA (2021) "Socioeconomic Impacts of Atlantic Offshore Wind Development" NOAA-Fisheries developed sets of tables summarizing annual fishing activity within each offshore wind lease or project area and related annual fishing revenues during years 2008-2019. These tables highlight annual landings and revenue by species, gear type, and fishery management plan within each area as well as revenue by port and vessel dependence upon operations in each area. These reports can be accessed at: https://www.fisheries.noaa.gov/resource/data/socioeconomic-impacts-atlantic-offshore-wind-development.

Table 2 Estimates of Commercial Fishing Economic Exposure in the SWDA, Unadjusted for Lobster and Jonah Crab[1]

Source	Study Period (Years)	Study Area	Size of Study Area (square kilometer [km^2])	Value of Study Area (all years)	Average Annual Value of SWDA	High Annual Value of SWDA	Low Annual Value of SWDA	Average Annual Value of SWDA per km^2
NOAA (2021)	2008-2019	SWDA	453	$6,832,323	$569,360	$1,096,868	$310,024	$1,257

Notes:
1. All economic values are reported in 2019 dollars.

Table 3a Estimate of Commercial Fishing Economic Exposure in the SWDA, Adjusted for Lobster and Jonah Crab[1]

Source	Average Annual Fishing Revenues in the SWDA	High Annual Fishing Revenues in the SWDA	Low Annual Fishing Revenues in the SWDA	Average Annual Fishing Revenues in the SWDA per km^2
NOAA (2021)	$685,692	$1,213,200	$426,356	$1,514

Notes:
1. All economic values are reported in 2019 dollars.

Table 3b Estimate of Commercial Fishing Economic Exposure in the SWDA by State, Adjusted for Lobster and Jonah Crab[1]

Source	State	Percentage of Annual Average SWDA Value	SWDA Annual Average[1]
NOAA (2021)	Massachusetts	45.21%	$310,001
NOAA (2021)	Rhode Island	44.20%	$303,076
NOAA (2021)	New York	7.21%	$49,439
NOAA (2021)	Virginia	1.32%	$9,051
NOAA (2021)	North Carolina	1.04%	$7,131
NOAA (2021)	New Jersey	0.93%	$6,377
NOAA (2021)	All Others	0.09%	$617
Total		100%	$685,692

Notes:
1. All economic values are reported in 2019 dollars.

Table 4 Commercial Fishing Vessels Operating in the SWDA, 2016–2019[1]

	Total Time (Hours)	Time in SWDA (Hours)	Percent of Time in SWDA
Fishing Vessel AIS Tracks Transecting the SWDA at ≤4 knots	3396.9	854.6	25.2%

Notes:
1. Baird (2021).

Table 5a Summary of Fishing Vessel Activity in SWDA, 2016–2019 (AIS)[1]

Year	Month												
2016	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total (Unique Vessels)
Fishing Vessels (≤4.0 knots [kts.])	0	0	1	1	2	3	6	20	42	6	2	2	56
Fishing Vessel Tracks (≤4.0 kts.)	0	0	2	1	4	3	20	156	220	12	2	2	421
Fishing Vessels (>4.0 kts.)	1	6	12	6	11	17	26	34	52	18	11	9	85
Fishing Vessel Tracks (>4.0 kts.)	1	10	19	9	26	46	71	118	125	34	18	15	487

Table 5a Summary of Fishing Vessel Activity in SWDA, 2016–2019 (AIS)[1] (Continued)

Year 2017	Month												
Fishing Vessels (≤4.0 kts.)	0	0	0	1	3	3	6	4	18	6	0	0	33
Fishing Vessel Tracks (≤4.0 kts.)	0	0	0	1	3	3	8	15	34	6	0	0	70
Fishing Vessels (>4.0 kts.)	8	13	6	14	19	26	32	35	35	15	3	0	96
Fishing Vessel Tracks (>4.0 kts.)	29	18	10	24	28	48	73	92	81	20	3	0	417
Fishing Vessels (≤4.0 kts.)	0	0	0	0	5	2	1	3	3	2	0	0	14
Fishing Vessel Tracks (≤4.0 kts.)	0	0	0	0	7	3	2	3	10	3	0	0	28
Fishing Vessels (>4.0 kts.)	2	1	1	12	39	39	38	36	22	7	3	1	98

Table 5a Summary of Fishing Vessel Activity in SWDA, 2016–2019 (AIS)[1] (Continued)

Year	Month												
2018	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual Total (Unique Vessels)**
Fishing Vessel Tracks (>4.0 kts.)	2	0	1	12	66	85	70	62	34	10	4	1	339
2019													
Fishing Vessels (≤4.0 kts.)	0	0	0	1	0	2	5	12	12	1	0	0	29
Fishing Vessel Tracks (≤4.0 kts.)	0	0	0	1	0	5	6	25	23	4	0	0	63
Fishing Vessels (>4.0 kts.)	1	1	6	19	34	38	46	51	33	10	6	2	124
Fishing Vessel Tracks (>4.0 kts.)	1	2	8	25	50	72	111	125	42	15	6	2	446

Notes:

1. Baird (2021).

Table 5b Total Average of Fishing Vessel Activity in SWDA, 2016–2019 (AIS)[1]

Year	Month												
2016-2019	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total (Unique Vessels)
Fishing Vessels (≤4.0 knots [kts.])	0	0	0	1	3	3	5	10	19	4	1	1	33
Fishing Vessel Tracks (≤4.0 kts.)	0	0	1	1	4	4	9	50	72	6	1	1	146
Fishing Vessels (>4.0 kts.)	3	5	6	13	26	30	36	39	36	13	6	3	101
Fishing Vessel Tracks (>4.0 kts.)	8	8	10	18	43	63	81	99	71	20	8	5	422

Notes:

1. Baird (2021).

Table 6a Shoreside Impacts with a Decline in Fish Landings Based on Full Economic Exposure[1,2]

Impacted Percentage of SWDA Economic Exposure	Direct Impacts	Upstream Impacts		Downstream Impacts		Summary of Economic Impacts			
	Economic Exposure[3]	Economic Multiplier[4]	Economic Impacts	Processor Markup[5]	Lost Processor Markup	Commercial Fishing (Annual)	Shoreside Businesses (Annual)	Total (Annual)	Total (Over 30 years)
100%	$685,692	0.852	$584,210	$0.565	$387,416	$685,692	$971,626	$1,657,318	$49,719,540

Notes:

1. Assumes all fishing effort in the SWDA ceases with no offsetting increase in fishing effort in other areas (see Section 3.0).
2. All values are reported in 2019 dollars and do not include potential fishing revenue losses of $15,372 in the OECC
3. Reductions in the ex-vessel value of fish landings are based on all landings from the SWDA being lost and not replaced.
4. New England Type 2 Output Multipliers (indirect and induced impacts) for the fish harvesting sector (NOAA Online Fishery Impact Model Advanced Query 2020).
5. "Markup" is the difference between the value of seafood products sold and the dockside or wholesale value for an equivalent weight of fish purchased (NMFS 2016). Raw fish accounts for 63.9% of primary dealer/processor revenues (Scheld 2020). Therefore, each $1.00 reduction in raw fish purchased and processed results in $1.565 less seafood revenues. Therefore, each $1.00 reduction in raw fish purchased results in lost markup of $0.565; that is, $1.565 less $1.00.

Table 6b Shoreside Impacts with Some Lost landings in the SWDA Recouped from Increased Fishing in Other Areas[1,2]

Percent of Lost SWDA Landings Recouped	Direct Impacts	Upstream Impacts		Downstream Impacts		Summary of Economic Impacts			
	Net Reduction in Fish Landing [3]	Economic Multiplier[4]	Economic Impacts	Processor Markup[5]	Lost Processor Markup	Commercial Fishing (Annual)	Shoreside Businesses (Annual)	Total (Annual)	Total (Over 30 years)
25%	$514,269	0.852	$438,157	0.565	$290,562	$514,269	$728,719	$1,242,988	$37,289,640
50%	$342,846	0.852	$292,105	0.565	$193,708	$342,846	$485,813	$828,659	$24,859,770
75%	$171,423	0.852	$146,052	0.565	$96,854	$171,423	$242,906	$414,329	$12,429,870

Notes:

1. Assumes 25%, 50%, and 75% of fishing revenues lost in the SWDA will be recouped as a result of fishing effort shifting from the SWDA to other nearby fishing areas (see Section 3.0).
2. Economic values are reported in 2019 dollars and do not include potential fishing revenue losses of $15,372 in the OECC.
3. Net reduction in the ex-vessel value of fish landings based on the percent of fishing revenues lost in the SWDA recouped as a result of fishing effort shifting from the SWDA to other nearby fishing areas.
4. New England Type 2 Output Multipliers (indirect and induced impacts) for the fish harvesting sector (NOAA Online Fishery Impact Model Advanced Query 2020).
5. "Markup" is the difference between the value of seafood products sold and the dockside or wholesale value for an equivalent weight of fish purchased (NMFS 2016). Raw fish accounts for 63.9% of primary dealer/processor revenues (Scheld 2020). Therefore, each $1.00 reduction in raw fish purchased and processed results in $1.565 less seafood revenues. Therefore, each $1.00 reduction in raw fish purchased results in lost markup of $0.565; that is, $1.565 less $1.00.

REFERENCES AND ENDNOTES

[ASMFC] Atlantic States Marine Fisheries Commission. [date unknown]. Jonah crab. [accessed 2021 Mar 24]. http://www.asmfc.org/species/jonah-crab

[Baird] W.F. Baird & Associates Ltd. 2021. Draft New England Wind Navigation Safety Risk Assessment.

[BOEM] Bureau of Ocean Energy Management. 2018. Vineyard Wind Offshore Wind Energy Project Draft Environmental Impact Statement. BOEM. OCS EIS/EA BOEM 2018-060. US Department of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, VA. https://www.boem.gov/Vineyard-Wind-EIS/

[BOEM] Bureau of Ocean Energy Management. 2020. Renewable energy GIS data: Socio-economic impact of Outer Continental Shelf wind energy development on fishing in the U.S. Atlantic. https://www.boem.gov/renewable-energy/mapping-and-data/renewable-energy-gis-data

[BOEM] Bureau of Ocean Energy Management. 2021. Vineyard Wind 1 Offshore Wind Energy Project Final Environmental Impact Statement. OCS EIS/EA BOEM 2021-0012. https://www.boem.gov/vineyard-wind

[CFCRI] Commercial Fisheries Center of Rhode Island. 2018. Affidavit Rationale for Commercial Fishing Industries Required East & West Turbine Layout for Wind Energy Areas for Rhode Island and Massachusetts Including Bureau of Ocean Energy Management OCS Lease Sites A-0486, A-0500, A-0501. Submitted to BOEM, October 3, 2018.

[MARCO] Mid-Atlantic Ocean Data Portal. 2018. Commercial fishing – VTR (also referred to as Communities at Sea) maps. http://portal.midatlanticocean.org/

[NMFS] National Marine Fisheries Service, Office of Science and Technology, Division of Fisheries Statistics and Economics. 2016. Frequently asked question (FAQ) sheet for the value-added table.

[NOAA] National Oceanic and Atmospheric Administration. 2021. Socioeconomic impacts of Atlantic offshore wind development. [updated 2021 July 6; accessed 2021 August 2]. https://www.fisheries.noaa.gov/resource/data/socioeconomic-impacts-atlantic-offshore-wind-development

[NOAA] National Oceanic and Atmospheric Administration. 2020a. What is the vessel monitoring system? [accessed 2020 June 20]. https://www.fisheries.noaa.gov/node/696

[NOAA] National Oceanic and Atmospheric Administration. 2020b. Annual commercial landings statistics [dataset]. [accessed August 2021]. https://www.fisheries.noaa.gov/foss

[NOAA] National Oceanic and Atmospheric Administration. 2020c. NOAA VTR data.

[RI DEM] Rhode Island Department of Environmental Management, Division of Marine Fisheries. 2017. Spatiotemporal and economic analysis of vessel monitoring system data within wind energy areas in the Greater North Atlantic. http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/RIDEM_VMS_Report_2017.pdf

[RI DEM] Rhode Island Department of Environmental Management, Division of Marine Fisheries. 2018. Spatiotemporal and economic analysis of vessel monitoring system data within wind energy areas in the Greater North Atlantic, Addendum I. http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/RIDEM_VMS_Report_2017.pdf

[USCG] United States Coast Guard. 2020. The areas offshore of Massachusetts and Rhode Island Port Access Route Study (MARIPARS). USCG-2019-0131. https://www.regulations.gov/document?D=USCG-2019-0131-0101

Baruah E. 2016. A review of the evidence of electromagnetic field (EMF) effects on marine organisms. Research & Reviews: Journal of Ecology and Environmental Sciences. 4(4): 22-26.

Dupigny-Giroux LA, Mecray EL, Lemcke-Stampone MD, Hodgkins GA, Lentz EE, Mills KE, Lane ED, Miller R, Hollinger DY, Solecki WD, et al. 2018. National Climate Assessment Chapter 18: Northeast. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller DR, Avery CW, Easterling DR, Kunkel KE, Lewis KLM, Maycock TK, Stewart BC (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 669–742. doi: 10.7930/NCA4.2018.CH18

Epsilon Associates, Inc. 2018. Draft Construction and Operations Plan. Vineyard Wind LLC. https://www.boem.gov/Vineyard-Wind/

Hutchison ZL, Sigray P, He H, Gill AB, King J, Gibson C. 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, Sterling, VA. OCS Study BOEM 2018-003.

Lipton D, Parker M, DuBerg J, Rubino M. 2019. An approach to determining economic impacts of U.S. aquaculture. NOAA Technical Memorandum NMFS-F/SPO-197, 26 p.

Love MS, Nishimoto MM, Clark S, McCrea M, Bull AS. 2017. The organisms living around energized submarine power cables, pipe, and natural sea floor in the inshore waters of Southern California. Bulletin, Southern California Academy of Sciences 116(2), pp.61-89.

Kirkpatrick AJ, Benjamin S, DePiper GD, Murphy T, Steinback S, Demarest C. 2017. Socio-economic impact of outer continental shelf wind energy development on fisheries in the U.S. Atlantic, Vol. 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. Volume I: https://espis.boem.gov/final%20reports/5580.pdf Volume II: https://espis.boem.gov/final%20reports/5581.pdf

Normandeau Associates Inc., Exponent Inc., Tricas T, Gill A. 2011. Effects of EMFs from undersea power cables on elasmobranchs and other marine species. US Dept. of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement, Pacific OCS Region, Camarillo, CA. OCS Study BOEMRE 2011-09. https://espis.boem.gov/final%20reports/5115.pdf

Scheld AM. 2020. Economic impacts associated with the commercial fishery for longfin squid (*Doryteuthis pealeii*) in the Northeast U.S. Gloucester Point, VA: Virginia Institute of Marine Science, William & Mary. https://scemfis.org/wp-content/uploads/2020/03/LFS_EI_Report.pdf

Snyder DB, Bailey WH, Palmquist K, Cotts BRT, Olsen KR. 2019. Evaluation of potential EMF effects on fish species of commercial or recreational fishing importance in Southern New England. Sterling VA: U.S. Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2019-049.

Endnotes

[1] The Western Muskeget Variant is the same exact corridor as the western Muskeget option included in the Vineyard Wind 1 COP and has already been thoroughly reviewed and approved by BOEM as part of that COP.

[2] The length of the OECC for both Phases (~78 km) is conservatively measured from the offshore edge of the corridor at the potential Phase 1 landfall sites, which is slightly farther from the SWDA than the potential Phase 2 landfall sites.

[3] The "MA/RI WEA" as used in the USCG's (2020) MARIPARS includes all seven adjacent lease areas on the Outer Continental Shelf (OCS) south of Martha's Vineyard, Massachusetts, and east of Rhode Island, which are referred to in the COP as the "MA WEA and RI/MA WEA."

[4] Fishing congestion impacts involve increases in fishing costs or decreases in fishing revenues that result when fishing activity in an area is so concentrated that fishing vessel operations interfere with one another. This concept is used to distinguish these types of impacts from other types of impacts that can be caused when a fishing area becomes overcapitalized, such as overfishing, fishing quotas being reached, or fishing seasons being closed sooner. See additional discussion on fishing congestion in Section 4.6.

[5] This report does not address potential impacts of New England Wind on fish resources. Estimates of economic exposure and potential economic impacts presented in the report are based on the ex-vessel value of recent year commercial harvests and so would not be affected by predictions of potential New England Wind impacts on fish resources.

[6] This report focuses on potential New England Wind impacts on commercial fishing and fishing-related shoreside businesses, not on potential indirect and induced impacts of these businesses on the broader US economy. Section 4.8.2 describes why upstream impacts associated with businesses that supply fishing inputs are associated with project-driven changes in fishing effort, and downstream impacts are associated with changes in fish landings that result in changes in "value added" and "margins" in the primary processors/distributors sector.

[7] The OECC will consist mostly of buried cable that will not affect commercial fishing after installation. As described in Section 4.5.2, while the Proponent will make every effort to achieve sufficient burial depth, it is conservatively estimated that up to approximately 6% of the OECC for both Phases (or up to 7% of the OECC for both Phases if the Western Muskeget Variant is used for one or two Phase 2 cables) may not achieve the proper burial depth and may require cable protection to be installed on the seafloor.

[8] Fishing congestion impacts occur when a high concentration of vessels operating in a fishing area result in fishing vessels interfering with one another resulting in increases in fleetwide fishing costs or reductions in fleetwide fishing revenues, or both (see Section 4.6.3 for additional information).

[9] No attempt was made to estimate potential economic impacts associated with the very small amounts of fish that are landed outside of the five states in the Offshore Development Region and are reported to have been harvested in the SWDA.

[10] Concerns have been expressed about potential fishery-related economic losses associated with WTG cables along the OECC generating electromagnetic fields (EMF)that harm or cause negative responses in fish. These possibilities have also been examined and determined not to be based on science (see Section 6.6.2.2.3 of COP Volume III).

[11] Economic exposure is estimated based on past fishing values and the assumption that all fishing values from the SWDA and the OECC will be lost and not recouped by fishing effort being diverted elsewhere. These estimates are not affected by estimates of potential New England Wind effects on fish resources inside or outside of those areas. Under the assumption that at least some fishing effort from the SWDA and OECC will be diverted to other areas, potential New England Wind impacts on the abundance, availability, and catchability of fish in those other areas may help determine how much of the fishing value lost in the SWDA and OECC will be recouped.

[12] The web address of NOAA-Fisheries website titled *Socio-economic Impacts of Atlantic Offshore Wind Development* is (https://www.fisheries.noaa.gov/resource/data/socioeconomic-impacts-atlantic-offshore-wind-development).

[13] An extremely broad definition of fishing activities that "may be impacted" could include all fishing activities in all fishing areas where fishing effort diverted from the SWDA might cause "fishing congestion" impacts. The analysis presented in Section 4.6 shows that congestion impacts resulting from New England Wind, even in nearby fishing areas, are so improbable, insignificant, and impossible to measure that they should be ignored for purposes of estimating fishery-related economic exposure and economic impacts.

[14] The SWDA represents 67% of Lease Areas OCS-A 0501 and OCS-A 0534, and based on the assumption of uniform fishing and fishing values, accounts for that percent of fishing values estimated for the overall Lease Area. Feedback from MA DMF on a previous analysis where the assumption of uniform fishing values in Lease Areas OCS-A 0501 and OCS-A 0534 was used to assess fishing values for Vineyard Wind 1, indicated that significantly more fishing revenues are generated in the northern part of Lease Areas OCS-A 0501 and OCS-A 0534 than in the southern part. This implies that using 67% as the percent of fishing values for the area that is attributable to the SWDA overstates fishing values in the SWDA.

[15] Trends in the American lobster and Jonah crab fisheries have been documented elsewhere. Historically, Jonah crabs were harvested as an incidental catch in the American lobster trap fishery. In recent years, landings increased significantly due to a decrease in southern New England lobsters and an increase in price of other crab species (ASMFC [date unknown]).

[16] Fishing values reported for various years in the four data sources listed in Table 1 were updated to 2020 values using the Bureau of Labor Statistics, Producer Price Index for Commodity Code # 0223, Unprocessed, and Prepared seafood.

[17] These FRD rasters do not reflect fishing revenues associated with lobster and Jonah crab harvests taken by vessels that fish exclusively for those two species and do not file VTRs.

[18] Two sources—NOAA (2020c) and BOEM (2020)—contain partial estimates of lobster and Jonah crab values based only on landings by vessels that file VTR reports. These values were not included in the "unadjusted" fishing values presented in Figure 3 in order to keep fishing value estimates from various sources consistent and allow accounting for the full value of lobster and Jonah crab landings as described in Section 3.3.

[19] Portions of the SWDA are within Lobster Management Area 3 (LMA 3). Because LMA 3 is very large and includes a large number of permitted pots, including the number of permitted pots in LMA 3 in the estimation of revenues per permitted pot would have resulted in very low estimates of revenue per permitted pot. As a result, the analysis developed here does not include LMA 3 permitted vessels. This results in estimates of economic exposure and economic impacts related to lobster and Jonah crab harvests in the SWDA being higher than they would otherwise be.

[20] After construction, both the SWDA and the OECC will be open to fishing so opportunities for fishermen to continue generating fishing revenues during O&M of New England Wind will include fishing in the SWDA and the OECC as well as redirecting fishing effort to other areas.

[21] A basic tenet of economics is that businesses will continue to operate in the short-term as long as revenues (e.g. ex-vessel value of landings) exceed operating costs (trip expenses), which allows net operating profits to offset at least some fixed costs. In many meetings related to Vineyard Wind 1, commercial fishermen themselves acknowledged that fishing will likely continue in or at least around offshore wind farms.

[22] This is based on AIS data for the SWDA and a conventional 4 knot screening method for distinguishing between vessels that are involved in fishing rather than transiting. If a vessel's speed is 4 knots or less, it is assumed to be fishing and if it is greater than 4 knots it is assumed to be transiting.

[23] Note that this estimate of a 25% decline in fishing revenues is based on the assumption that lost fishing revenues from the SWDA will not be recouped by shifting more time on trips that currently transect the SWDA to other fishing areas. Based on the more realistic assumption that fishing effort reductions and lost fishing revenues in the SWDA will be at least partly offset by increased fishing effort and fishing revenues in other areas the expected decline in fishing revenues would be significantly less than the 25% of fishing revenues generated on fishing trips that currently transect the SWDA.

[24] Where it is difficult to achieve a sufficient burial depth or where cables must cross existing infrastructure, New England Wind's inter-array, inter-link, and offshore export cables may be protected by rocks, gabion rock bags, prefabricated flexible concrete coverings (referred to as concrete mattresses), or half-shell pipes (or similar products).

[25] Electromagnetic fields (EMFs) will be generated by cables along the OECC. As described in Section 6.6.2.2.3 of COP Volume III, a white paper review study funded by BOEM determined that there would be negligible, if any, effects on bottom-dwelling commercial and recreational fish species and no negative effects on pelagic commercial

and recreational fish species in the southern New England area from EMFs produced by power transmission cables (Snyder et al. 2019). Of species potentially present in the SWDA and along the OECC, electrosensitivity has been documented in elasmobranchs (sharks, skates, and rays) and some teleost fish species (ray-finned fishes). Because EMFs produced by cables decreases with distance, and the target burial depth for the cables is 1.5–2.5 m (5–8 ft), the EMFs at the seabed would be expected to be weak and likely only detectable by demersal species (c). Another study funded by BOEM found that although there were changes in the behavior of little skate (*Leucoraja erinacea*), an elasmobranch, and American lobster in the presence of energized cables, EMFs from cables did not act as a barrier to movement in any way (Hutchison et al. 2018). In addition, research investigating habitat use around energized cables found no evidence that fishes or invertebrates were attracted to or repelled by EMFs emitted by cables (Love et al. 2017). To date, there is no evidence linking anthropogenic EMFs from WTG cables to negative responses in fish (Baruah 2016; Normandeau Associates Inc. et al. 2011). In addition, subsea power cables are already present in the region with four located between Martha's Vineyard and Falmouth and two more between Nantucket and Cape Cod (see Section 7.9 of COP Volume III).

[26] Baird (2021) is based on an analysis of AIS data. AIS is required on fishing vessels 19.8 m (65 ft) and over and is used on many vessels under 19.8 m (65 ft). However, analysis of fishing vessel activity based solely on AIS data does not account for many fishing vessels that are less than 19.8 m (65 ft) in length.

[27] Some of the 422 annual fishing vessel tracks through the SWDA shown in Table 6b may involve transits between fishing areas rather than from fishing ports to fishing areas. In some cases, these may involve longer north-south transits through the SWDA. This will not affect the added distance associated with transiting around rather than through the SWDA.

[28] This is based on 75% of landings generated outside the SWDA on trips that transect the SWDA continuing to be landed if those trips avoid the SWDA (see Section 4.1.1). It does not account for even higher landings on those trips if it is assumed that the decline in fishing effort in the SWDA on those trips will be diverted to other areas.

[29] The analysis presented here will focus only on shoreside impacts related to changes in output (sales) associated with commercial fishing and primary seafood processors and distributors. Similar analysis could focus on shoreside impacts on household income, jobs, or value-added.

[30] The NOAA Interactive Fisheries Economic Impact Tool can be found at https://www.fisheries.noaa.gov/data-tools/fisheries-economics-united-states-interactive-tool.

[31] In commercial fisheries, CPUE is a measure of output per unit of input and is determined, in general, by the abundance, availability, and catchability of fish in the area where the fishing effort is exerted. This is significantly different than the input-output relationships that exist in most other commercial activities where known quantities of inputs are used in factories or farms to produce known quantities of outputs.

[32] This report focuses on providing estimates of economic exposure and potential economic losses related to potential impacts of New England Wind on commercial fishing and related shoreside businesses. It does not provide estimates of how these businesses generate economic impacts on the overall US economy. For that reason, the

report generates estimates of potential downstream impacts only related to lost markups among primary processors/dealers. It does not address potential "economic multiplier" effects further downstream which may be associated with indirect and induced economic impacts related to the wholesale, grocer, or restaurant sectors.

[33] If operators of fishing vessels were assumed to replace at least some of the 25% decline in fishing revenues generated in the SWDA on trips that transect the SWDA by diverting fishing effort from the SWDA to other areas, lost fishing revenues would be less than 25% and the landed value of fish on those trips would be greater than 75% of what it would have been if fishing continued in the SWDA.

[34] Profits earned by fishing vessel owners and shares earned by skippers and crews are typically related to trip revenues and some combination of vessel costs and trip costs. They are not classified as shoreside input purchases.