VINEYARD NORTHEAST

CONSTRUCTION AND OPERATIONS PLAN

VOLUME II APPENDIX

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VINEYARD OFFSHORE

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Vineyard Northeast COP

Appendix II-F Economic Exposure of Commercial Fisheries

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Revision	Date	Description
0	July 2022	Initial submission.
1	April 2023	Reorganized and updated with the most recent commercial fisheries landings and revenue data from National Oceanographic and Atmospheric Administration (NOAA) Fisheries.
2	November 2023	Updated to address United States Coast Guard (USCG) Round 3 Comments (dated August 8, 2023) and made other minor revisions.
2	March 2024	Resubmitted without revisions.

Economic Exposure of Commercial Fisheries to the Vineyard Northeast Wind Energy Development in Lease Area OCS-A 0522

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List of Acronyms

AIS	automatic identification system
ASMFC	Atlantic States Marine Fisheries Commission
BEA	Bureau of Economic Analysis
BOEM	Bureau of Ocean Energy Management
CBRA	Cable Burial Risk Assessment
CFR	Code of Federal Regulations
CFSI	Commercial Fishing & Seafood Industry
COP	Construction and Operations Plan
CZMA	Coastal Zone Management Act
EE	economic exposure
ESP	electrical service platform
FAD	fish aggregation device
FE	fishing effort
FMP	fishery management plan
FRD	fishing revenue density
ft	feet
GDP	gross domestic product
HVAC	high voltage alternating current
km	kilometers
kts	knots
LMA	Lobster Management Area
m	meters
MADMF	Massachusetts Division of Marine Fisheries
MA/RI WEA	Massachusetts/Rhode Island Wind Energy Area
MARIPARS	Massachusetts and Rhode Island Port Access Route Study
NM	nautical miles
NOAA	National Oceanic Atmospheric Administration
NTM	Notices to Mariners
O&M	operations and maintenance
OCS	Outer Continental Shelf
OECC	offshore export cable corridor
US	United States
USCG	United States Coast Guard
VMS	vessel monitoring system
VTR	vessel trip report
WEA	Wind Energy Area
WTG	wind turbine generator

Executive Summary

Context

Vineyard Northeast LLC (the "Proponent") proposes to develop, construct, and operate offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0522 (the "Lease Area") along with associated offshore and onshore transmission systems. This proposed development is referred to as "Vineyard Northeast." Vineyard Northeast includes 160 total wind turbine generator (WTG) and electrical service platform (ESP) positions within the Lease Area. Two offshore export cable corridors (OECCs)—the Massachusetts OECC and the Connecticut OECC—will connect the offshore renewable wind energy facilities to onshore transmission systems in Massachusetts and Connecticut. If high voltage alternating current (HVAC) offshore export cables are used in the Massachusetts OECC, the cables would connect to a booster station in the northwestern aliquot[1] of Lease Area OCS-A 0534. Figure 1-1 provides an overview of Vineyard Northeast.

This report addresses the "economic exposure" of commercial fisheries to Vineyard Northeast based on historical commercial fishing revenues in the Lease Area and the OECCs. BOEM states that "economic exposure refers to potential economic impacts, not predicted or expected economic impacts" (Kirkpatrick et al. 2017) and is "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 2021). This report focuses on "economic exposure" and does not address expected "economic impacts." Expected economic impacts are likely to be significantly lower than full "economic exposure" because fishing effort temporarily precluded in the Lease Area and OECCs is likely to be diverted to other areas where it will continue generating at least some of the fishing revenues lost in the Lease Area and OECCs.

During the construction and operations and maintenance (O&M) of Vineyard Northeast, fishing vessels will not be restricted from operating in or transiting through the Lease Area or OECCs other than where the United States Coast Guard (USCG) establishes temporary safety zones, per 33 CFR Part 147, that extend 500 meters (m) (1,640 feet [ft]) around each WTG, ESP, and booster station (if used) during construction and certain maintenance activities. However, depending on the construction or O&M activity, the Proponent may also request that mariners give a wide berth to active work sites or construction and maintenance vessel(s) through the issuance of Offshore Wind Mariner Updates. For purposes of estimating economic exposure in this report, fishing vessels are assumed to be precluded from fishing or transiting within 1 kilometer (km) (0.54 nautical mile [NM]) of active work sites or construction and maintenance vessel(s).

[1] An aliquot is 1/64th of a BOEM Outer Continental Shelf (OCS) Lease Block.

Within the Lease Area some fishing tracks and vessel transit routes will need to be modified to account for the presence of WTGs and ESPs. Within the OECCs, the target burial depth for offshore export cables will be 1.5 to 2.5 m (5 to 8 ft) below the stable seafloor[2] which the Proponent's offshore cable engineers have determined is more than twice the burial depth required to prevent cables from interfering with fishing activity or fishing vessel transits. While every effort will be made to achieve sufficient burial depths this may not be possible along certain segments of the offshore export cables (up to 9% of cables to Massachusetts and up to 6% of cables to Connecticut). This may require remedial cable protection (rocks, rock bags, concrete mattresses, half-shell pipes, or similar) if a sufficient burial depth cannot be achieved. Cable protection will be designed and installed to minimize interfering with bottom fishing gear to the maximum extent practicable, and fishermen will be informed of exactly where cable protection exists. However, after cable installation there will remain a possibility that mobile bottom fishing gear could snag on cable protection resulting in gear damage, lost fishing time, and associated economic losses. This is the only potential source of economic exposure in the OECCs during the O&M phase of Vineyard Northeast. Vineyard Northeast has established a program that will compensate commercial fishermen for economic losses associated with damaged gear.

Focus

This report focuses primarily on direct sources of economic exposure involving commercial fishing disruptions in the Lease Area and OECCs during the construction, O&M, and decommissioning phases of Vineyard Northeast. It also addresses two potential indirect sources of economic exposure including: (1) potential "fishing congestion impacts" outside the Lease Area and OECCs caused by fishing effort shifting from those areas to other fishing areas; and (2) increased fishing vessel transit times and costs associated with vessels being forced to steam around or alter routes through the Lease Area and OECCs.

Findings

Estimates of Economic Exposure

Economic Exposure in the Lease Area

Based on National Oceanic Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) data, annual commercial fishing revenues in the Lease Area during 2008–2021, adjusted upward to fully account for unreported lobster and Jonah crab revenues, averaged $370,651 (2021 dollars; NOAA Fisheries 2023a). This adjusted estimate of annual

[2] Unless the final Cable Burial Risk Assessment (CBRA) indicates that a greater burial depth is necessary and taking into consideration technical feasibility factors, including thermal conductivity.

fishing revenues from the Lease Area provides an estimate of full annual economic exposure, that is lost commercial fishing revenues if all commercial fishing ceased in the entire Lease Area for a full year with none of the resulting losses in fishing revenues recouped as a result of fishing effort being diverted from the Lease Area to other fishing areas.

Economic Exposure in the OECCs

Based on NOAA Fisheries data, annual fishing revenues in the Massachusetts OECC during 2008–2021 averaged $2,291 per km^2, and in the Connecticut OECC averaged $3,301 to $3,427 per km^2 depending on which landfall approach is used[3] (2021 dollars; NOAA Fisheries 2023b). These provide baseline values for estimating economic exposure in parts of these OECCs where commercial fishing will be temporarily precluded during cable installation. Commercial fishing will be precluded in the OECCs only in areas where pre-installation and cable installation activities are underway and will not be precluded or impaired in the rest of the OECCs where cable installation is either planned or has been completed.

During pre-installation and cable installation activities, the Proponent expects to request that mariners give a wide berth to active work sites or construction vessel(s) through the issuance of Offshore Wind Mariner Updates. The Proponent will also coordinate with the USCG to issue Notices to Mariners (NTMs) advising other vessel operators of planned offshore activities. For the purposes of this economic analysis, it was assumed that fishermen would give a wide berth of up to 1 km (0.54 NM) around cable pre-installation and installation activities. This results in the assumption that commercial fishing will be precluded in the OECC in an area of approximately 3.14 km^2 (776 acres) around where pre-installation and cable installation activities are underway (see Figure 1-7). It is not expected that commercial fishing will be precluded or impaired in other parts of the OECC where cable installation is either planned or has been completed. If cable laying activities occasionally take place at more than one location, the increase in estimated economic exposure based on larger impact areas will be offset by a reduction in the overall duration of cable installation activity, so this possibility does not significantly increase estimated economic exposure based on cable installation taking place at only one location at a time. Based on the expected duration of cable pre-installation and installation activities in the two OECCs (22 months or 183% of a full year in the Massachusetts OECC and 21 months or 175% of a full year in the Connecticut OECC), economic exposure during cable pre-installation and installation is estimated to be $13,182 in the Massachusetts OECC and could range from $18,177 to $18,842 in the Connecticut OECC depending on which landfall approach is used.[3]

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[3] Offshore export cables installed within the Connecticut OECC will transition onshore at one of the three landfall sites shown on Figure 1-1. The economic exposure of the Connecticut OECC connecting to each of the three potential landfall sites (Eastern Point Beach Landfall Site, Ocean Beach Landfall Site, and Niantic Beach Landfall Site) have been analyzed for this report. The precise location of the landfall site will be determined through consultations and coordination with state and local officials.

Indirect Sources of Potential Economic Exposure

As described above, Vineyard Northeast has potential to generate two indirect types of economic exposure related to commercial fisheries, including:

1. Potential "fishing congestion" impacts outside the Lease Area and OECCs; and

2. Potential increases in fishing vessel transit times in and around the Lease Area and OECCs.

Lease Area

During the construction and O&M of Vineyard Northeast, fishing vessels will not be restricted from operating in or transiting through the Lease Area other than where the USCG establishes temporary safety zones, per 33 CFR Part 147, that extend 500 m (1,640 ft) around each WTG and ESP during construction and certain maintenance activities. Depending on the activity, the Proponent may also request that mariners give a wide berth to active work sites or construction and maintenance vessel(s) through the issuance of Offshore Wind Mariner Updates. For the purpose of estimating indirect economic exposure in this report it is assumed that fishing vessels in the Lease Area are precluded from operating or transiting within 1 km (0.54 NM) of active work sites or construction and maintenance vessel(s).

As described in Section 3.1, there is a low level of fishing effort in the Lease Area. Based on automatic identification system [AIS] data, an average of 69 fishing trips annually have tracks that intersect the Lease Area) and most fishing time on those trips is spent outside the Lease Area. These two factors indicate there is no risk that restricting those parts of fishing trips that transect the Lease Area will result in enough new fishing effort being introduced into other fishing areas to result in fishing congestion impacts outside the Lease Area.

Within the Lease Area, WTGs and ESP(s) will be oriented in fixed east-to-west rows and north-to-south columns with 1 NM (1.85 km) spacing between WTG/ESP positions.[4] As the recent United States Coast Guard (USCG) Massachusetts and Rhode Island Port Access Route Study (MARIPARS) indicates, this will allow multiple straight-line options for fishing vessels to transit safely through the Lease Area (USCG 2020). As described in Section 3.2 and illustrated in Figure 3-2 and Table 3-2, if unusually severe weather causes some fishing vessel operators to decide to reroute around the Lease Area when transiting between fishing ports and fishing areas, the resulting increases in steaming time and costs would also not be significant.

[4] Where necessary, WTGs and ESP(s) may be micro-sited by a maximum of 152 m (500 ft) to avoid unfavorable seabed conditions, maintain facilities within the Lease Area boundaries, and/or for other unexpected circumstances.

OECCs

The analysis described in Section 2.2 indicates that the small areas and limited durations of commercial fishing impacts during cable installation in the OECCs and the low probability of any significant impacts of OECC operations on commercial fishing after cable installation make it highly unlikely that the OECCs will result in either of the potential indirect economic exposure listed above.

Potential Impacts on the Abundance and Distribution of Fish

As described in Section 4.6 of COP Volume II, studies related to other proposed wind farms in US waters (and studies of established offshore wind energy farms in Europe) indicate that impacts of offshore wind farms on fish population dynamics are primarily local and short-term. That research indicates that the potential impacts of Vineyard Northeast on fish population dynamics is not a likely source of economic exposure in commercial fisheries.

Concern has also been expressed that WTG and ESP foundations may function as fish aggregation devices (FADs) that will attract fish to locations in the Lease Area where they will become less accessible to some types of commercial fishing. While these FADs may provide advantages and disadvantages to different types of fishing methods, the available studies indicate that they could have overall positive economic impacts on commercial fisheries (Wilhelmsson, et al. 2006; Riefolo et al. 2016; Raoux et al. 2017; Wilber, et.al, 2022).

Conclusions

As shown in Table 2-2, potential annual economic exposure in the Lease Area is estimated to be $370,651, and as shown in Table 2-4, economic exposure during cable installation in the Massachusetts OECC is estimated to be $13,182 and could range from $18,177 to $18,842 in the Connecticut OECC depending on which landfall approach is used. These are estimates of full economic exposure based on the assumption that none of the annual fishing revenues lost in the Lease Area and in impacted segments of the OECCs will be recouped as a result of fishing effort being diverted to other fishing areas.

Economic impact estimates based on estimates of economic exposure presented in this report will be determined at a later date based on updated BOEM guidance and consultations with the states through the Coastal Zone Management Act (CZMA) review processes.

1 Introduction

1.1 Vineyard Northeast Overview

Vineyard Northeast LLC (the "Proponent") proposes to develop, construct, and operate offshore renewable wind energy facilities in Bureau of Ocean Energy Management (BOEM) Lease Area OCS-A 0522 (the "Lease Area") along with associated offshore and onshore transmission systems. This proposed development is referred to as "Vineyard Northeast." Vineyard Northeast includes 160 total wind turbine generator (WTG) and electrical service platform (ESP) positions within the Lease Area. Two offshore export cable corridors (OECCs)—the Massachusetts OECC and the Connecticut OECC—will connect offshore renewable wind energy facilities to onshore transmission systems in Massachusetts and Connecticut (see Figure 1-1). If high voltage alternating current (HVAC) offshore export cables are used in the Massachusetts OECC, the cables would connect to a booster station in the northwestern aliquot[5] of Lease Area OCS-A 0534.

1.2 Focus

This report develops estimates of the "economic exposure" of commercial fisheries to construction, operation, and decommissioning of Vineyard Northeast facilities in the Lease Area and OECCs. BOEM states that "economic exposure refers to potential economic impacts, not predicted or expected economic impacts" 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" (Kirkpatrick et al. 2017). BOEM emphasizes 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).

Following BOEM guidance, estimates of economic exposure are developed in this report based on the assumption that during construction Vineyard Northeast will result in the cessation of all fishing activity in the Lease Area and in areas of active construction along the OECCs, with none of the resulting losses in fishing revenues recouped as a result of fishing effort shifting from the Lease Area and the OECCs to other fishing areas.

[5] An aliquot is 1/64th of a BOEM Outer Continental Shelf (OCS) Lease Block.

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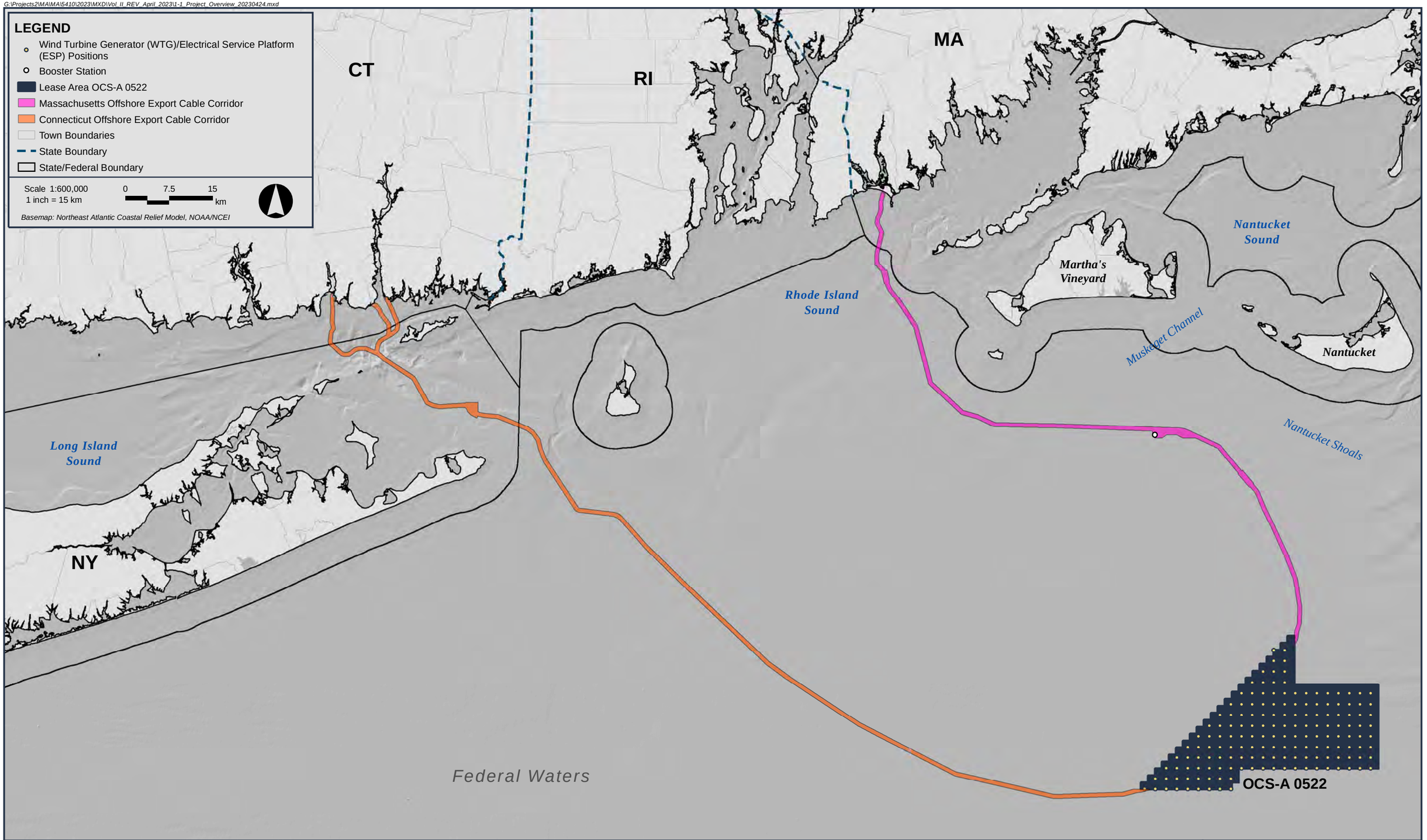

Figure 1-1
Overview of Vineyard Northeast

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As stated above, however; BOEM guidance indicates that expected economic impacts will be less than economic exposure if fishing vessel operators can recoup at least some lost fishing revenues by shifting fishing effort from impacted areas to other nearby areas. In the case of Vineyard Northeast, most of the Lease Area and most of the OECCs will remain open to fishing during and after construction 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 the opportunity to recoup at least some lost fishing revenues from those areas by diverting fishing effort to other nearby fishing areas.

This report focuses on measures of economic exposure. The two most significant sources of potential commercial fishery economic exposure from Vineyard Northeast addressed in this report are:

- Potential lost fishing revenues in the Lease Area during construction of a total of 160 WTG and ESP positions.
- Potential lost fishing revenues in the OECCs during construction resulting from commercial fishing being precluded from areas around where cable installation activities are underway.

The report also addresses two potential indirect sources of fishery-related economic exposure, including:

- Potential costs associated with increased fishing congestion outside the Lease Area and OECCs 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.
- Potential costs and lost fishing time associated with increased fishing vessel transit times if Vineyard Northeast results in fishing vessels that typically steam through the Lease Area using less direct routes through or around the Lease Area as they transit between fishing ports and fishing areas.

1.2.1 Indicators of Economic Exposure in the Lease Area

During 2016–2021 commercial fishing vessels entered the Lease Area an average of approximately 990 times annually.[6] However, they engaged in fishing in the Lease Area during only 69 (7%) of those trips. It is also important to note that only 6% of time spent on fishing tracks that transect the Lease Area took place in the Lease Area; the remaining 94% of time on

[6] Numbers of times fishing vessels entered the Lease Area to fish or in transit during 2016–2021 are based on analysis of AIS records for those years as presented in Baird (2022).

those fishing trips that transected the Lease Area was spent outside the Lease Area.[7] This indicates that the Lease Area is a relatively small part of a much larger fishing area that includes adjacent and nearby locations where fishing vessels that occasionally operate in, and more frequently transit through the Lease Area, spend most of their fishing time.

This relatively low level of commercial fishing effort in the Lease Area is consistent with the relatively low fishing revenue density (FRD) in the Lease Area ($692 per sq km) and the relatively low value of the expected harvest in the Lease Area (average annual revenue of $370,651 [2021 dollars] between years 2008 and 2021; NOAA Fisheries 2023a).[8] This estimate of average annual fishing revenues in the Lease Area of $370,651 is the best available estimate of full economic exposure in the Lease Area (NOAA Fisheries 2023a). It represents the expected reduction in commercial fishing revenues that would result if commercial fishing was precluded in the entire Lease Area for a full year with none of the resulting loss of fishing revenues recouped as a result of fishing effort shifting from those areas to other fishing areas.

Fishing revenue density charts presented in Figure 1-2 through Figure 1-6 indicate that the Lease Area does not contain exceptionally productive fishing grounds and is surrounded by other comparable, and in many cases more productive, fishing areas. On an individual permit basis, most fishermen who spend time operating in the Lease Area generate less than 1% of their annual revenue from the Lease Area (NOAA Fisheries 2023c). This is consistent with the results of the analysis of AIS data for the Lease Area mentioned above which indicate that a significant portion of fishing vessel time on trips that involve some fishing in the Lease Area is spent fishing in other nearby areas.

During O&M it is expected that some commercial fishing vessels operating in or transiting through the Lease Area may need to modify transit routes or fishing tracks to account for the presence of WTGs and ESP(s). It is also possible that some transiting fishing vessels may reroute around the Lease Area and some fishing effort may shift from the Lease Area to other areas. Changes in fishing revenues associated with these potential changes in commercial fishing practices are sources of potential economic exposure. However, the relatively low level of fishing effort in the Lease Area and the correspondingly low amount of fishing revenues generated in the Lease Area indicate that direct economic exposure of commercial fishing in the Lease Area associated with these potential modifications in fishing vessel tracks will be relatively small. Records of fishing activity and fishing revenues in the Lease Area also indicate that fishing effort diverted from the Lease Area to other fishing areas would not involve a significant enough shift in fishing effort to result in "fishing congestion impacts" in those other

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[7] See Baird 2022.

[8] These values of fishing revenues and fishing revenue density in the Lease Area are based on NOAA Fisheries (2023a), which reports fishing revenues in the Lease Area for years 2008-2021 based on VTR data, which were then adjusted upward to include estimates of fishing revenues associated with lobster and Jonah crab harvests that are not included in VTR records (see Table 2-1 and Table 2-2).

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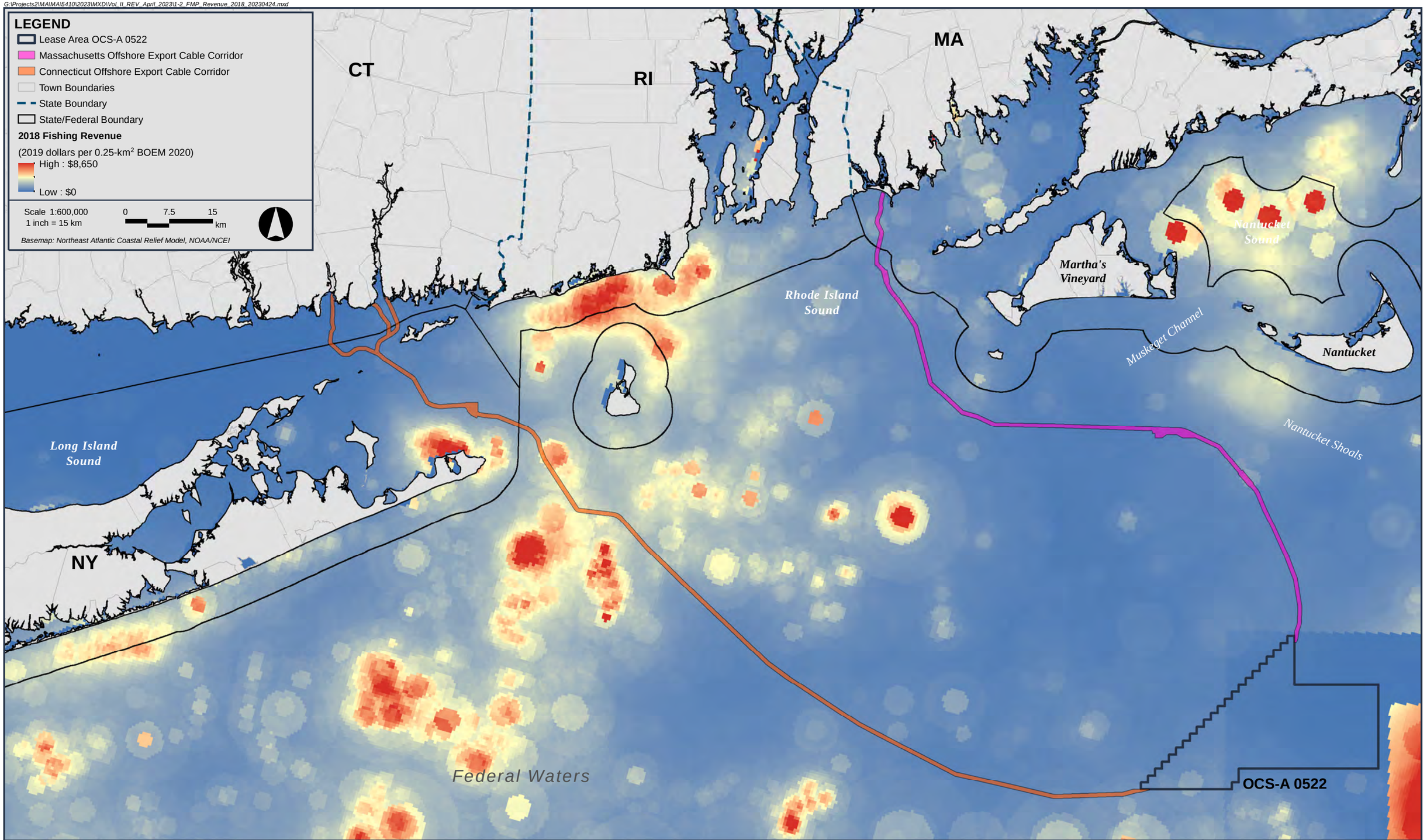

Figure 1-2
Fishing Revenue Density, All Fishery Management Plans, 2018

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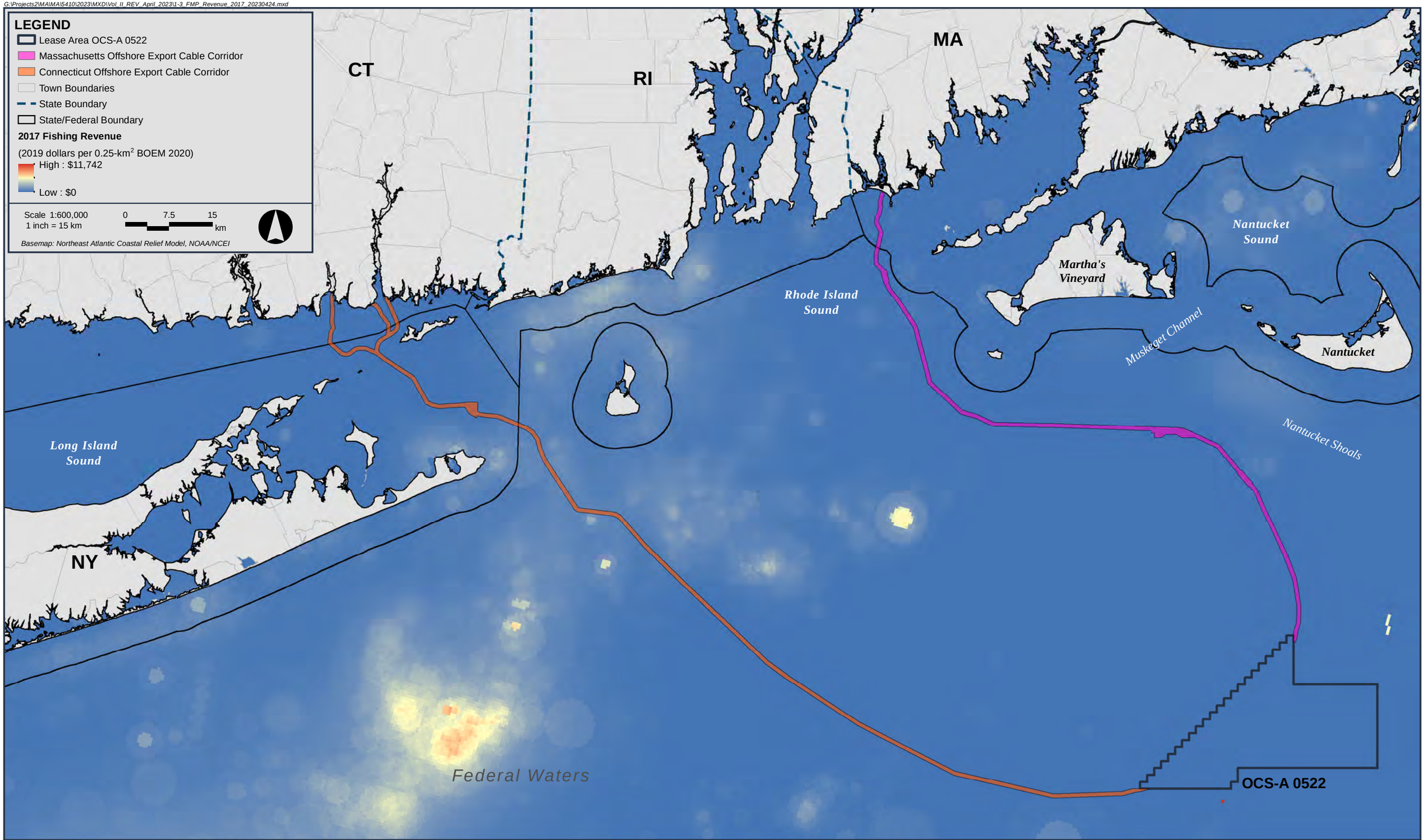

Figure 1-3
Fishing Revenue Density, All Fishery Management Plans, 2017

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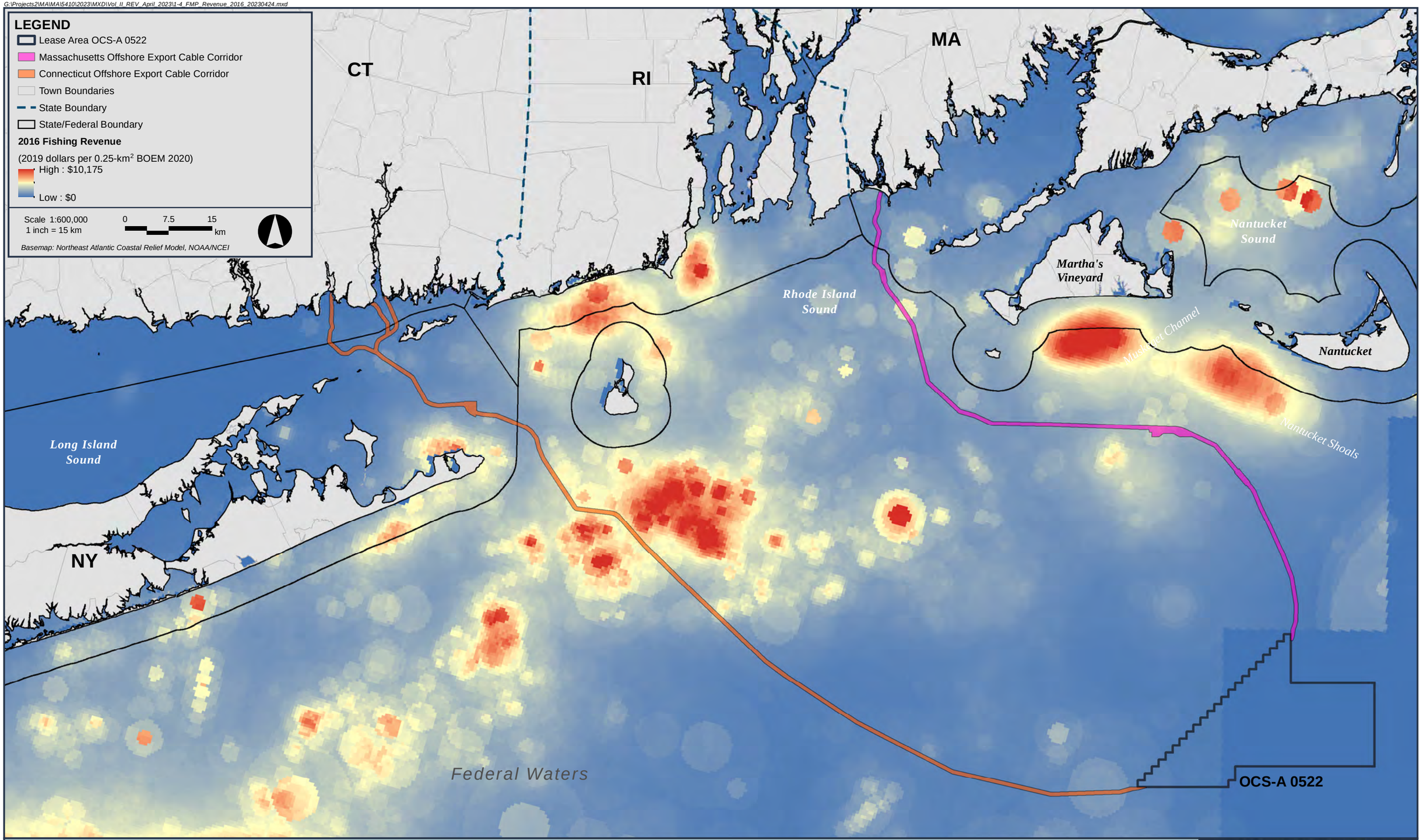

Figure 1-4
Fishing Revenue Density, All Fishery Management Plans, 2016

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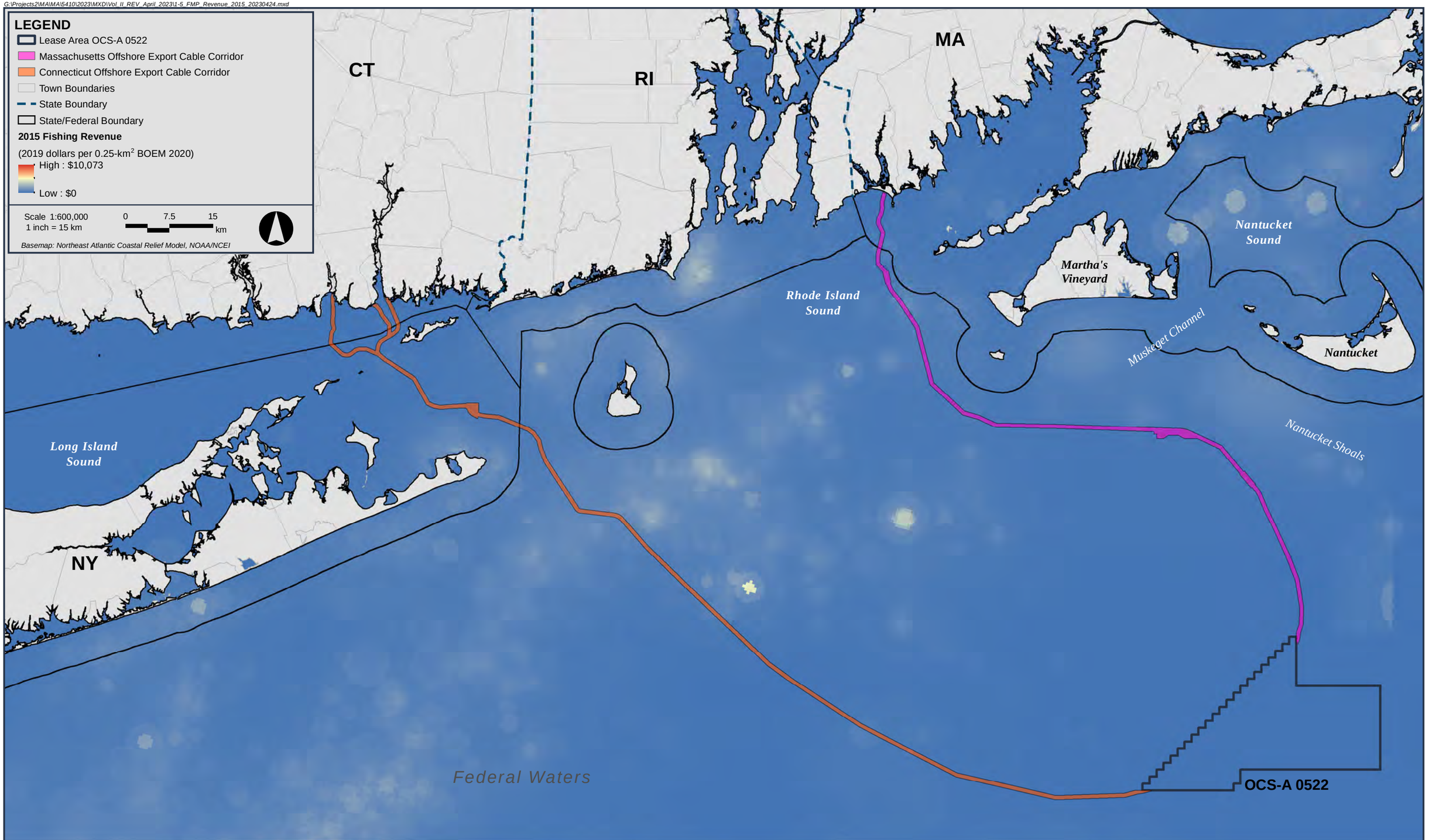

Figure 1-5
Fishing Revenue Density, All Fishery Management Plans, 2015

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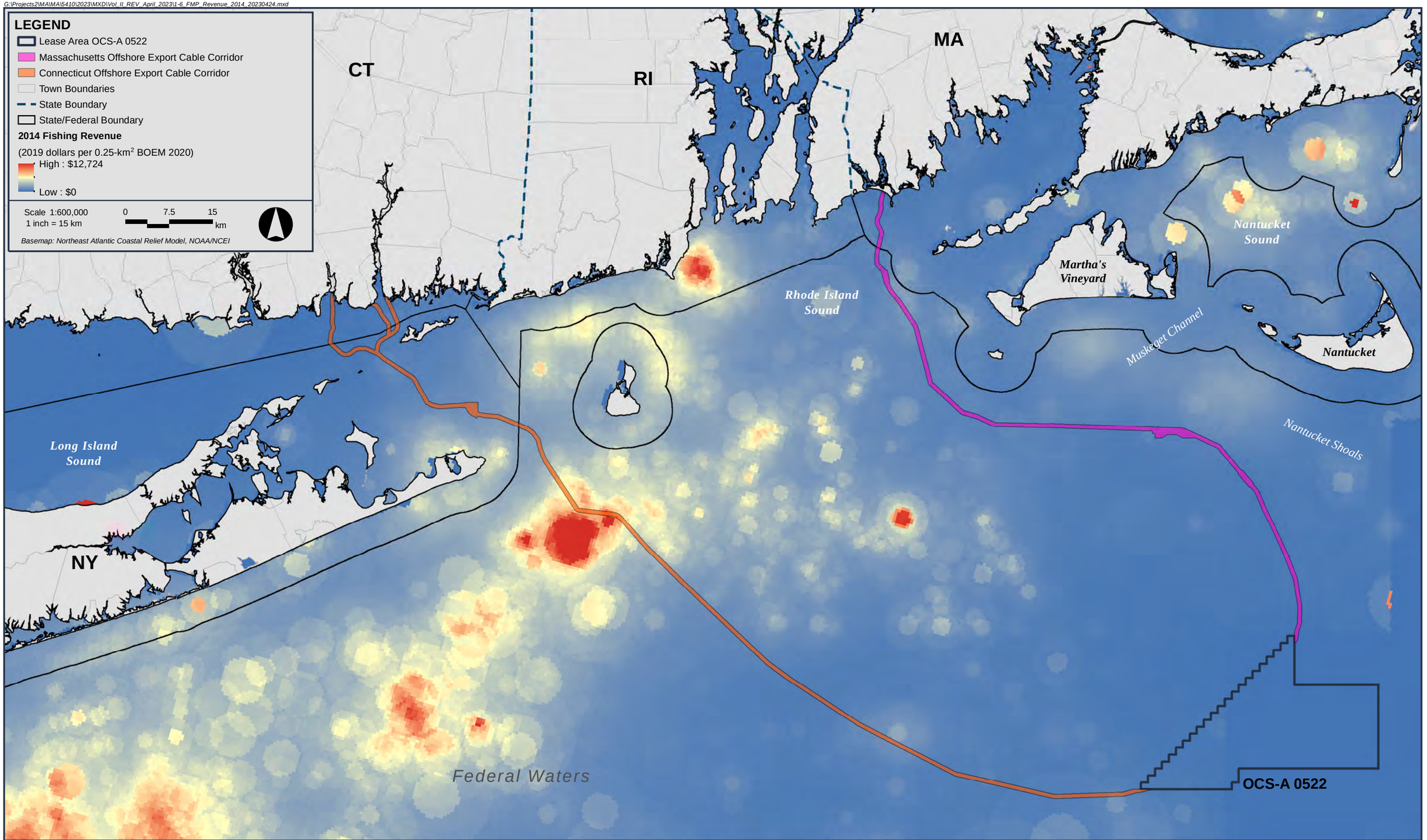

Figure 1-6
Fishing Revenue Density, All Fishery Management Plans, 2014

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areas. The 1 x 1 NM layout that will be established between WTG and ESP positions in the Lease Area to accommodate continued fishing is also expected to result in fishing vessels transiting through the Lease Area experiencing no significant increases in transit times or costs. As described in Section 3.2, even if fishing vessel operators choose to reroute transits between fishing ports and fishing areas that would typically pass through the Lease Area around the Lease Area it would have relatively small impacts on transit times or costs.

1.2.2 Indicators of Economic Exposure in the OECCs

During OECC Construction

Pre-construction activities and offshore export cable installation are expected to occur over a period of approximately 22 months in the Massachusetts OECC, which is approximately 126 km (68 NM) long,[9] and over a period of approximately 21 months in the Connecticut OECC, which is approximately 171–179 km (92–96 NM).[10] However, at any given time, cable installation activity in these OECCs will typically be underway at only one location and fishing in the OECCs will be precluded only in the vicinity of that one location while construction activity is underway (see Figure 1-7).

During pre-installation and cable installation activities, the Proponent expects to request that mariners give a wide berth to active work sites or construction vessel(s) through the issuance of Offshore Wind Mariner Updates. The Proponent will also coordinate with the USCG to issue NTMs advising other vessel operators of planned offshore activities. For the purposes of this economic analysis, it was assumed that fishermen would give a wide berth of up to 1 km (0.54 NM) around cable pre-installation and installation activities, resulting in an estimated fishing preclusion area of 3.14 km^2 (776 acres) around cable installation activity. It is assumed, therefore, that during cable installation commercial fishing will be precluded in the 1% to 2% of the OECCs where cable installation is underway and not in the remaining 98% to 99% of the OECC areas where cable installation has either been completed or is planned. Note that if cable installation activity is occasionally underway at more than one location, the fishing preclusion area during that period will be larger than 3.14 km^2 (776 acres) but there will be an offsetting reduction in the overall duration of cable laying activity which will result in no significant overall change in economic exposure.

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[9] The length of the Massachusetts OECC is measured from the Lease Area boundary to the offshore edge of the corridor at the landfall site.

[10] The length of the Connecticut OECC is measured from the Lease Area boundary to the offshore edge of the corridor at the landfall site. Depending on the approach used, the maximum length of the Connecticut OECC varies. See Section 3.5.2 of COP Volume I for additional details.

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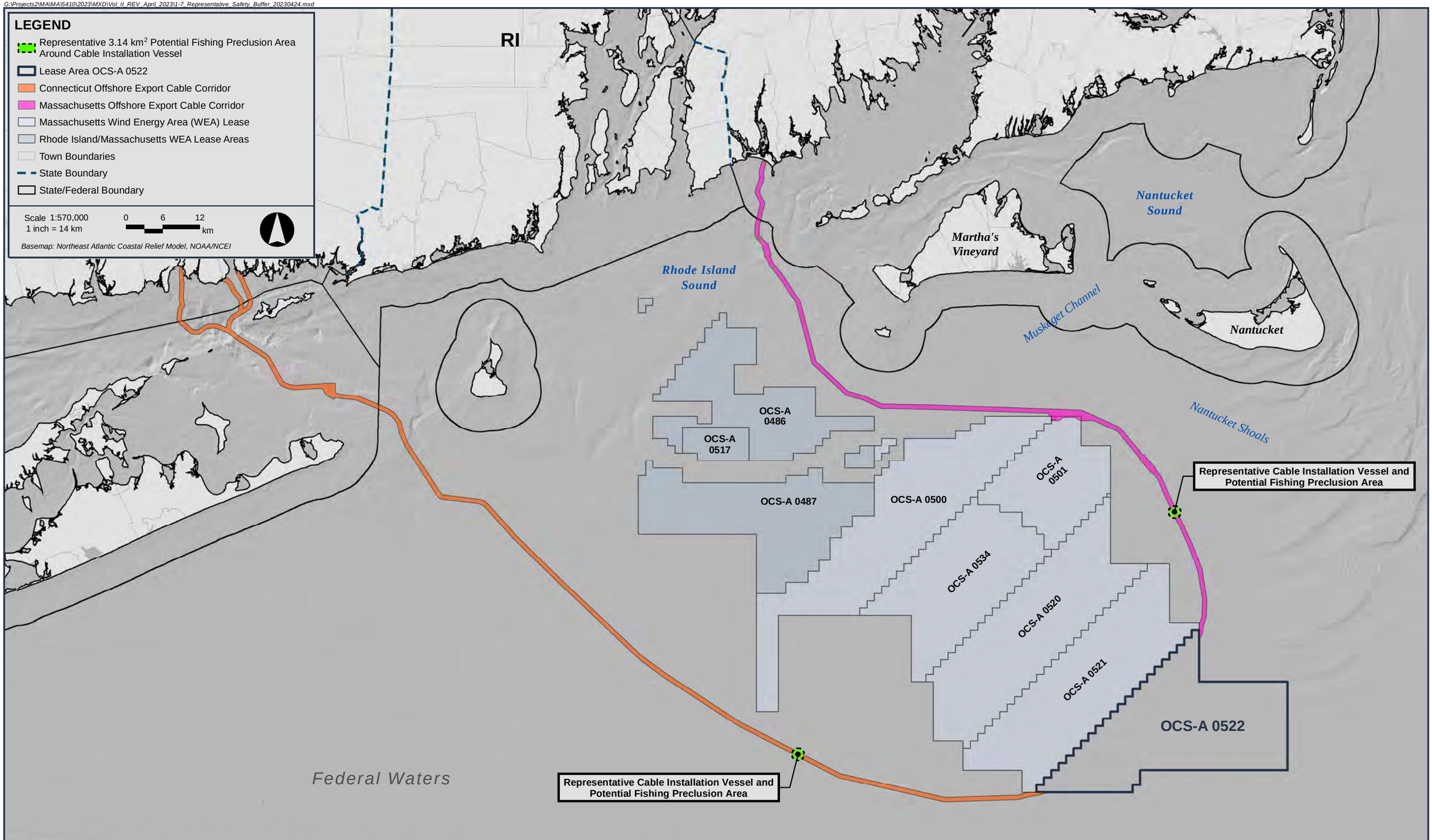

Figure 1-7
Representative Cable Installation Active Work Site in the OECCs

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After OECC Construction

Offshore export cables will be installed at a target burial depth of 1.5 to 2.5 m (5 to 8 ft) below the stable seafloor,[11] which the Proponent's engineers have determined is more than twice the burial depth required to 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 9% for the cables to Massachusetts and up to 6% for the cables to Connecticut may require remedial cable protection to be installed on the seafloor. [12]

Any required cable protection will be designed and installed to minimize interfering with mobile bottom fishing gear to the maximum extent practicable, and fishermen will be fully informed about locations where cable protection has been used. For these reasons, and because there is limited use of trawlers, draggers, and other mobile bottom fishing gear in the OECCs, potential fishery-related economic losses associated with bottom fishing gear snagging on cable protection are expected to be extremely low. The Proponent will also be developing and implementing procedures to compensate fishermen for any unexpected economic losses associated with bottom fishing gear snagging on cable protection. For these reasons, the economic exposure of commercial fishing in the two OECCs after cable installation is expected to be at or near zero.

1.3 Data Sources

Reliable sources of fishing revenue data for the Lease Area and OECCs or for larger ocean areas that include those areas are described in Table 1-1. One source listed in Table 1-1, *Socioeconomic Impacts of Atlantic Offshore Wind Development* (NOAA Fisheries 2023a), is a website that was developed by NOAA Fisheries, and includes what are now the most reliable and current estimates of annual fishing revenues in each offshore wind lease area in New England and Mid-Atlantic waters.

[11] Unless the final CBRA indicates that a greater burial depth is necessary and taking into consideration technical feasibility factors, including thermal conductivity.

[12] Potential cable protection methods include rocks, rock bags, concrete mattresses, or half-shell pipes or similar materials.

Table 1-1 Data Sources

Data Source	Description
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 vessel trip report (VTR) data, spatial data from the Northeast Fisheries Observer Program database, and vessel monitoring system (VMS) data, the study provides information on commercial harvest by location, species caught, gear type, and port group. This study is available at: Volume 1: https://espis.boem.gov/final%20reports/5580.pdf Volume 2: https://espis.boem.gov/final%20reports/5581.pdf
BOEM (2020)	BOEM makes available single-year revenue intensity rasters summarized by Fishery Management Plan. These revenue intensity rasters were developed for Kirkpatrick et al. (2017), 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. This data source was used to develop Figure 1-2 through Figure 1-6, which show the fishing revenue density for 2014–2018.
NOAA Fisheries (2023a)	Socioeconomic Impacts of Atlantic Offshore Wind Development Website 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 2008–2021. This data is based on modeled results of federal VTR, clam logbook, and queried for spatial overlap and linked to dealer data for value and landings information. These tables highlight annual landings and revenue by species, gear type, and fishery management plan within each wind energy area (WEA), as well as revenue by port and vessel dependence upon operations in each WEA. Landing and revenue data can be accessed at: https://www.greateratlantic.fisheries.noaa.gov/ro/fso/reports/WIND/ALL_WEA_BY_AREA_DATA.html. This data was used to develop estimates of annual economic exposure for the Lease Area.
NOAA Fisheries (2023b)	Upon request from the Proponent, NOAA Fisheries provided landing and revenue data (2008–2021) for the OECCs. The OECC data from NOAA Fisheries is the same data used for revenue estimates for the Lease Area in the Socioeconomic Impacts of Atlantic Offshore Wind Development website (see above). The average annual revenue per km^2 is the value used to develop the estimated economic exposure during construction and is based on a uniform distribution fishing revenues generated throughout the larger area, which includes the OECCs (see Table 2-4).

1.3.1 Thresholds of Data Requirements

In order to use fishing revenue data to estimate the economic exposure of commercial fishing to offshore wind energy projects it is necessary to make assumptions about thresholds or minimum standards for defining what BOEM refers to as fishing values that "may be impacted" (Kirkpatrick et al. 2017). For the purposes of this report, it is assumed that all fishing revenues in the Lease Area and in areas of cable installation activity in the OECCs "may be impacted." It is also assumed that fishing values outside the Lease Area and OECCs "may be impacted" if Vineyard Northeast can be expected to result in either increased fishing vessel transit times resulting from vessels avoiding the Lease Area or OECCs or fishing congestion impacts resulting from vessels diverting fishing effort from those areas to other ocean areas that are already being fished.

1.4 Baseline Commercial Fisheries Landings and Values

Data summarizing commercial fishing activity and fishing revenue within the Lease Area during years 2008 through 2021 are available from NOAA Fisheries (NOAA Fisheries 2023a). These data are used in this report to identify the primary commercial fisheries, species, fishery management plan (FMP), gear types, ports, and states potentially affected by development in the Lease Area.

The data summarized in Tables 1-2 through 1-7 are based on NOAA Fisheries' analysis of combined data from VTRs submitted by vessels with federal permits and dealer reports. Annual values reported in these tables have all been deflated to 2021 dollars using the US Bureau of Economic Analysis (BEA) Gross Domestic Product (GDP) Implicit Price Deflator.[13]

Table 1-2 provides the annual landed weight and dollar value of all species harvested within the Lease Area between 2008 and 2021.

Table 1-2 Landings from the Lease Area by Year, 2008–2021

Year	Landings (lbs)	Value (2021 dollars)
2008	215,176	$214,864
2009	200,664	$310,409
2010	858,545	$309,680
2011	79,315	$111,306
2012	95,608	$130,030
2013	149,018	$166,685

[13] Both NOAA Fisheries and BOEM recommend making inter-annual fish price adjustments using the GDP Price Deflator rather than Producer Price Indices for seafood products. Descriptions of the annual GDP Price Deflator and how it differs from annual Producer Price Indices can be found at the BEA website at: https://www.bea.gov/data/prices-inflation.

Table 1-2 Landings from the Lease Area by Year, 2008–2021 (Continued)

Year	Landings (lbs)	Value (2021 dollars)
2014	167,495	$208,863
2015	179,599	$208,800
2016	164,394	$191,863
2017	209,880	$254,395
2018	353,568	$454,734
2019	390,499	$521,371
2020	407,908	$472,372
2021	283,804	$454,785
Annual Average	268,248	$286,440

Notes:
1. Values are reported in 2021 dollars. Data source is NOAA Fisheries 2023a.

The 14-year average annual weight and dollar value of the 15 most valuable species landed in the Lease Area are shown in Table 1-3. These 15 species account for approximately 90% of the average annual commercial fishing revenues from the Lease Area.

Table 1-3 Landings from the Lease Area by Species, 2008–2021

Species	Average Annual Landings (lbs)	Average Annual Value (2021 dollars)	Percentage of Average Annual Lease Area Value
Jonah Crab	86,955	$80,236	28%
American Lobster	5,443	$29,480	10%
Summer Flounder	8,839	$26,602	9%
Longfin Squid	17,889	$26,180	9%
Sea Scallop	2,085	$19,746	7%
Scup	24,115	$17,967	6%
Golden Tilefish	3,725	$15,224	5%
Monkfish	8,630	$14,252	5%
Silver Hake	11,808	$8,774	3%
Skates	14,975	$8,339	3%
Atlantic Herring	43,588	$4,251	1%
Butterfish	4,195	$3,006	1%
Rock Crab	4,274	$2,645	1%
Shortfin Squid	3,398	$1,908	1%
Black Sea Bass	461	$1,489	1%
All Others	27,867	$26,341	9%
Total	268,248	$286,440	-

Notes:
1. Values are reported in 2021 dollars. Data source is NOAA Fisheries 2023a.

The 14-year average annual weight and dollar value of the 10 most valuable species managed under Fishery Management Plans (FMPs) in the Lease Area are shown in Table 1-4. These FMPs account for approximately 90% of the average annual commercial fishing revenues from the Lease Area.

Table 1-4 Landings from the Lease Area by Fishery Management Plan, 2008–2021

Fishery Management Plan	Average Annual Landings (lbs)	Average Annual Value (2021 dollars)	Percentage of Average Annual Lease Area Value
ASMFC FMP	92,468	$109,966	38%
Summer Flounder, Scup, Black Sea Bass	33,415	$46,058	16%
Mackerel, Squid, and Butterfish	26,232	$31,351	11%
Sea Scallop	2,085	$19,746	7%
Tilefish	3,728	$15,232	5%
Monkfish	8,630	$14,252	5%
Small-Mesh Multispecies	12,942	$9,220	3%
Skates	14,975	$8,339	3%
Atlantic Herring	43,588	$4,251	2%
Northeast Multispecies	481	$850	0.3%
All Others	29,704	$27,175	10%
Total	268,428	$286,440	-

Notes:

1. Values are reported in 2021 dollars. Data source is NOAA Fisheries 2023a.
2. The Atlantic States Marine Fisheries Commission (ASMFC) FMP includes the following species: American lobster, cobia, Atlantic croaker, black drum, red drum, menhaden, NK sea bass, NK seatrout, spot, striped bass, tautog, Jonah crab, and pandalid shrimp.

The 14-year average annual weight and dollar value of the five most common gear types in the Lease Area are shown in Table 1-5. These five gear types account for approximately 86% of the average annual commercial fishing revenues from the Lease Area.

Table 1-5 Landings from the Lease Area by Gear Type, 2008–2021

Gear Type	Average Annual Landings (lbs)	Average Annual Value (2021 dollars)	Percentage of Average Annual Lease Area Value
Lobster Pot	95,895	$112,003	39%
Bottom Trawl	69,290	$85,685	30%
Gillnet (sink)	21,905	$21,279	7%
Longline (bottom)	3,808	$14,377	5%

Table 1-5 Landings from the Lease Area by Gear Type, 2008–2021 (Continued)

Gear Type	Average Annual Landings (lbs)	Average Annual Value (2021 dollars)	Percentage of Average Annual Lease Area Value
Scallop Dredge	1,441	$13,352	5%
All Others	75,925	$39,784	14%
Total	268,264	$286,481	-

Notes: 1. Values are reported in 2021 dollars. Data source is NOAA Fisheries 2023a.

The 14-year average annual weight and dollar value of landings in the three most exposed states to fishing revenue losses in the Lease Area are shown in Table 1-6. These states account for approximately 88% of the average annual commercial fishing revenues from the Lease Area.

Table 1-6 Landings from the Lease Area by State, 2008–2021

State	Average Annual Landings (lbs)	Average Annual Value (2021 dollars)	Percentage of Average Annual Lease Area Value
Massachusetts	160,990	$141,791	50%
Rhode Island	82,856	$86,040	30%
New York	10,602	$23,715	8%
All Others	13,626	$34,666	12%
Total	268,074	$286,212	-

Notes: 1. Values are reported in 2021 dollars. Data source is NOAA Fisheries 2023a.

The 14-year average annual weight and dollar value of the five most exposed ports in the Lease Area are shown in Table 1-7. These five ports account for approximately 75% of the average annual commercial fishing revenues from the Lease Area.

Table 1-7 Landings from the Lease Area by Port, 2008–2021

Port	Average Annual Landings (lbs)	Average Annual Value (2021 dollars)	Percentage of Average Annual Lease Area Value
New Bedford, MA	117,597	$101,769	36%
Point Judith, RI	47,900	$47,819	17%
Newport, RI	25,546	$30,285	11%
Montauk, NY	9,946	$21,736	8%
Chatham, MA	10,707	$12,155	4%
All Others	56,375	$72,447	25%
Total	268,071	$286,211	-

Notes: 1. Values are reported in 2021 dollars. Data source is NOAA Fisheries 2023a.

2 Estimates of Economic Exposure

2.1 Economic Exposure in the Lease Area

2.1.1 Unadjusted Estimates of Fishing Values for the Lease Area

Table 2-1 presents the 14-year total and average annual fishing revenues generated in the Lease Area during the years 2008–2021, valued in 2021 dollars (NOAA Fisheries 2023a). These annual values range from $111,306 to $521,371 and average $286,440 or $534 per km^2. They are referred to in this report as "unadjusted" fishing revenues because they do not include the value of lobster and Jonah crab landings harvested in the Lease Area by vessels that fish only for those two species and do not need to file federal VTRs on which NOAA Fisheries fishing revenue estimates are based.

Table 2-1 Estimates of Annual Commercial Fishing Economic Exposure in the Lease Area, Unadjusted for Lobster and Jonah Crab

Total Fishing Revenues (2008–2021)	Average Annual Revenues	Average Annual Fishing Revenues per km^2
$4,010,156	$286,440	$534

2.1.2 Adjustments for Lobster and Jonah Crab

To provide a basis for estimating full economic exposure, annual fishing values presented in Table 2-1 were adjusted to account for lobster and Jonah crab landings by vessels that land only these two species and do not file federal VTRs. 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) and Lobster Management Area 3 (LMA 3) by vessels that file VTRs and by vessels that do not file VTRs. The northerly portion of the Lease Area is located within LMA 2/3 overlap and the southerly portion of the Lease Area is located in LMA 3.

Federal fishing permit data for 2022 show that 143,548 pots are permitted to harvest lobster in LMA 2 and LMA 3. Of these 143,548 permitted pots, 103,051 pots or 72% of all permitted pots in LMA 2 and LMA 3, are permitted to vessels that target species other than lobster and Jonah crab and therefore file VTRs that include the value of their landings of lobster and Jonah crab. The remaining 40,497 pots, or 28% of all permitted pots, are permitted to vessels that only possess permits to harvest lobster and Jonah crab and are not required to file VTRs.

NOAA Fisheries (2023a) data shows that during years 2008-2021 the economic value of fish harvested in the Lease Area by vessels that filed VTRs included $412,719 worth of lobster, an average annual value of $29,480, and $1,123,301 worth of Jonah crab, an average annual value of $80,236, resulting in average annual fishing revenues from both species of $109,716. The

average annual lobster and Jonah crab revenues per pot permitted in LMA 2 and LMA 3 to vessels that file VTRs, therefore, is $1.07. This value is based on the average annual fishing revenue from both species ($109,716) and the number of pots permitted to vessels that file VTRs for these species (103,051 pots).

If the characteristics of lobster and Jonah crab fishing by vessels that do not file VTRs were similar to those of vessels that do file VTRs, the $1.07 in annual lobster and Jonah crab revenues in the Lease Area per pot permitted to vessels that file VTRs could be applied equally to pots permitted to vessels that do not file VTRs. However, information received from lobster fishery experts at the Massachusetts Division of Marine Fisheries (MADMF) indicated that it is not reasonable to assume that revenues per permitted pot are the same for vessels that file and do not file VTRs. They 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 wind energy development areas, and (3) achieve higher average annual catch rates and fishing revenues per active pot.

To account for these three factors the annual value of lobster and Jonah crab harvested by non-VTR vessels in the Lease Area 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, and generate 25% more fishing revenues than pots permitted to vessels that file VTRs. In effect, these assumptions result in $2.08 as an estimate of revenues generated in the Lease Area per pot permitted to non-VTR vessels in LMA 2 and LMA 3 ($1.07 x 1.25 x 1.25 x 1.25).

Given the assumptions above, the $109,716 in average annual VTR reported fishing revenues from lobster and Jonah crab in the Lease Area (103,051 pots x $1.07) accounts for 57% of $193,927 in adjusted total annual fishing revenues from those two species in the Lease Area, and unreported fishing revenues from those two species (40,497 pots x $2.08) account for the other 43% or $84,211.

Table 2-2 below adjusts the estimates of annual economic exposure in the Lease Area presented in Table 2-1 upward by $84,211 to account for these estimates of unreported annual fishing revenues from lobster and Jonah crab harvested in the Lease Area.[14]

[14] Note this adjustment method is conservative and likely results in a high estimate of the annual lobster and Jonah crab revenues from the Lease Area that are not included in fishing revenues reported in the NOAA Fisheries data (NOAA Fisheries 2023a).

Table 2-2 Estimates of Annual Commercial Fishing Economic Exposure in the Lease Area, Adjusted for Lobster and Jonah Crab

Total Fishing Revenues (2008–2021)	Average Annual Fishing Revenue	Average Annual Fishing Revenues per km²
$5,189,110	$370,651	$692

2.1.3 Final Estimate of Annual Fishing Revenues (Economic Exposure) in the Lease Area

Table 2-2 shows that average annual fishing revenues generated in the Lease Area during 2008–2021, adjusted to account for unreported lobster and Jonah crab landings, equal $370,651. This represents an estimate of the annual economic exposure of commercial fisheries if all commercial fishing ceased in the Lease Area for a full year and none of the associated loss of fishing revenues were recouped as a result of fishing effort shifting from the Lease Area to other fishing areas.

Table 1-5 shows that lobster pots account for 39% and bottom trawlers account for 30% of fishing revenues generated in the Lease Area. However, based on adjusted lobster and Jonah crab revenues, as described in Section 2.1.2, lobster pots are estimated to account for 53% of fishing revenues in the Lease Area with bottom trawlers accounting for 23%, and all other gear types accounting for 24%. This represents the share of economic exposure facing these gear types and indicates that most economic exposure in the Lease Area is associated with fixed fishing gear, such as lobster traps, and not mobile fishing gear, such as trawlers and draggers.

Table 2-3 presents estimates of annual economic exposure by state based on each state's shares of fishing revenues in the Lease Area as shown in NOAA Fisheries (2023a).[15] Commercial fishing fleets from Massachusetts and Rhode Island face the most economic exposure in the Lease Area, accounting, respectively, for 49.5% and 30.1% of average annual fishing revenues from the Lease Area.

[15] Note that these state shares of fishing revenues from the Lease Area assume that state shares of unreported lobster and Jonah crab revenues are the same as state shares of all commercially harvested species.

Table 2-3 Estimate of Commercial Fishing Economic Exposure in the Lease Area by State, Adjusted for Lobster and Jonah Crab

State	Average Annual Fishing Revenues from the Lease Area	Percentage of Average Annual Lease Area Fishing Revenues
Massachusetts	$183,623	49.5%
Rhode Island	$111,423	30.1%
New York	$30,711	8.3%
North Carolina	$15,148	4.1%
New Jersey	$11,967	3.2%
Virginia	$11,348	3.1%
Connecticut	$4,646	1.3%
All Others	$1,785	0.5%

Notes:

1. Values are reported in 2021 dollars. Data source is NOAA Fisheries 2023a.

2.2 Economic Exposure in the OECCs

2.2.1 Overview

Table 2-4 shows that the average annual Fishing Revenue Density (FRD) in the Massachusetts OECC is $2,291 per km^2 and ranges from $3,301 to $3,427 per km^2 in the Connecticut OECC depending on which landfall approach is used (NOAA Fisheries 2023b). These provide baseline values for estimating economic exposure in each OECC.

As described in Section 1.2.2, this report assumes that fishermen would give a wide berth of up to 1 km (0.54 NM) around cable pre-installation and installation activities in the OECCs, which results in a fishing preclusion area of 3.14 km^2 (776 acres) around these activities. 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.

However, cable installation requires several pre-lay activities, such as surveys of cable alignments, pre-lay grapnel runs of cable alignments, 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 and cable installation, Vineyard Northeast's export cable engineers have estimated that overall cable installation activities will take place during

approximately 22 months (183% of a year) in the Massachusetts OECC and 21 months (175% of a year) in the Connecticut OECC. As shown in Table 2-4, based on the annual FRDs noted above ($ per km^2) and the expected durations and areas of fishing preclusions in each OECC, estimated economic exposure during cable installation will be $13,182 in the Massachusetts OECC and could range from $18,177 to $18,842 in the Connecticut OECC depending on which landfall approach is used.

As Figure 1-7 illustrates the fishing preclusion area that will move along the OECC as cable installation activities move along the OECC resulting in fishing impacts at any particular time along approximately 2 km (1.1 NM) of the OECC; that is, 1 km (0.54 NM) forward of and 1 km (0.54 NM) aft of where cable installation vessels are operating. This means that cable installation activity taking place at any given time is expected to preclude commercial fishing along approximately 2% of the overall length of the Massachusetts OECC and 1% of the length of the Connecticut OECC. During periods of cable installation it is not expected that commercial fishing will be precluded or impaired in the remaining 98% of the Massachusetts OECC or 99% of the Connecticut OECC where cable installation is either completed or planned.

Possibilities exist that disruptions in the rate of cable installation may increase the duration of cable installation impacts on commercial fishing, but that should not affect the area of fishing impacts at any particular time. There may also be circumstances where more than one cable installation activity will need to be scheduled to take place at a particular time which will result in a proportional increase in the area of fishing impacts during those times. However, overlapping cable installation activities that increase the area of impacts will result in a proportional decrease in the expected duration of overall cable installation activities. Under most circumstances, therefore, the possibility of multiple cable installation activities being underway at the same time is expected to result in no net change in overall commercial fishing impacts.

2.2.2 Estimating Economic Exposure in the OECCs

The estimates of economic exposure in each OECC that were summarized in the previous section were generated by estimating three factors for each OECC, A, B, and C, and multiplying them together.

That is:

Economic Exposure in the OECC = $EE_{OECC} = A \times B \times C$

Where:

A = expected FRD (annual fishing revenues per km^2) in the OECCs

B = area precluded to fishing during ongoing cable installation activities (3.14 km^2)

C = the total duration of cable installation activities expressed in years

Table 2-4 presents estimates of A, B, and C for the Massachusetts OECC and the Connecticut OECC and resulting estimates of economic exposure in those two OECCs during cable installation. Table 2-5a and Table 2-5b show the estimates of economic exposure for the Massachusetts OECC and the Connecticut OECC by state. For each OECC, Massachusetts and Rhode Island experience the highest percentage of economic exposure. The five most valuable species landed in the Massachusetts OECC are longfin squid, lobster, summer flounder, sea scallop, and Atlantic herring. The five most valuable species landed in the Connecticut OECC are sea scallop, summer flounder, scup, lobster, and skates (NOAA Fisheries 2023b).

Table 2-4 Estimates of Commercial Fishing Economic Exposure in the OECCs During Construction

	A	B	C	EE
OECC	**Average Annual Fishing Revenues per km²**	**Fishing Preclusion Area (km²)**	**Construction Period (years)**	**Economic Exposure During Construction**
Massachusetts OECC	$2,294	3.14	1.83	$13,182
Connecticut OECC Using Eastern Point Beach Approach	$3,420	3.14	1.75	$18,793
Connecticut OECC Using Ocean Beach Approach	$3,429	3.14	1.75	$18,842
Connecticut OECC Using Niantic Beach Approach	$3,308	3.14	1.75	$18,177

Table 2-5a Estimate of Commercial Fishing Economic Exposure in the Massachusetts OECC by State

State	Percentage of Average Annual Massachusetts OECC Fishing Revenues (2008–2021)
Massachusetts	52.9%
Rhode Island	36.7%
New York	3.9%
North Carolina	2.4%
Connecticut	1.5%
All Others	3.9%

Notes:

1. Data source is NOAA Fisheries 2023b.

Table 2-5b Estimate of Commercial Fishing Economic Exposure in the Connecticut OECC by State

State	Percentage of Average Annual Connecticut OECC Fishing Revenues (2008–2021)		
	Connecticut OECC Using Eastern Point Beach Approach	Connecticut OECC Using Ocean Beach Approach	Connecticut OECC Using Niantic Beach Approach
Massachusetts	32.0%	32.1%	32.1%
Rhode Island	30.4%	30.5%	30.3%
New York	22.3%	22.4%	22.5%
Connecticut	11.4%	11.1%	11.3%
New Jersey	1.8%	1.8%	1.9%
All Others	2%	2%	2%

Notes:

1. Data source is NOAA Fisheries 2023b.

2.3 Summary of Economic Exposure

Annual economic exposure in the Lease Area is estimated based on the assumption that all fishing will be precluded for a full year with none of the associated losses in fishing revenues recouped as a result of fishing effort being diverted from the Lease Area to other fishing areas. Since annual fishing revenues in the Lease Area are estimated in Section 2.1 to be $370,651 (2021 dollars), this represents full annual economic exposure in the Lease Area during each year of construction. As shown in Table 2-4 economic exposure related to cable installation is estimated to be $13,182 in the Massachusetts OECC and could range from $18,177 to $18,842 in the Connecticut OECC depending on which landfall approach is used. Economic impact estimates based on estimates of economic exposure presented in this report will be determined at a later date based on updated BOEM guidance and consultations with the states through the CZMA review processes.

3 Indirect Sources of Potential Economic Exposure

3.1 Fishing Congestion Impacts Outside the Lease Area and the OECCs

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 or where fishing is allowed.

In general, the likelihood that the introduction of new fishing effort to 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 associated with small shifts in where fishing effort is deployed to be significant in open ocean fisheries. Possible exceptions are when fishing regulations involve fishing area or fishing season closures or quota limitations that cause fishing effort to become highly concentrated in particular ocean areas.

Concentrations of fishing effort and related fishing congestion impacts could result from large offshore wind energy projects. However, the evidence described below indicates that it is extremely unlikely that the level of potential fishing effort that could be diverted from the Lease Area or the OECCs to other fishing areas could constitute a significant source of potential fishing congestion impacts. In fact, AIS data indicate that vessels that spend time fishing in the Lease Area and OECCs already spend most of their fishing time in adjacent and nearby fishing areas and so do not constitute a significant new source of potential fishing effort in those areas.

3.1.1 Potential Fishing Congestion Impacts from the Lease Area

As shown in Figure 1-2 through Figure 1-6, the Lease Area does not include highly productive commercial fishing grounds and as AIS data presented in Figure 3-1 and Table 3-1 illustrate. It is primarily an area that fishing vessels transit through as they steam between fishing ports and more productive offshore fishing areas. Table 3-1, for example, shows that during 2016–2021 fishing vessels entered the Lease Area an average of 990 times per year, but were engaged in fishing in the Lease area on just 69 (7%) of those trips. During those five years the number of fishing trips in the Lease Area per month averaged over ten during only two months (August and September). This very modest level of fishing effort is not a significant enough source of potential new fishing effort entering nearby fishing areas to pose fishing congestion threats in those areas. Also, as Table 3-1 indicates, fishing vessels that operate in the Lease Area are already part of the established fishing fleet operating in adjacent and nearby areas and already spend most of their fishing time in those areas. In summary, based on the available data the development of the Lease Area should not be expected to result in fishing congestion impacts in nearby fishing areas.

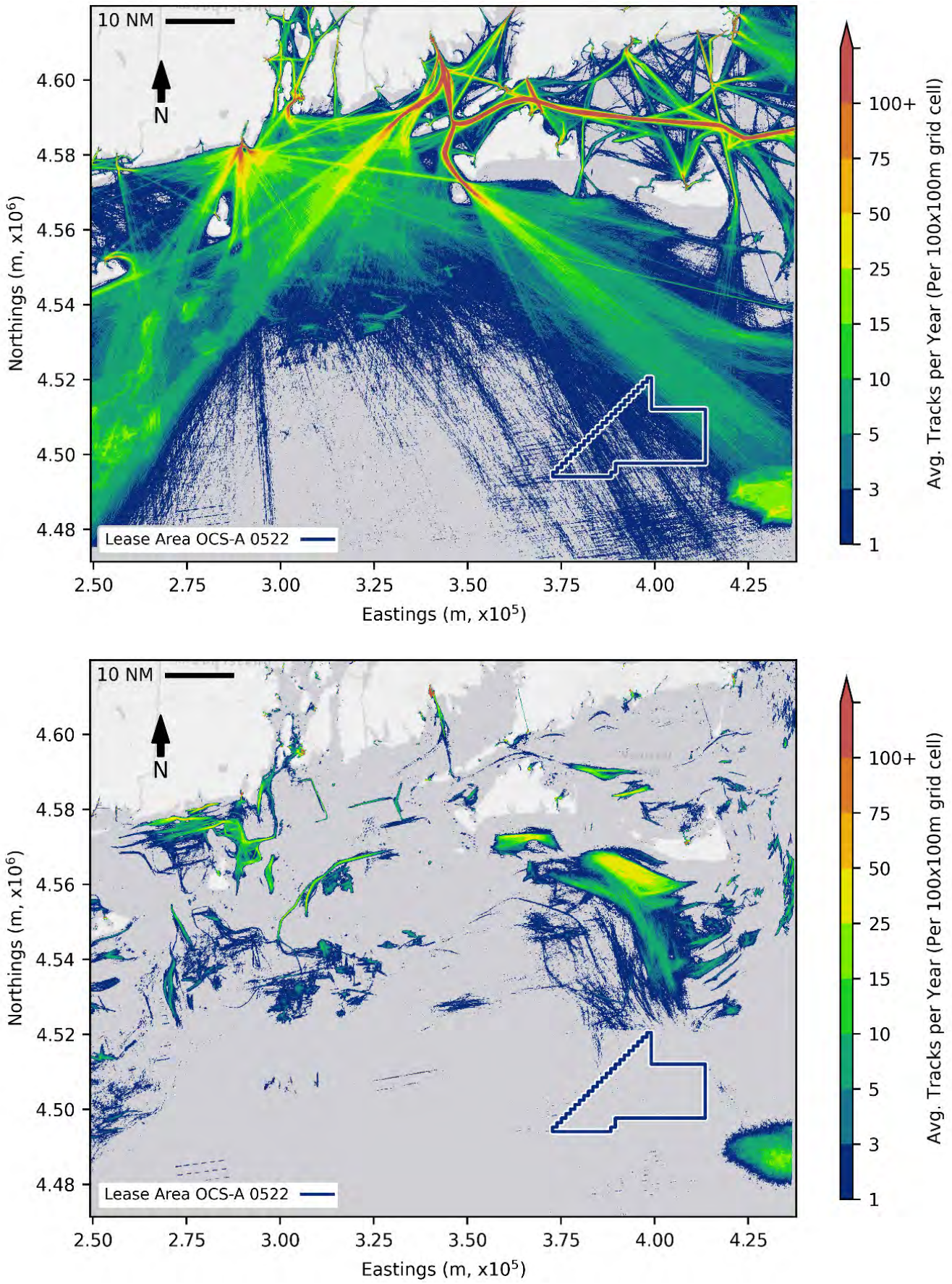

Figure 3-1

Transiting (top) and Actively Fishing (bottom) AIS Vessel Average Annual Traffic Densities (Baird 2022)

VINEYARD NORTHEAST
VINEYARD OFFSHORE

Table 3-1 Average AIS Fishing Vessel Traffic through the Lease Area (2016–2021)

Year	Month												
Average (2016–2021)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Annual Average Total (Unique Vessels)**
Number of Unique Fishing Vessels (fishing)	1.5	0.3	1.5	1.8	3.5	3.2	3.8	5.3	9.7	3.8	2.0	1.6	29.0
Number of Unique Fishing Vessel Transits (fishing)	1.7	1.0	1.7	2.2	4.3	5.2	7.5	13.3	20.3	5.8	3.2	2.0	69.2
Number of Unique Fishing Vessels (transiting)	14.7	14.3	19.8	41.3	55.0	59.7	62.7	57.3	41.3	32.4	25.0	20.0	198.6
Number of Unique Fishing Vessel Transits (transiting)	28.8	28.5	40.3	95.2	126.0	128.2	137.8	137.0	85.3	63.4	46.2	33.0	966.3
Number of Unique Fishing Vessels (all)	14.8	14.3	20.0	41.3	55.0	59.7	62.8	57.7	43.3	33.0	25.2	20.2	200.9
Number of Unique Fishing Vessel Transits (all)	29.2	28.7	40.5	95.2	126.8	129.3	139.8	141.7	95.2	65.8	47.4	33.6	989.9

Notes:

1. Data source is Baird 2022.
2. Analysis was performed to separate transiting fishing vessels (vessels moving at > 4 knots) from fishing vessels that are likely to be engaged in fishing (vessels moving at ≤4 knots).
3. Transiting and actively fishing tracks can be doubly counted.

3.1.2 Potential Fishing Congestion Impacts from the OECCs

As Figure 1-2 through Figure 1-6 indicate, the OECCs represent a small portion of the available fishing grounds in the Offshore Development Area and account for a small share of the fishing effort and fishing revenues generated in those areas. As described above in Section 2.2, it is assumed in this analysis that fishermen would give a wide berth of up to 1 km (0.54 NM) around cable pre-installation and installation activities in the OECCs, resulting in an estimated fishing preclusion area of 3.14 km^2 (776 acres) where cable installation activity is underway. The remainder of the OECCs, where cable installation is either completed or planned, will remain open to fishing vessels. It is not expected that the small areas of temporary fishing limitations within the OECCs during limited duration cable installation activities will cause significant enough shifts in fishing effort to other fishing areas to result in any measurable fishing congestion impacts.

During O&M of Vineyard Northeast, the OECCs will have no impact on commercial fishing, except, as described in Section 1.2.2, potentially along short segments of the cable route where cable protection may need to be installed on the seafloor and may pose risks of bottom fishing gear snagging. While avoiding these risks may involve modifications in the precise tracks of mobile bottom fishing gear in the OECCs, it is unlikely to result in enough fishing effort by those vessels shifting away from the OECCs to cause fishing congestion impacts in other areas.

3.2 Lease Area Impacts on Fishing Vessel Transit Costs

Figure 3-2 shows the proximity of the Lease Area to major nearby fishing ports and fishing areas and the most direct (shortest distance) tracks that fishing vessels would normally use to travel between them. Some of these direct routes pass through the Lease Area and, as Table 3-1 indicates, during 2016-2021 the annual average number of fishing vessel transits through the Lease Area was 966.

After examining options for accommodating fishing and vessel transit lanes in the Massachusetts/Rhode Island Wind Energy Area (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." (USCG 2020).

The Proponent has sited the WTG/ESP positions within the Lease Area consistent with the recommendations of the MARIPARS with WTG/ESP positions oriented in fixed east-to-west rows and north-to-south columns with 1 NM (1.9 km) spacing between positions. This grid layout provides multiple 1 NM wide corridors in the east-west and north-south directions as well as 0.6 NM (1.1 km) wide corridors in the northwest-southeast and northeast-southwest directions. As the recent MARIPARS study indicates, this will allow multiple straight-line options

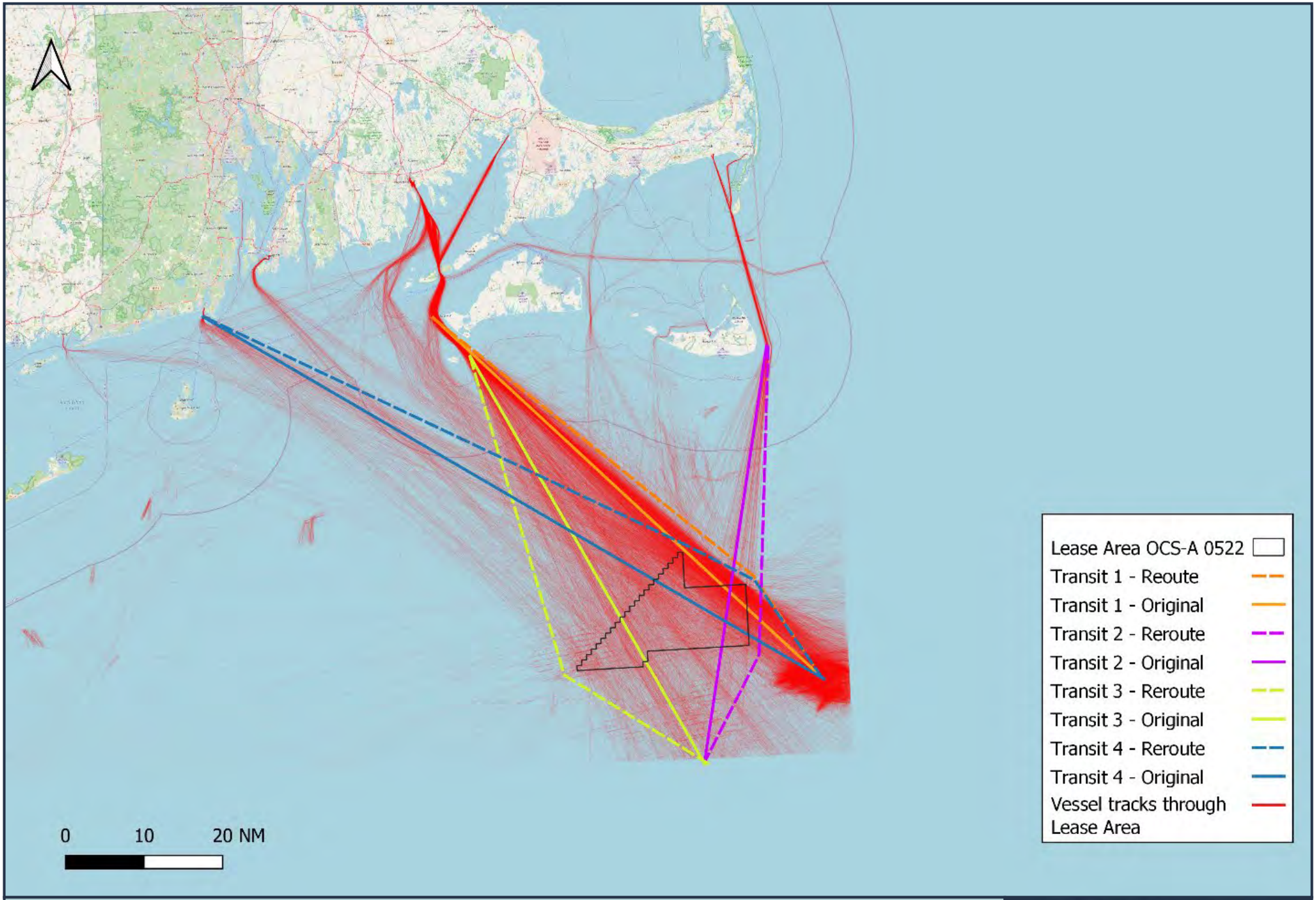

Figure 3-2
Analysis of Transit Routes for AIS Commercial Fishing Vessels:
Existing and Post-construction (Bypassing Lease Area) (Baird 2022)

VINEYARD NORTHEAST
VINEYARD OFFSHORE

for fishing vessels to transit safely through the Lease Area (USCG 2020). During O&M of Vineyard Northeast, there will be no restrictions on fishing vessels operating in or transiting through the Lease Area.

However, despite the existence of transit/fishing corridors in the Lease Area, some fishermen may opt to reroute transits around the Lease Area, especially during extreme weather. Figure 3-7 depicts how transiting around, rather than through, the Lease Area will affect transit distances by depicting "original" routes through the Lease Area (solid lines) and "adjusted" routes (dashed lines) around the Lease Area. Table 3-5 presents associated differences in transit distances (NM) and added transit times (minutes) based on the average fishing vessel transit speed through the Lease Area which has been estimated to be 7.6 knots (Baird 2022).

Table 3-4 displays the average number of unique AIS-equipped fishing vessels that transited the Lease Area and the average number of unique fishing vessel transits through the Lease Area by month from 2016 to 2021. It shows that during these years, the average monthly number of fishing vessel transits through the Lease Area ranged from 29 to 138 and annual vessel transits averaged 966 (Baird 2022).

During construction and installation activities in the Lease Area, fishing vessels will be allowed to transit through the Lease Area but will need to avoid any safety zones that are temporarily established by USCG around the WTGs and ESP(s). This may require at least some of the vessels transiting through the Lease Area to implement minor adjustments from the most direct transit route through the Lease Area in order to use the transit/fishing corridors created by the WTG/ESP layout in the Lease Area.

Table 3-2 Transit Route Analysis for AIS Commercial Fishing Vessels Currently Transiting the Lease Area: Existing and Lease Area Bypass Route

Transit Route	Average Vessel Speed (knots)	Existing Route		Bypass Route		
		Distance (NM)	Transit Time (hr)	Distance (NM)	Transit Time (hr)	Change in Time (min.)
1	8	67.2	8.4	67.7	8.47	3.74
2	8	53.2	6.65	54.3	6.79	8.17
3	8	59.8	7.48	63.8	7.97	29.6
4	8	91.5	11.4	92.5	11.6	7.45

Notes:

1. Data source is Baird 2022.

It is not possible to predict how many annual transits through the Lease Area may be rerouted around the Lease Area during and after construction. For purposes of illustrating potential economic exposure, therefore, it is assumed here that 100% of the 966 annual average fishing vessel transits through the Lease Area will reroute around the Lease Area.

As shown in Figure 3-2, at a typical steaming speed of 7.6 knots, the expected increase in transit time around the Lease Area between major fishing ports and important fishing areas ranges from 5 minutes to 30 minutes. If each of the 966 annual transits through the Lease Area were rerouted around the Lease Area, and those transits experienced the maximum estimated increase in transit time of 30 minutes, the increase in annual fleetwide transit time would be 431 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 $5.00 per gallon, this additional transit time would add approximately $62.50 to fuel costs per transit and add $60,375 to annual fleet-wide fuel-based transit costs for AIS-equipped vessels.

This estimate of a $60,375 increase in annual fleetwide transit cost if all current annual transits through the Lease Area were to detour around the Lease Area, is sensitive to assumptions about steaming speeds, 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 longer transit times. However, as Table 3-2 illustrates, increases in typical transit times associated with rerouting around the Lease Area result in relatively minor increases in overall transit times even if all current transits through the Lease Area were to reroute around it. From a fleetwide perspective, therefore, factoring in potential transit cost impacts beyond the $60,375 fuel costs described above will be more than offset by a reduction in estimated costs if the extreme assumption that all fishing vessels that currently transit through the Lease Area will be transiting around the Lease Area is relaxed. In fact, most vessels that currently transit through the Lease Area can be expected to continue transiting through rather than around the Lease Area and therefore can be expected to experience little to no increase in transit times or costs.

4 Conclusions

BOEM refers to economic exposure as "a starting point to understanding potential *economic impacts* … if a harvester opts to no longer fish in the area and cannot recapture that income in a different location" (BOEM 2021). Section 2 of this report developed $370,651 as an estimate of full annual economic exposure in the Lease Area and estimated economic exposure during cable installation to be $13,182 in the Massachusetts OECC and ranging from $18,177 to $18,842 in the Connecticut OECC depending on which landfall approach is used. However, lost fishing revenues would be as high as these estimates of economic exposure only if fishing vessels generate no fishing revenues when they are precluded from fishing in parts of the Lease Area or the OECCs. This requires assuming that they will either stay in port or remain idle at sea or will continue fishing while generating no fishing revenues. All of these responses to the areas impacted by Vineyard Northeast are highly unlikely because they would require all fishing vessel owner/operators who typically operate in the Lease Area or OECCs to act in an economically irrational manner.[16]

Economic impact estimates based on estimates of economic exposure presented in this report will be determined at a later date based on updated BOEM guidance and consultations with the states through the CZMA review processes.

[16] 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 (e.g., trip expenses), which allows net operating profits to offset at least some fixed costs. It is highly unlikely that the limited areas and durations of fishing preclusions associated with Vineyard Northeast would cause fishermen to cease fishing (return to port or remain idle at sea), as opposed to diverting fishing effort away from impact areas. 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.

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