RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
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January 22, 2019

Brian Krevor
Environmental Protection Specialist
Office of Energy Programs
Environmental Review Branch
Bureau of Ocean Energy Management

RE: **BOEM-2018-0069**
Draft Environmental Impact Statement for the Construction and Operations Plan
Vineyard Wind LLC

Dear Mr. Krevor:

Staff at the Rhode Island Department of Environmental Management (RIDEM) have reviewed the Notice of Availability (88 FR 63184) and associated Draft Environmental Impact Statement (EIS) for the Construction and Operation Plan (COP) submitted by Vineyard Wind LLC (Vineyard Wind) and offer the following comments:

Layout Alternatives

- The RIDEM **strongly** recommends that the Bureau of Ocean Energy Management (BOEM) select a combination of Alternatives D1, D2, and E over the Proposed Action, as it will mitigate Rhode Island fisheries concerns more substantially than compensation alone. This recommendation is supported by the Rhode Island Marine Fisheries Council (RIMFC), as dictated to the RIDEM and the Coastal Resources Management Council (CRMC) via a letter dated October 12, 2018. The letter states that the RIMFC members "recommend to the Director of DEM and CRMC that all wind power leases off southern New England be required to have turbines set in an east-west pattern with 1 nm of spacing to minimize the negative impacts on historical fishing activities, and further require that all structures are removed after the lease termination to restore fishing access to the entire area." Compensation may still be required for certain vessels or companies, but 84 turbines in an E-W, 1-nautical mile spaced grid ameliorates a variety of concerns to the greatest extent possible compared to the other proposed options.
    - Concerns will be reduced for the following issues:
        - Fishing access within the turbine array (reduced conflict between the fixed and mobile gear fisheries, mobile gear physically able to operate within

the array, easier fishing within the array due to simpler headings to follow while actively towing gear, etc.)
    - Easier navigation (more logical pattern for experienced and inexperienced mariners to follow, more consistent with abutting wind farms proposed around the Vineyard Wind wind development area (WDA) and with Vineyard Wind's future development in the southern portion of the lease area)
    - Lowered risk of allision or collision due to more logical navigational patterns

- Additionally, the merging of Alternative E with the combined Alternatives D1 and D2 will help to reduce some of the challenges associated with D1 and D2 (i.e., increased acreage caused by wider-spaced layout). Alternative E would cause a reduction of 22 turbines, allowing the increased acreage in Figure 2.1.-5 to be eliminated, as the 17 turbines in the expanded section to the south would no longer be necessary.
- The 1-nautical mile spacing may also serve to reduce turbine shadowing, or power loss caused by wake effects of upstream wind turbine generators (WTGs), to accommodate the larger 9.5 MW WTGs. This would require experimental verification via modeling (see Frandsen 2007).

Mitigation:

- The Department finds the Mitigation Measures for "Compensation for lost income due to offshore wind energy facility operations and maintenance" in Appendix D to be lacking.
    - A complete mitigation package should include more than lost net revenue due to inability to access fishery resources within the WDA.
    - The consideration of only ex-vessel values omits the possible fishing impacts caused by potential environmental effects of construction and/or operation. These environmental effects may affect not only the areas within the WDA, but also surrounding areas.
    - Shoreside impacts should also be taken into consideration, as ex-vessel values are not a complete reflection of the economic value of potentially lost seafood landings to the state economy.
    - Refer to the attached January 14, 2019 RIDEM report on the economic exposure of the Vineyard Wind COP WDA which details an estimate of the ex-vessel value of the Rhode Island commercial fishing industry, along with a projection of that value over 30 years.

Section-specific comments:

- Section 1.5.2. Page 1-6: Please define "reasonably foreseeable actions or other projects". Only projects with power purchase agreements or state agreements in place appear to be considered in the cumulative impacts sections.

- Section 2.1. Page 2-6: What is the area occupied by each turbine (foundation plus scour protection)?
- Section 2.1. Page 2-7: What amount of area will 10% of the inter-array and OECC (offshore export cable corridor) equate to? The RIDEM suggests avoiding the use of concrete mattresses for cable coverage, as there have been reported and unresolved conflicts with this type of coverage in Rhode Island state waters. Additionally, visual monitoring by the University of Rhode Island has shown that the mattresses have not been colonized by organisms that prefer hard bottom habitat. Rock placement or other types of cable protection may be better for allowing marine life to recolonize the area post cable installation.
- Section 2.1.1.2. Page 2-8: The operating phase of the project is stated as 30 years in this section. Therefore, any mitigation to the fishing industry should be done on a 30-year basis.
- Section 2.1.4. Page 2-11: Will BOEM actually consider any project alternatives that will require substantial additional survey work to resolve data gaps for WTG placements and inter-array cable locations not contemplated in the Proposed Action?
- Section 2.1.4.1. Page 2-11: When stating that the Proposed Action will result in a minimum of 0.75 nautical mile spacing, what is this spacing measured between? Is this between the towers, the foundations, or does it also incorporate scour protection? The Rhode Island fishing industry has stated the 1-nautical mile spacing should be between the scour protection, as it will prevent mobile fishing in close proximity, which therefore reduces the navigable and fishable region between turbines.
- Section 2.1.4.1. and Section 2.1.4.2. Page 2-11: Here and throughout the document, Alternative D1 and D2 seem unnecessary as they do not individually meet the needs of the Rhode Island commercial fishing industry. A combined alternative D (1-nautical mile spaced turbines in an E-W layout) would meet the request and save space throughout the document.
- Section 2.1.7. Page 2-15: BOEM asserts that a Shared Cable Corridor was not analyzed in detail because the presence of a Vineyard Wind transmission cable does not prevent other developers from laying cables in close proximity to the Vineyard Wind cable. However, this assertion ignores potential environmental benefits and fishing mitigation due to ensuring that a smaller area will be disturbed by construction and a more limited area will potentially have new hangs created within it.
- Section 2.1.7. Page 2-16: The statement that phased development and monitoring potentially reducing environmental impacts is "speculative at this time" and could impact project economic feasibility is essentially affirming that economic gain is more important than minimizing environmental effects. Using this approach, there is limited consideration for ecosystem services, existence value of affected species, etc. A phased approach would allow for incorporation of the precautionary principle into the development process, without preventing innovation. Such an approach may slow development but allow ample research to be conducted and impacts to be addressed on a smaller scale (in both space and time).

- Section 2.3. Page 2-18: BOEM indicates that the risk of collisions and allisions will be low based on the proposed spacing between WTG and other facility components. The Rhode Island commercial fishing industry has stated otherwise. The Proposed Action has spacing of 0.75 nautical miles between WTGs, which fishermen have argued is not sufficient for safe fishing and/or navigation. They have suggested 1 nautical mile at minimum.
- Section 2.3. Page 2-18: The statement that cable displacement or damage by fishing gear is unlikely due to cable burial or hard armoring needs elaboration. The type of hard armor is of significance, as concrete mattressing may not stay in place if caught on towed mobile gear, which would leave the cable exposed. There were unconfirmed reports of a concrete mattress being dragged by a purse seine in Rhode Island waters. While these reports were never confirmed to RIDEM by the cable owner, it may be worth considering this possibility while deciding on cable armoring strategies.
- Section 2.3. Page 2-18: The WTGs will be designed to endure sustained wind speeds of up to 112 mph and gusts of 157 mph. They will also be designed for maximum wave heights greater than 60 ft. Are these planning parameters sufficient given increased storm strengths in recent years and northward shifting peak intensities (Emanuel 2017)? The Saffir-Simpson Hurricane Wind Scale indicates that a category 5 hurricane has sustained winds greater than 156 mph, while the WTGs can only handle 112 mph sustained winds (category 3 hurricane intensity). Additionally, hurricane Florence (2018 category 4 storm) had waves that exceeded 83 ft. (www.weather.gov/wrn/florence).
- Section 3.2.2.3. Page 3-19 Table 3.2.2-3: The estimated years between incidents are smaller than the life of the project, suggesting that BOEM anticipates that there will be small vessel allisions and large vessel allisions. If allisions are anticipated, it may be necessary to discuss culpability (i.e., who is at fault and who pays for vessel or WTG damages). This may affect vessel operators' insurance rates and availability.
- Section 3.3.1.3. Page 3-27: The DEIS states that Vineyard Wind would restore any previously undeveloped areas on land that were disturbed by construction. Elaboration on restoration is necessary; how will the areas be restored?
- Section 3.3.1.3. Page 3-27: The italicized portion of the following statement requires a citation: "Collisions between animals and vehicles or construction equipment might cause direct mortality. BOEM expects this to be rare, *as most individuals should avoid the noise and vibration of the construction areas.*"
- Section 3.3.1.3. Page 3-27: It is unclear what reptiles and amphibians are being referred to when discussing limited mobility and vulnerability to construction impacts. The sentence states "reptiles and amphibians mentioned above in 3.3.1.1.", but no specific species are discussed in the preceding text in 3.3.1.1.
- Section 3.3.2.2. Page 3-33: The type of lighting on the WTGs should also be considered as a relevant design parameter that may influence the magnitude of impact on birds.
- Section 3.3.2.3. Page 3-34: It is stated that the risk of collisions between birds and vehicles or construction equipment is negligible, as most birds would avoid the noisy construction areas. Research supporting the claim that birds will avoid the noisy areas should be cited.

- Section 3.3.2.3. Page 3-35: The following statement also requires a citation: "Loons, grebes, seaducks, and northern gannets typically avoid offshore wind developments, resulting in loss of habitat and reduced risk of collision."
- Section 3.3.3.1. Page 3-43: "Conversely, the unprecedented mortality of more than 5.5 million bats in northeastern North America as of 2015 reduces the likelihood of many individuals being present within the proposed project area." Remove this sentence as it inappropriately downplays that the proposed project may affect bat populations already in poor shape. The preceding sentence sufficiently makes this argument.
- Section 3.3.3.9. Page 3-48: It is appropriate to state that "existing information seems adequate to assess the potential impacts of the proposed Project," when "estimates of population size, survival rates, reproductive, rates and other biological parameters are lacking for many species of bats". This is especially important considering drastic population declines (approaching 90% in some areas) in regional species of bats due to white-nose syndrome.
- Section 3.3.5.3. Page 3-62: Has a power analysis been done to confirm that accepted ecological and fisheries methods would be unable to detect population changes with the benthic organism mortality associated with 0.5% of WDA area? This is plausible but citing an analysis would strengthen this argument.
- Section 3.3.5.3. Page 3-62: BOEM states that they could reduce potential impacts by requiring time-of-year (TOY) restrictions for horseshoe crabs, winter flounder, and bay scallop to protect the spawning period, larval settlement, and juvenile development. BOEM should most definitely implement these TOY restrictions to minimize impacts to all three species.
- Section 3.3.5.3. Page 3-63: Will the fishing industry be notified of all cable and scour protection locations to prevent mobile gear interactions with the new fixed structures?
- Section 3.3.5.3. Page 3-63: "The conversion of soft-bottom habitat to new hard bottom would be unavoidable, but this effect would be localized and should not have a population-level adverse impact on soft bottom communities, while hard bottom communities could increase from the additional substrate." Will there be monitoring of the soft-bottom habitat prior to construction and of new hard-bottom habitat during and post construction? This information would be valuable to understand with the added hard-bottom habitat does to the local biological community.
- Section 3.3.5.3. Page 3-64: "BOEM could reduce potential impacts of construction to minor by requiring the following mitigation measures as a condition of COP approval … : (1) adaptive management involving refinement of exclusion zones, and (2) long-term monitoring to document the changes to the ecological communities on, around, and between WTG foundations and other benthic areas disturbed by the proposed Project, including the movement of and habitat use of protected species." Will BOEM implement these measures? Both should occur to minimize biological impacts to the extent practicable.
- Section 3.3.5.3. Page 3-64: It is argued that impacts related to powered transmission cables will be negligible. Prior to making this statement, it is made clear that there is limited information available on EMF impacts on invertebrates. Therefore, the impacts

should be considered as a range (e.g., negligible – moderate) due to the uncertainty associated with invertebrates.

- Section 3.3.6.3. Page 3-75: "Although the vertical surfaces on WTG and ESP [(electrical service platform)] monopiles would also introduce a source of new hard substrate, the relatively smooth surfaces of steel monopiles are not expected to be favorable to colonization or reef formation due to their low surface complexity and rugosity (MMS 2009)." This has not been the case with the Block Island Wind Farm. The vertical structures have been heavily colonized by blue mussels. This MMS study is outdated and lessons from the Block Island Wind Farm (the first offshore wind farm in the US, which is situated near the Vineyard Wind Farm) should be incorporated here instead.
- Section 3.3.6.3. Page 3-75 – 3-76: Localized loss of demersal eggs could lead to reduced fish recruitment; however, this would be limited and BOEM does not anticipate impacts on the flounder stock." Is this the winter flounder stock? It is unclear based on the current wording. Additionally, what data are available to support his claim. Only Cape Wind modeled cable jet plowing trough reconstitution times are presented as justification of recolonization. Again, these data are outdated (2005 and 2009) and lessons learned from the Block Island Wind Farm (including unpublished) would be more appropriate, as findings are more recent and results were measured instead of modeled.
- Section 3.3.6.3. Page 3-76: The proposed long-term monitoring to document the changes to ecological communities on, around, and between WTG foundations should occur. However, how does monitoring of changes reduce potential impacts as stated? Does this imply that action will be taken if negative effects to benthic communities are occurring?
- Section 3.3.6.3. Page 3-76: "Sub-lethal effects for mollusk eggs occur with an exposure of 200 mg/l for 12 hours; for other life stages, the minimum threshold for sub-legal effects took 24 hours at 100 mg/l." This is only for single disturbance events. Construction would be ongoing over the course of two years, resulting in regular increased turbidity. Are data available on recurring turbidity events caused by day-to-day construction?
- Section 3.3.6.3. Page 3-76: While depositions of 0.04 in or greater may occur only in limited spaces, the effect may be more severe than minor. The overlap with the juvenile Atlantic cod habitat area of particular concern (HAPC) is especially concerning, as cod are known for high site specificity in spawning. Siceloff and Howell (2013) contend that Atlantic cod "aggregate around find-scale bathymetric features on the spawning ground and utilize relatively small areas during spawning." If one of these spawning areas is smothered, effects will be greater than minor.
- Section 3.3.6.3. Page 3-77: "Noise impacts on fish and invertebrates in the WDA and OECC would vary depending on the ability of the fish to detect sound pressure…" This is all true for fish, but there is no discussion of particle motion in this section, which applies to invertebrates that hear by way of statocysts. Further discussion should address pile driving noise impacts on invertebrates.
- Section 3.3.6.3. Page 3-80: Only half of the Hutchinson et al. (2018) paper is described in the EMF section; American lobster impacts are described, but little skate responses to

EMF are not discussed. Considering little skates showed a stronger response to EMF than the American lobster, those findings and their implications should be described here.

- Section 3.3.6.10. Page 3-85: Why are the Bay State Wind project and the three more recently leased areas not discussed in the cumulative impacts section? While these projects have not yet secured power purchased agreements, their development is still reasonably foreseeable. Given that the consecutive area leased in Southern New England alone (OCS-A 485, OCS-A 487, OCS-A 500, OCS-A 501, OCS-A 520, OCS-A 521, OCS-A 522) is over 1,400 square miles (and the largest existing contiguous array is closer to 112 square miles – the Walney Wind Farm, UK; Orsted), there is little existing information to compare to this scale of development. Consequently, impacts could be moderate to major.
- Section 3.3.7.3. Page 3-102: How does long-term passive acoustic monitoring help to reduce the likelihood of impacts to marine mammals? Would construction activities be modified if sound levels exceed a certain threshold, as determined through monitoring?
- Section 3.4.5.1. Page 3-163: An addendum to the RIDEM 2017 report was released in 2018. The addendum provides total trip values of all trips that utilized each wind lease area. These results should also be considered, as they encompass full trips that may be eliminated altogether if E-W navigation is not feasible. The addendum is provided at the end of the 2017 report, provided here: http://www.dem.ri.gov/programs/bnatres/fishwild/pdf/RIDEM_VMS_Report_2017.pdf Further, the January 14, 2019 report (attached to this letter) provides the most recent estimate of economic exposure of Rhode Island fisheries in the COP area.
- Section 3.4.5.1. Page 3-179: The inability of the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) survey vessel to operate within the WDA under any development scenario may affect scientists' ability to monitor population changes, which may in turn affect management (e.g. quotas).
- Section 3.4.5.1. Page 3-179: The 500 m temporary restriction zones created by construction are likely to change very regularly. This was a challenge for the Block Island Wind Farm, as construction plans changed constantly in response to a variety of external factors (e.g., weather). Construction vehicle locations and anticipated future locations for each day should be reported to the fishing industry to avoid conflicts, especially with those setting fixed gear. While "Vineyard Wind would communicate in advance where and when construction activities are scheduled to take place, so as to allow fishing vessels to alter their plans if needed to avoid impacted areas," real-time reporting will be necessary to prevent overlaps in activity due to the regular changes in construction schedules.
- Section 3.4.5.1. Page 3-180: "Vineyard Wind would communicate where and when activities would occur in the OECC to avoid conflicts with fishing activities." Vineyard Wind should also communicate when fishing can return to the area post cable laying.
- Section 3.4.5.1. Page 3-180 - 3-181: "… construction and installation activities are expected to have a moderate impact on commercial fisheries for for-hire recreational fishing." Based on feedback from the Rhode Island commercial fishing industry, the RIDEM disagrees with this statement that impacts will be moderate. If proper

compensation to those losing access to fishing grounds cannot be achieved, impacts will be major, not moderate. BOEM later states that construction disruption payments would reduce impacts to minor, which downplays the impacts to the Rhode Island commercial fishing industry. Additionally, payments will only reduce impacts if the developer and the fishing industry can agree on mitigation measures. How does BOEM ensure that this occurs?

- Section 3.4.5.1. Page 3-180 – 3-181: Does BOEM require compensation to the fishery if there are detected negative biological impacts that result in lower catches or other related cost increases (increased fuel costs due to navigational changes, lower catches due to displacement of fishing vessels into other vessels' historic fishing grounds, etc.)? For instance, while BOEM anticipates that impacts to longfin inshore squid caused by construction (pile driving noise, sedimentation, and water quality) will be minimal, the lifespan of a squid may be as short as 9 months. If there are any environmental impacts, a portion of a population could be disrupted, resulting in population-level effects. Considering construction on this project and others in the area are likely to extend many years, there could be impacts at a biological level that lead to reduced catch for fishermen. How will fishermen be compensated for a potential loss of this kind?
- Section 3.4.5.1. Page 3-181: "A time of year restriction, however, would not result in benefits to squid eggs given that up to 80 squid vessels throughout the year (on average between 40 and 60) are bottom trawling on spawning squid and squid egg mops…" This is only a valid comparison for activities that directly alter benthic habitat (i.e., jet plowing or pile driving). The impacts of sound are more widely distributed than individual trawl tows, as only areas where tows occurred will be affected. To complicate matters further, there are limited data on the impacts of sound to squid eggs.
- Section 3.4.5.1. Page 3-182: There should be more discussion on radar interference than is presented. It would be helpful to discuss potential solutions to the problem (new radar systems, courses to demonstrate how to configure a radar within a turbine array, etc.). This is an issue that could also be reduced in severity by situating turbines on lines of latitude, as it would help the vessel operator to understand where to expect turbine foundations and towers in the absence of properly functioning radar.
- Section 3.4.5.1. Page 3-182: The spacing between turbines is unclear again. What part of the turbines (foundation, tower, scour protection) is used to determine distance between them?
- Section 3.4.5.1. Page 3-182: "In addition, smaller vessels could drift into WTGs or ESP structures during times where steerage is limited due to haul back of gear or loss of power." Loss of power can occur on vessels of any size and potentially result in an allision.
- Section 3.4.5.1. Page 3-182: Vineyard Wind should engage with the fishing industry to determine what form of cable armoring (rock placement, concrete mattresses, and/or half-shell) would be the least likely to create new hangs for mobile gear. The fisheries scientific community should also be consulted to discuss what options will be most likely to create habitat suitable for local benthic communities. The concrete mattresses used for

the Sea2Shore cable have not been colonized by benthic communities to date. As such, other options may be better suited for this application.

- Section 3.4.5.7. Page 3-189: When describing the Alternative D2 in the Conclusion, it is not discussed that all other development in the area, including future Vineyard Wind development, is expected to be situated in an E-W formation. The United States Coast Guard (USCG) has recommended a single contiguous pattern for all turbines in abutting sites. The Proposed Action (a diagonal grid) therefore creates challenges to navigation and fishing if the layout is not contiguous with surrounding developments. It also fails to meet the USCG recommendation.

The Rhode Island Department of Environmental Management thanks you for the opportunity to provide comments. Should you have any questions or comments regarding these recommendations, please feel free to contact Julia Livermore (julia.livermore@dem.ri.gov; 401-423-1937).

Sincerely,

Janet Coit
Director

References:

Emanuel K (2017) What do hurricanes Harvey and Irma portend? Presentation at MIT on September 20, 2017

Frandsen S, Barthelmie R, Rathmann O, Jorgensen HE, Badger J, Hansen K, Ott S, Rethore P-E, Larsen SE, Jensen LE (2007) Summary report: the shadow effect of large wind farms: measurements, data analysis and modelling. Risø National Laboratory, Roskilde

Hutchison, Zoe, Sigray P, Haibo 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. BOEM

Siceloff L, Howell WH (2013) Fine-scale temporal and spatial distributions of Atlantic cod (Gadus morhua) on a western Gulf of Maine spawning ground. Fisheries Research 141:31–43. doi: 10.1016/j.fishres.2012.04.0

Rhode Island Fishing Value in the Vineyard Wind Construction and Operations Plan Area

RHODE ISLAND

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

JANUARY 14, 2019

The following analysis briefing document created by the Rhode Island Department of Environmental Management, Division of Marine Fisheries (DMF) details an estimate of the exvessel value of the Rhode Island (RI) commercial fishing industry that is derived from the Vineyard Wind Construction and Operations Plan (COP) area, along with a projection of that value over 30 years. As with other analyses of this type, given limited and incomplete data over the past 15 years connecting landings to location, it was necessary to make science-based assumptions to derive a total value from this area. The area of the leased site used for this analysis is the area bounded by the turbine locations provided in the COP, released through a BOEM Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) on March 30, 2018 (federal register code 83 FR 13777). The area has been modified since this original layout, but DMF was not able to redo the analysis with this new area. This analysis does not examine any other economic, social, or ecological factors beyond ex-vessel values.

The DMF estimates that the ex-vessel value of fishing in the Vineyard Wind COP area with an assumed 2 nautical mile (nm) buffer along the north and south boundaries is $35,611,702.85 for a 30-year period (including lease and construction time). This value is premised on existing trips that either fully or partially intersect the COP area, including a 2 nm section north or south of the area (Figure 1), not being taken if the wind farm is constructed in a manner that is not consistent with traditional fishing practices. The 2 nm buffer and loss of the whole trip are assumptions based on feedback from fishermen who prosecute various fisheries in this area.

Recall that the value associated with the 2 nm assumption is $35,611,702.85 for the 30-year period of the lease including construction (Table 1). A different assumption can be made that only a 1 nm buffer around the COP area would be impacted (Figure 1). In other words, trips that utilize only the waters beyond 1 nm around the COP would not be affected. For a buffer of only 1 nm, the value associated with fishing over the 30-year period is $30,531,599.84 (Table 2).

The values in this analysis include ex-vessel value of fishing currently occurring in the COP area plus the buffer per the assumptions stated above and below and do not account for future increases in fish populations, increases in value, or inflation. The ex-vessel values therefore should not be considered an analysis of any economic value beyond the ex-vessel value of fishing in the COP area.

The following steps were taken to arrive at a range of $30,531,599.84 to $35,611,702.85, depending on the size of the buffer:

- Vessel Monitoring System (VMS) data were connected to Vessel Trip Report (VTR) data by Vessel ID. The VTR data were then linked to dealer reports (landings) by VTR number. The combined dataset was then used to select only data points where the latitude and longitude coordinates in the VMS fell within the target area including the Vineyard Wind COP, with a 2 nm buffer to the north and south of the turbines (or 1 nm, depending on the selected method). The remaining data points were then sorted to include only a single row per trip per species landed in Rhode Island. For each species, within each year,

the individual trip values were summed to calculate the value of landings of trips that utilized the COP area. These values were divided by the rate of VMS coverage (number of permits in the VMS data divided by the number of federal permits in the VTR landing the same species for the same area) to calculate total exposure.

- Assumptions:
  - Those utilizing federal permits and fishing in the COP area are not also fishing in state waters on the trip where they were in the COP.
  - Landings characteristics from vessels covered by VMS are similar to those not covered by VMS.
  - A whole trip would be affected by avoidance of the wind development area as noted in fishermen feedback during public meetings about this area.
  - A distance (2 nm or 1 nm depending on the methodology used) around the wind turbines may also be avoided by commercial fishing vessels based on fishermen feedback during the discussions on transit lanes.

- Given that lobster and Jonah crab fishing have no VMS or VTR data requirements, separate methods were necessary. Catch information (biomass) from tows collected by the Northeast Fisheries Science Center Bottom Trawl Survey were used to understand spatial distribution of American lobster and Jonah crab. Tow information from both the spring and fall surveys were included. Biomass per tow information were spatially interpolated over the northeast U.S. shelf using inverse distance weighting. Interpolations were conducted over a 0.1-degree grid. Using annual depictions of interpolated abundances, the proportion of abundance of Lobster Management Area 2 (LMA2) within the COP was estimated by dividing the total COP abundance by that of the abundance in the entire LMA2. The proportion was then multiplied by the annual poundage of Rhode Island landings from LMA2. Finally, the poundage value was multiplied in each year by the average Rhode Island dockside sales price per pound of lobster, and Jonah crab, respectively for each year.

  - Assumptions:
    - North East Fisheries Science Center (NEFSC) trawls adequately characterize lobster abundances.
    - The NEFSC survey over the shelf provides spatial resolution useful in estimating fine scale changes, such as those in the COP and LMA2.
    - Spring and fall are adequate seasons to estimate these species abundances.
    - The weighting used in the inverse distance weighting is adequate.
    - Abundance is correlated linearly to landings in this area through time.

- Finally, since the wind farm lease will span over multiple years, and a non-east-west configuration will likely preclude all commercial fishing from this area during that period per feedback we have received from the fishing community, projections were made of the total exposure for 30 years (25 years for the lease duration and an additional 5 years for construction and decommissioning). To be able to adequately project this information, the proportion of species-specific seafood ex-vessel value coming from the COP area relative to the overall value of these same species to RI was calculated for years in which the COP specific value could be calculated. An average proportion for these years was then acquired. Species were grouped based on relevant management groupings. The overall value for these species to RI was prorated based on this proportion. The reason for this is the number of years of direct value from the COP area is limited by VMS coverage, therefore to get an adequate time period to analyze, this proportionalization was employed. Once the RI species-specific value was prorated, an Auto-Regressive Integrated Moving Average (ARIMA) model was used on the timeseries (spanning from 2004 – 2017) to model the trends in value and project those trends forward for the projection period based on the ARIMA model parameters. ARIMA models are a class of models that capture a suite of different standard temporal structures in time series data. For this analysis, the resulting trends were largely flat given the variance in the data and the length of the time series.

    - Assumptions:

        - The annual proportion of total Rhode Island species-specific value coming from the COP area scales directly to the overall species-specific value in a consistent manner.
        - Factors controlling effects on value, while different in any given year, will result in similar value trends over the projection period.
        - Effects of regulations are ignored as these could move in either a negative or positive direction and are not readily predictable.
        - Effects of climate change are not explicitly modeled, though may be picked up by the ARIMA model.

Using available data from the Standard Atlantic Fisheries Information System (SAFIS), VTR, VMS, scientific surveys, and the assumptions outlined above, and depending on the size of the requisite buffer bordering the COP, the estimated range of ex-vessel landing values associated with that portion of the total area leased by Vineyard Wind (depicted in Figure 1) range from $30,531,599.84 to $35,611,702.85 over 30 years. It is important to re-emphasize that the values presented do not include any shoreside impacts (including crew, fuel, gear, ice, processing, or packaging costs). There are entire businesses that provide these services that may also be affected, and many of these services occur in the major RI ports, which will also see impacts from the offshore wind energy area if fishing is precluded from occurring in this area. Additionally, the value of seafood served at local restaurants has not been accounted for; restaurants may also be affected by changes in seafood availability. Additionally, ecological

impacts to marine resources and impacts that habitat alteration in this area may impose upon the productivity of various marine populations are not considered, which could also affect landings from the area as well as surrounding regions through time.

Table 1 – Projected ex-vessel landing values for COP with 2 nm buffered total trip analysis

Species	30-Year Value
BLUEFISH	$116,408.13
CRAB, JONAH	$137,324.71
DOGFISH, SMOOTH	$28,921.06
DORY, AMERICAN JOHN	$12,191.76
SUMMER FLOUNDER - SCUP - BLACK SEA BASS	$4,585,714.62
GOOSEFISH	$435,638.44
GROUNDFISH	$2,160,474.76
LOBSTER, AMERICAN	$1,413,517.02
SCALLOP, SEA	$1,060,092.09
SKATES	$25,318.54
NE SMALLMESH SPECIES (HAKES)	$4,664,599.43
SQUID - MACKEREL - BUTTERFISH	$20,968,100.76
OTHER*	$3,401.53
Total	$35,611,702.85

* The other category includes Atlantic bonito, spiny dogfish, conger eel, and sea robins.

Table 2 – Projected ex-vessel landing values for COP with 1 nm buffered total trip analysis

Species	30-Year Value
BLUEFISH	$90,151.13
CRAB, JONAH	$137,324.71
DOGFISH, SMOOTH	$28,921.06
DORY, AMERICAN JOHN	$9,250.86
SUMMER FLOUNDER - SCUP - BLACK SEA BASS	$4,071,710.54
GOOSEFISH	$388,476.48
GROUNDFISH	$2,144,209.51
LOBSTER, AMERICAN	$1,465,889.13
SCALLOP, SEA	$1,059,381.71
SKATES	$25,129.43
NE SMALLMESH SPECIES (HAKES)	$4,401,443.07
SQUID - MACKEREL - BUTTERFISH	$16,706,909.04
OTHER*	$2,803.18
Total	$30,531,599.84

* The other category includes Atlantic bonito, spiny dogfish, conger eel, and sea robins.

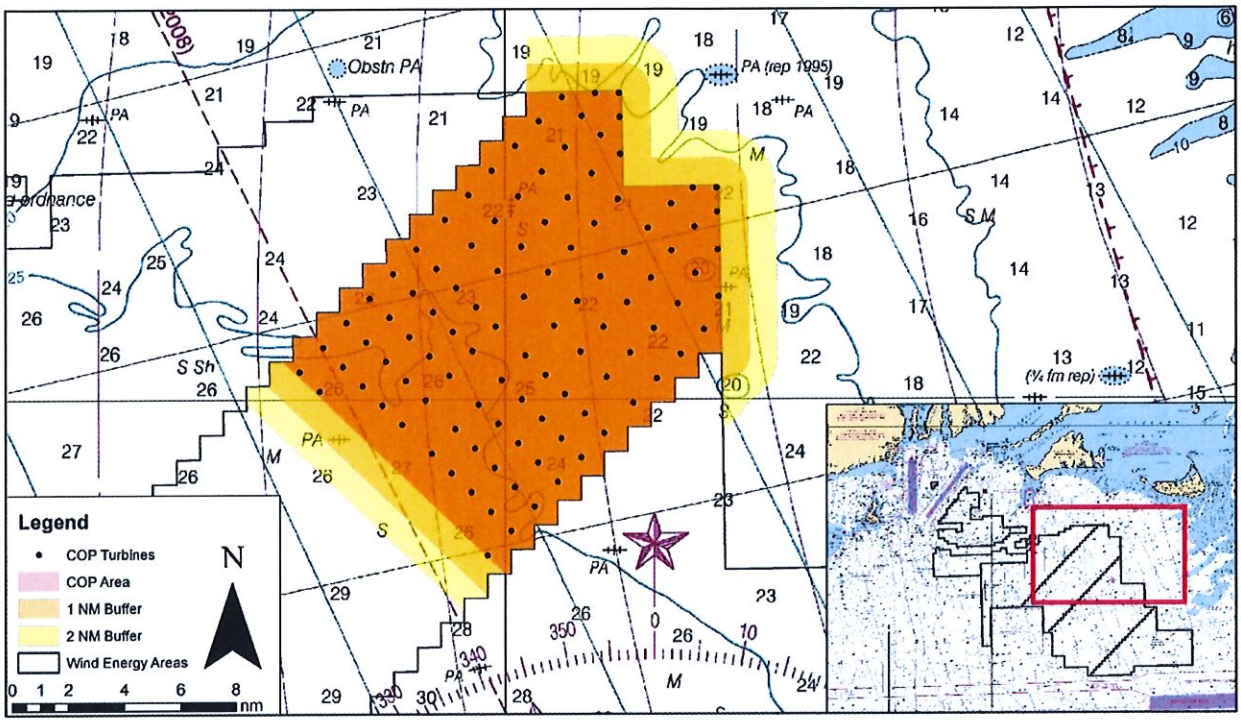

Figure 1 - The Vineyard Wind COP area (as published on 3/30/2018) with 1 nm and 2 nm buffers.