Appendix G. Initial proposal for trawl survey

Project Summary

The University of Massachusetts Dartmouth School for Marine Science and Technology (SMAST) will plan, coordinate and conduct a trawl survey to assess the fish community in the Vineyard Wind Development Area (VWDA) and an adjacent control area. The survey will be adapted from the NEAMAP protocols to provide a consistent framework with existing surveys in the region and facilitate easier sharing and integration between state and federal agencies. The survey will encompass the approximately 370 km^2 Vineyard Wind Development Area and an adjacent control area of similar size and depths, using a systematic random sampling method. A minimum of 20 tows will be conducted in the development area, and another 20 tows in the control area. For each tow, aggregate species weight, as well as individual lengths and weights will be collected for all commercial fish species. This survey will provide the baseline data on catch rates, population and community structure for a future environmental assessment using the Before/After Control Impact (BACI) framework.

Project Narrative

Objectives

The primary goal of this project is to establish a survey methodology and provide baseline data to for future assessments of the possible effect of wind farm development on fish communities in the Vineyard Wind lease area. Additionally, analysis of the data will yield recommendations toward future survey effort. This project will develop a baseline of species and size composition before construct begins and provide: 1) abundance estimates for all commercially important species from for both the lease area and a control region; and 2) a comparison of the fish community between the two areas. Establishing a control area will allow comparisons of BACI analysis after wind turbines are built. More specifically, this survey will yield estimates of fish abundance, spatial distribution, size structure and length-weight relationship within the Vineyard Wind lease area compared to an adjacent control region of similar depth and seabed characteristics. This will allow an evaluation of the after-construction fish abundance and community structure by comparing them to the same control area.

Methodology

The methodology for the survey will be adapted from the Atlantic States Marine Fisheries Commission's (ASMFC) Northeast Area Monitoring and Assessment Program (NEAMAP) nearshore trawl survey. Initiated in 2006 NEAMAP conducts annual spring and fall trawl surveys from Cape Hatteras to Cape Cod. The NEAMAP protocol has gone through extensive peer review, currently operates near the lease site and uses a commercial fishing vessel (Bonzek et al. 2008). Adapting these existing methods will improve the consistency between survey platforms which should facilitate easier sharing and integration of the data with state and federal agencies.

Survey Design. An initial survey was conducted by SMAST in the fall of 2018. This survey provided an initial description of abundance, spatial distribution, size structure, and length-weight relationships for fish community in that area (Stokesbury and Lowery, 2018). An attempt was made to use the open-codend video-based technology; however, poor visibility due to soft benthic substrates stirred up by the trawl system (e.g. the door and sweep) proved this optical method infeasible. Twenty-one survey tows with the traditional closed-codend method were completed during that trip (Figure 1). Based on the catch data, a power analysis was conducted to inform future survey effort. The results indicated that 20 tows within the lease site and a similar number in the control region would allow for a 95% chance of detecting a 25% change in the population of the most abundant species (i.e. scup, butterfish, whiting and summer flounder).

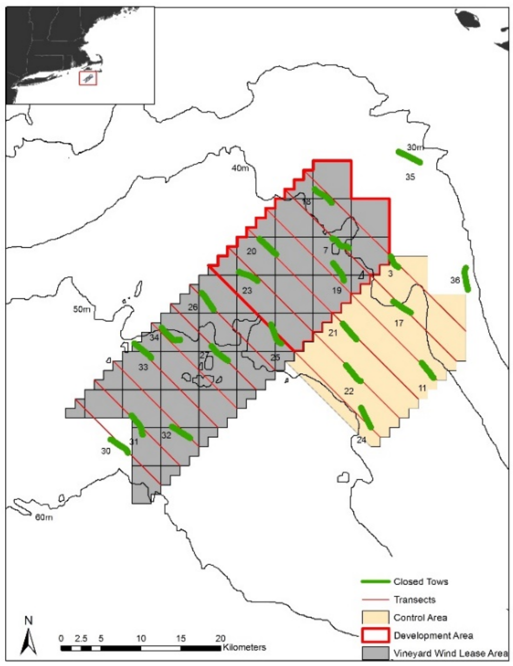

Figure 7. Tow paths from the fall 2018 survey in the Vineyard Wind lease area. The grey polygon with a red outline is the current wind development area. The grey polygon without the red outline is a future development area. The yellow polygon is the control areas.

During this survey we will conduct a minimum of 40 tows; 20 in the 370 km^2 development area, 20 in the 306 km^2 control area (Figure 2). This will give a sampling density of 1 station per 18.5 km^2 (5.4 sq. nautical miles) in the development area. Currently the NEAMAP nearshore survey samples at a density of one station per ~100 km^2 (30 sq. nautical miles). A systematic random sampling design will be used in which each area is subdivided into 20 sub-areas. This will ensure adequate spatial coverage throughout survey regions. The starting location within each area will be randomly selected. Tow duration will be 20 minutes. Tow speed will target at 3.0 knots. For each tow the following environmental and operational data will be collected:

- Start and End Time
- Start and End GPS Location
- Start and End Water Depth
- Tow Speed
- Tow Direction
- Surface and Bottom Water Temperature
- Wind Speed and Direction
- Wave Height
- Air Temperature

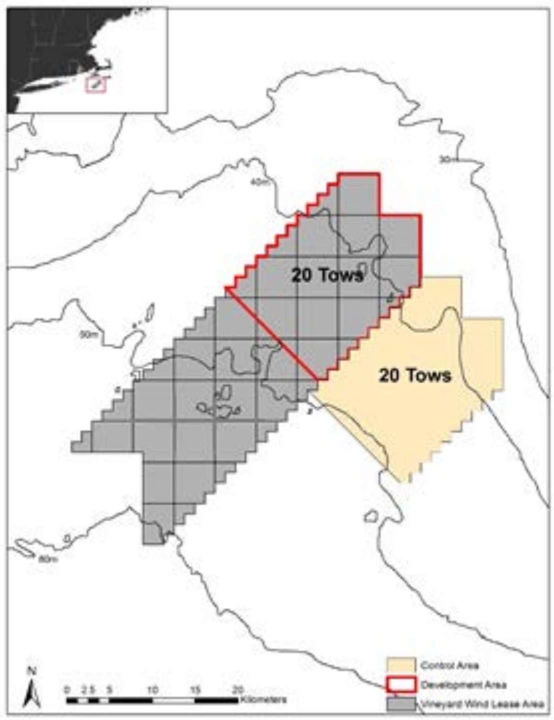

Figure 2. Proposed tow areas for the spring 2019 survey in the Vineyard Wind Development Area (grey with red outline), adjacent control area (yellow), and southern undeveloped area (grey).

***Trawl Design*.** The survey trawl will be a 400 x 12cm, three-bridle four-seam bottom trawl identical to that used in the NEAMAP surveys. The net will include a 12 cm codend with a 2.54 cm (1 inch) knotless liner. This trawl was designed by the Mid-Atlantic and New England Fisheries Management Council's Trawl Advisory Panel. The net design has been accepted by both the scientific community and commercial fishing industry. The net will be paired with a 3" cookie sweep and a set of Thyboron Type IV 66" doors. Prior to the survey the net will be inspected to ensure the construction is within the acceptable tolerance range based on the net certification criteria highlighted in the NEAMAP protocol. Before and after the survey, the mesh size of codend and liner will be measured based on the ICES mesh measurement protocol (Fonteyne, 2005). A commercial fishing vessel (to be determined) will be contracted to conduct the survey. Prior to beginning the survey "test" tows will be conducted to ensure adequate gear performance.

Trawl monitoring. A Simrad PX trawl monitoring system will be used to measure and monitor trawl geometry in real time. Door spread, wing spread, headline height, and bottom contact will be measured for every tow. These data will be used to validate trawl tows against established permissible deviations from targeted geometry. Tows with geometry outside of allowed deviations may be considered invalid. Initially, acceptable trawl parameters will be adopted from the NEAMAP protocol. These values are ±5% of the optimal trawl parameters for wingspread and headline height (as defined by the Trawl Survey Advisory Panel). Additionally, the trawl monitoring system will also log depth and bottom water temperature.

***Catch Sampling*.** The catch from each tow will be sorted by species. Aggregated weight from each species will be weighted on a motion-compensated Marel scale. Individual fish length (to the nearest cm) and weights (to the nearest gram) will be collected. Effort will be made to process all animals, however during large catches sub-sampling will be used for some abundant species. Three sub-sampling strategies may be employed: straight subsampling by weight, mixed subsampling by weight or discard by count. When catch diversity is relatively low (5-10 species), straight sub-sampling will be used. In this method the catch will be sorted by species. An aggregated species weight will be measured then a sub-sample (50-150 individuals) will be selected for individual length and weight measurements. The ratio of the sub-sample weight to the total species weight is used to extrapolate the length-frequency estimates.

When catch diversity is high (10+ species) a mixed-subsampling strategy will be used. With this strategy the catch of some large animals/species may be "pre-sorted" to isolate these species and sub-sample these individual species separately. Subsequently, the unsorted catch which usually contain smaller species will be placed into baskets and an aggregated tow weight will be measured. A sub-sample will be sorted, and the relative proportions will be used to extrapolate the total species weight from the unsorted catch. Individual lengths and weights of species will then be collected.

Lastly, the discard by count method will be used when a large catch of large bodied fish is caught, primarily dogfish and skates in this region. For this method a sub-sample of this species (50-100 individuals) will be collected to calculate a mean weight. The remaining individuals will be counted and discarded. The aggregated weight for the species is the total number multiplied by the average weight.

During individual tows multiple sub-sampling strategies maybe employed. The result from each tow will be a measurement of aggregated weight, length-frequency curves and length-weight curves for each species.

***Analysis*.** This data obtained from this survey will serve as a pre-construction baseline for future environmental assessments of impact using the BACI framework. To assess the species abundance before construction in the both treatment areas average catch per unit effort will be compared for each species. Similarly, estimates of abundance and biomass will be calculated. Swept area estimates (km^2) by the survey net will be derived from the trawl mensuration data and a GPS unit (Equation 1). The density by weight, or individuals, and total abundance and biomass in the study area is calculated using Equations 2, 3, and 4 (Gunderson, 1993; Cadrin et al., 2016). The efficiency of the survey net has not been investigated and is assumed to be 100% within the path of the trawl doors so the estimates represent the minimum biomass and abundance within the study area (i.e., the net has 100% herding and capture efficiency).

Equation 1:

$$Area\ swept\ (km^2) = doorspread\ (km) * tow\ speed\ \left(\frac{km}{hr}\right) * tow\ duration\ (hr)$$

Equation 2:

$$Density\ \left(\frac{individuals\ or\ kg}{km^2}\right) = \frac{catch\ (individuals\ or\ kg)}{area\ swept\ (km^2)}$$

Equation 3:

$$Biomass\ (kg) = \ density\ \left(\frac{kg}{km^2}\right) * size\ of\ survey\ area\ (km^2)$$

Equation 4:

$$Abundance\ (individuals) = \ Density\ \left(\frac{individuals}{km^2}\right) * size\ of\ survey\ area\ (km^2)$$

The length and individual weight data will be used to compare differences in the population structure between the two survey areas and serve as a baseline. Kernel density estimates (KDE's) will initially be used to analyze differences in the population structure of each species between the development and control areas (Sanvicente-Anorve et al. 2003; Langlois et al. 2012). This analysis compares the shape and position of the length frequency curve between the two treatment areas. Additionally, the data will be used to assess the community structure between the two treatment areas. Several ordination methods are commonly used in ecological research for this purpose (Anderson and Willis, 2003). These analyses will be useful to inform the adequacy of the selected control site. Finally, the catch data will be used to update the power analysis to inform future survey effort.

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