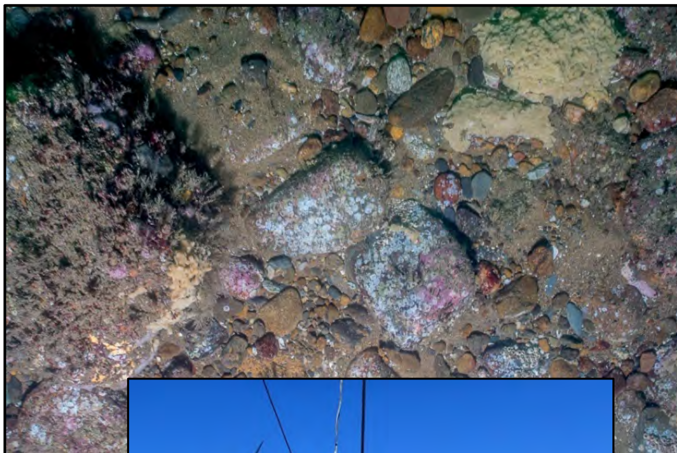
South Fork Wind
Fisheries Research and Monitoring Plan

September 2020



Prepared by:

South Fork Wind | Powered by Ørsted & Eversource

South Fork Wind, LLC

and

INSPIRE ENVIRONMENTAL

INSPIRE Environmental
513 Broadway, Suite 314
Newport, Rhode Island 02840

TABLE OF CONTENTS

Page

LIST OF FIGURES Page

LIST OF ACRONYMS

ACCOL	Anderson Cabot Center for Ocean Life
ASMFC	Atlantic States Marine Fisheries Commission
BACI	Before-After-Control-Impact
BAG	Before-After-Gradient
BIWF	Block Island Wind Farm
BOEM	Bureau of Ocean Energy Management
CMECS	Coastal and Marine Ecological Classification Standard
COP	Construction and Operation Plan
CPUE	Catch per unit effort
DSLR	Digital single-lens reflex
EFH	Essential Fish Habitat
EFP	Exempted Fishing Permit
ESA	Endangered Species Act
FGDC	Federal Geographic Data Committee
GPS	Global Positioning System
HMS	Highly migratory species
INSPIRE	INSPIRE Environmental, LLC
LOA	Letter of Acknowledgement
LPIL	Lowest possible identification level
MADMF	Massachusetts Division of Marine Fisheries
MARACOOS	Mid-Atlantic Regional Association Coastal Ocean Observing System
MMPA	Marine Mammal Protection Act
NERACOOS	Northeastern Regional Association of Coastal Ocean Observing Systems
NEAMAP	Northeast Area Monitoring and Assessment Program
NEFSC	Northeast Fisheries Science Center
NOAA	National Oceanic and Atmospheric Administration
NYSERDA	The New York State Energy Research and Development Authority
OCS	Outer Continental Shelf
PV	Plan View
RICRM	Rhode Island Coastal Resources Management
RIDEM	Rhode Island Department of Environmental Management
SFEC	South Fork Export Cable

SFW	South Fork Wind
SFWF	South Fork Wind Farm
SMAST	School for Marine Science & Technology
SNECVTS	Southern New England Cooperative Ventless Trap Survey
SPI	Sediment Profile Imaging
WEA	Wind Energy Areas

1.0 Introduction

This Fisheries Research and Monitoring Plan (the plan) has been developed for the South Fork Wind Farm (SFWF or Project), which is proposed to be located in Bureau of Ocean Energy Management (BOEM) Lease Area OCS A-0517, which is within the Rhode Island – Massachusetts Wind Energy Area (RI-MA WEA) (Figure 1). [1] SFWF includes up to 15 wind turbine generators (WTGs or turbines) with a nameplate capacity of 6 to 12 MW per turbine, submarine cables between the WTGs (Inter-array Cables), and an offshore substation (OSS), all of which will be located approximately 19 miles (30.6 kilometers [km], 16.6 nautical miles [nm]) southeast of Block Island, Rhode Island, and 35 miles (56.3 km, 30.4 nm) east of Montauk Point, New York.

1.1 Monitoring Plan Development

This monitoring plan has been developed in accordance with recommendations made by BOEM's "Guidelines for Providing Information on Fisheries for Renewable Energy Development on the Atlantic Outer Continental Shelf" (BOEM, 2013; BOEM, 2019) and by state agencies (RICRMC, 2018; NYSERDA, 2017; MADMF, 2018). In addition, as described in detail below and in Appendix A attached hereto, this plan was refined and expanded through an iterative process that considered feedback from agencies and stakeholder groups.

By way of background, in 2017, the South Fork Wind (SFW) team began meeting with regional fishing organizations, working groups, and individual fisherman to gather information on the fisheries in the SFWF area. Through the permitting and development process, the SFW team also consulted with several states (e.g., NY, CT, RI, and MA) and federal fisheries resource management agencies (BOEM, NOAA) about the fisheries in the SFWF area. With the information collected during these interactions, the SFW team prepared an initial version of the fisheries monitoring plan that contained a gillnet survey because gillnet gear was identified as the primary gear used by commercial fisheries in and around the proposed SFWF area, and because sampling in SFWF with an otter trawl was not a viable monitoring option. *See* Section 2.0 for details on the gillnet survey.[2]

The initial version of the plan was widely circulated for comment in November 2018 to state and federal agencies, regional working groups, advisory boards, research institutions, fishing groups, and other stakeholders. These entities and groups provided the SFW team with numerous comments that it took under consideration as it developed the next draft of the plan. *See* Appendix A.[3] While set forth in more detail in Appendix A, some of the key comments during this time period were: need for a power analysis to determine level of sampling; seasonal sampling intensity needed to increase; more specific information was needed on the sampling gear to be

[1] South Fork Wind, LLC, now a wholly-owned indirect subsidiary of North East Offshore, LLC, a joint venture between Ørsted and Eversource , submitted the major federal permit application, The South Fork Wind Farm Construction and Operations Plan (COP), to BOEM in June, 2018 and submitted a revised COP to BOEM in May, 2019.
The full revised COP document can be found online at: https://www.boem.gov/South-Fork/
[2] References to sections contained herein are to show that additions to the plan were made based on comments that the SFW team received.
[3] Please *see* Appendix A, which presents a summary of key comments received in writing and verbally on the various drafts of the plan. In addition, all written comments received are attached as exhibits to Appendix A.

used; and that a gillnet survey alone was not enough to effectively sample the area. *See* Appendix A for more details.

The SWF team then sought additional feedback on the plan during two webinars in March 2019 with state and federal agencies. Comments from those webinars informed the team about additional gear types that could be used for fisheries monitoring. *See* Appendix A. As a result of the feedback from the webinars and previous comments, a second draft of the fisheries monitoring plan was circulated to agencies and stakeholders for review in June 2019. This draft included the addition of a beam trawl survey protocol. *See* Section 3.0 herein. Also, modifications to the gillnet protocol were made based on comments received previously and additional feedback from industry members. *See* Appendix A. These modifications included adjustments to the sampling schedule and soak time of the survey and the decision to use a single mesh size and tie-downs to address questions about potential interactions with protected species. These changes to the sampling gear also mimic the practices of the commercial fishery and will allow comparability with commercial catch data. *See* Section 2.3 herein. More specific details regarding the sampling gear were also added to the plan. *See* Sections 2.1 and 2.2 herein.

Development of the plan continued through the summer of 2019 incorporating more comments and feedback on the second version of the plan. These comments included the necessity of sharing monitoring data with scientists in the region, feedback that additional gear types should be used for monitoring beyond the gillnet and beam trawl, and the location of the Reference Areas. *See* Appendix A. In September 2019, the SFW team attended two meetings of the Rhode Island Coastal Management Council's (RICRMC) Fishermen's Advisory Board (FAB) to discuss the fisheries monitoring plan. The FAB commented on the proximity of proposed Reference Areas to the SFWF development area as well as the Reference Areas being within areas identified for future development. The FAB also reiterated previously received comments on the need to conduct a power analysis to determine the level of sampling for each survey type. *See* Appendix A.

During the fall of 2019, the SFW team undertook extensive efforts to determine different Reference Area locations that were situated away from any potential impacts from development but were still of comparable depth and habitat as the impact area. *See* Section 2.2 herein. In addition, a power analysis was conducted for the beam trawl survey. *See* Appendix B herein. A power analysis was attempted for the gillnet survey. Comparable fishery-independent datasets for the region, however, are lacking for gillnet gear and the little data that were available did not adequately inform the power analysis to determine a proper level of sampling.

Continuing with the solicitation of feedback, SFW had productive in-person meetings in October and November of 2019 with scientists at Rhode Island Department of Environmental Management (RIDEM) and the Massachusetts Division of Marine Fisheries (MADMF) to review the new Reference Areas and the beam trawl power analysis. The comments received during these meetings are in Appendix A, and both agencies responded positively to the power analysis and new Reference Areas. *See* Appendix A. Meetings with individual fishermen also were conducted to gather additional feedback on the adequacy of the Reference Areas. Through these meetings, a consensus emerged that the new Reference Areas had similar bathymetry, benthic habitats, and species assemblages as the SFWF area. *See* Appendix A. Given the lack of data for a gillnet power analysis, discussions led to the decision to use an adaptive sampling approach whereby a power analysis would be performed after the first year of the survey to determine if the level of sampling would need to be adjusted in subsequent years. *See* Section 2.7 herein. These decisions on the Reference Areas and power analysis were provided to the FAB in late 2019 and added to the evolving plan. *See* Appendix A.

In February 2020, the SFW team attended another FAB meeting to discuss the amendments to the second version of the plan made in late 2019. The FAB stated that the two survey designs contained in the plan (gillnet and beam trawl) would not adequately sample the entire species assemblage at the SFWF site and suggested a one day workshop with the SFW team, state and federal agency scientists, area researchers, and industry members to outline a complete monitoring plan and discuss additional sampling gears. The Commercial Fisheries Research Foundation (CFRF) hosted the workshop and facilitated its development. *See* Appendix A. The workshop was conducted in March 2020 with the SFW team, individuals from the RI CRMC, FAB, RIDEM, NOAA, and several local industry members. *See* Appendix A. Species to be monitored and additional gear types were reviewed and discussed for potential addition to the plan. As a result of this meeting, ventless lobster trap, ventless fish pot, and benthic survey protocols were all added to the new version of the plan, which was distributed in May 2020. *See* Sections 4.0, 5,0 and 7.0 herein. Additionally, the SFW team has pledged to provide financial support for two projects being conducted by area researchers that use acoustic telemetry to monitor Atlantic cod and Highly Migratory Species (HMS) in and around SFWF and surrounding wind energy areas (WEAs). *See* Section 6.0 herein.

Following the release of the revised plan in May 2020, the SFW team hosted an inter-agency webinar on May 22nd. Following the webinar, NOAA, MADMF, NYDEC, and RIDEM provided additional feedback on the monitoring plan. The major feedback received included the need for a power analysis for the ventless trap monitoring plan, the need for a data sharing plan, consideration of spatial and temporal overlap between high-resolution geophysical surveys and fisheries monitoring, and the desire to see more details regarding the adaptive sampling strategy that was proposed. In response to these comments, substantial revisions were made to the monitoring plan. Appendix C was added to the plan, which describes the High-Resolution Geophysical survey equipment that may be used at SFWF, and describes how the operational frequency of that equipment compares to the auditory abilities of fish in the region. A data sharing plan was also added to the Plan (*see* Section 8.0), and a power analysis was completed for the ventless trap survey (*see* Appendix D). Finally, the plan was revised to better describe the specifics associated with the adaptive sampling approach (*see* Sections 2.7, 3.7 and 5.7). Further details are also provided in Appendix A.[4]

[4] As stated above, for more detailed information on the timeline and development of this plan, please also refer to Appendix A.

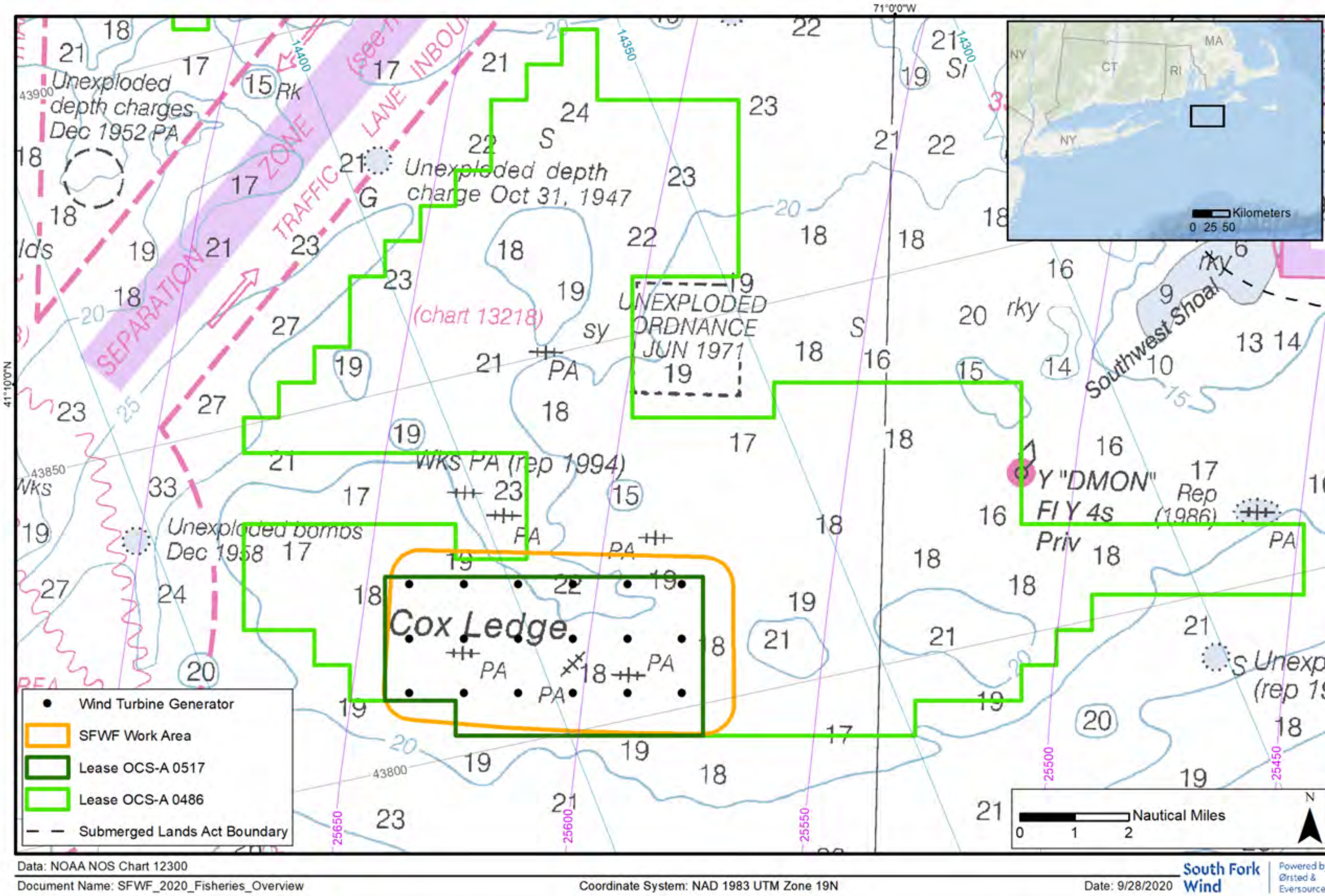


Figure 1. **Location of South Fork Wind Farm**

1.2 Overview of Fisheries Monitoring for South Fork Wind

SFW is committed to conducting sound, credible science. Biological surveys, developed in coordination with the commercial fishing fleet and state agencies, were conducted at the Block Island Wind Farm (BIWF) from 2012 through 2019. The guiding scientific principles implemented beginning with the BIWF and continuing into the future include:

- Producing transparent, unbiased, and clear results from all research;
- Working with commercial and recreational fishermen to identify areas important to them;
- Collecting long-term data sets to determine trends and develop knowledge;
- Promoting the smart growth of the American offshore wind industry;
- Focusing on maintaining access and navigation in, and around, our wind farms for all ocean users;
- Completing scientific research collaboratively with the fishing community;
- Being accessible and available to the fishing industry;
- Utilizing standardized monitoring protocols when possible and building on and supporting existing fisheries research;
- Sharing data with all stakeholder groups; and
- Maintaining data confidentiality for sensitive fisheries dependent monitoring data

The SFWF site is situated atop Cox Ledge, an area with complex bathymetry including extensive areas of boulders and mobile gear "hangs", making it difficult to safely operate large mobile gear (e.g., bottom trawl) in this area. Therefore, the SFWF site is not sampled routinely by the Northeast Fisheries Science Center (NEFSC) bottom trawl survey. Feedback from commercial fishermen, and an analysis of vessel Monitoring System (VMS) data indicate there is little commercial trawl effort in the area. Details of the SFWF fisheries data assessment and early stakeholder feedback can be found in the SFWF COP Appendix Y - *Commercial and Recreational Fisheries Technical Report* (Jacobs, 2018).[5]

The BOEM fishery guidelines recommend that trawl surveys be executed using a stratified random design. However, because of the complex bathymetry throughout the area, it is unlikely that a trawl survey can be safely conducted within the SFWF site using a scientific design with random site selection. Therefore, SFW has evaluated alternative survey designs and monitoring tools that can be used to collect pre-construction data for a wide range of taxa in the SFWF site. With this consideration in mind, the monitoring plan began with an emphasis on using gillnets as a monitoring tool. Over time, the plan evolved to incorporate additional survey techniques that could be executed safely within the SFWF area including a beam trawl, fish pots, ventless traps, and optical approaches to benthic monitoring. Through extensive outreach efforts with the fishing community, feedback from state and federal agencies (outlined in Section 1.1), and exploration of existing datasets (Jacobs, 2018), the SFW team has developed survey designs using multiple sampling gears to acquire pre-construction data on the abundance, biomass, demographics (e.g., length, fish condition, shell disease status), and species composition that occur in and around the SFWF site. In particular, the surveys have been designed to utilize sampling gear that can be fished safely and effectively, and with limited impact, on the complex, rocky habitat within the SFWF site (Thomsen et al., 2010; Malek, 2015).

[5] Appendix Y can be found online at: https://www.boem.gov/Appendix-Y/

Different gear types select for different fish and macro-invertebrate species, therefore, using multiple gear types to sample distinct species assemblages is needed for assessing potential impacts from SFWF (Walsh and Guida, 2017). Consistent survey methods and approaches will allow for data comparisons across studies, collaboration among developers and institutions, and an ability to address questions at appropriate spatial and temporal scales. Several gear types will be used to monitor a large portion of the species assemblage present in and around SFWF. However, it is acknowledged that the monitoring tools proposed herein may not sample for all of the species present within SFWF, particularly some of the smaller pelagic fauna (e.g., Atlantic herring, squid, and butterfish) that are too small to be retained in the gillnet gear, and are unlikely to be captured in substantial quantities by the beam trawls or fish pots. Some sampling will occur seasonally, while other sampling efforts will occur throughout the year (Figure 2). The proposed survey designs in this plan are not exhaustive but will form a basis for fisheries monitoring in the SFWF site. In particular, it is noted that additional fisheries monitoring will be performed along the route of the South Fork Export Cable (SFEC). Those studies are currently being planned in collaboration with local academic researchers and Subject Matter Experts. However, the details and methodologies associated with that monitoring effort are not included in this Plan.

For the gillnet survey, beam trawl survey, ventless trap survey and the fish pot survey, the overarching objective is to determine whether the construction and operation of the wind farm leads to changes in the relative abundance of fish and invertebrate species in the Project Area. The potential impacts associated with the construction and operation of an offshore wind farm have been described in various papers (e.g., Petersen and Malm, 2009; Gill et al., 2012), and it is recognized that several impacts may occur simultaneously (Bergstrom et al., (2013). Therefore, we will evaluate the relative abundance and distribution of fish and invertebrate resources around a wind farm after construction, as compared to abundance and distribution in Reference Areas, and in the Project Area prior to construction (Bergstrom et al., 2013). Our monitoring will be executed with an emphasis on detecting changes in relative abundance, rather than attempting to assess the ecological response to a single impact associated with the construction of an offshore wind farm.

Figure 2. Generic survey timeline for SFWF monitoring

These surveys will provide data that can be used to evaluate:

- Commercially and recreationally important species that utilize the area in and around the SFWF site.
- The seasonal timing of the occurrence of these species.
- Whether the taxonomic composition or relative abundance of fish and invertebrate assemblages change between the pre-construction and post-construction time periods.

The survey protocols have been designed to address requirements and guidelines outlined in the Federal Register (30 CFR 585.626), BOEM fishery guidelines, and RICRMC policies (11.10.9 C).

SFW issued a 'Request for Proposals' on May 5th, 2020 to local Universities and research institutions to execute fisheries monitoring elements of the monitoring plan. The proposals were reviewed in late May and early June, and our scientific research partners were selected in late June 2020. Commercial Fisheries Research Foundation (CFRF) was awarded the contract and will be responsible for executing the gillnet, beam trawl, fish pot, and ventless trap surveys. CFRF will partner with the University of Rhode Island (Dr. Jeremy Collie) to carry out the beam trawl and ventless trap surveys. These scientific researchers have worked collaboratively with SFW to make additional amendments and improvements to the methodologies in the fisheries monitoring plan. It was initially envisioned that field work for these components of the pre-construction monitoring would begin by early fall 2020. However, the start dates for the surveys have been delayed by several factors, including logistical difficulties associated with Covid-19 and delays in the receipt of the scientific research permits that are needed to conduct the monitoring. It is anticipated that the beam trawl monitoring will begin in October, 2020, while the other fisheries surveys (gillnets, ventless traps, and fish pots) will not commence until the Spring of 2021.

Similar to the principles and practices executed for the Block Island Wind Farm, SFW is committed to conducting scientific surveys and assessments that are collaborative with the fishing industry. The scientific contractors selected to perform the monitoring have identified eight local fishing vessels from which these monitoring surveys will be conducted.

2.0 Demersal Fisheries Resources Survey - Gillnet

Gillnet selectivity depends mainly on fish size and shape and mesh size, but is also affected by the thickness, material, and color of net twine, hanging of net, and method of fishing (Hamley, 1975). Using specific gear placements and prescribed mesh sizes, gillnets may be designed to target specific species, or subgroupings of species, and life stages. Southern New England waters are host to an active gillnet fishery that primarily targets monkfish and winter skate. The proposed gillnet survey will focus on monitoring these two species, pre- and post-construction of SFWF, using large-mesh gillnet gear that is designed to effectively target these species.

The objective of the pre-construction monitoring survey is to collect data on the distribution, abundance and composition of demersal fish species in the area of potential affect and in the Reference Areas. The objective of post-construction monitoring is to identify any changes in the fish community in the Project Area between pre- and post- construction that did not also occur at the Reference Areas that could be attributed to either construction or operation of the wind turbines.

At least two years of sampling (*see* Section 2.2. for details) will be conducted prior to the commencement of offshore construction. Similarly, a minimum of two years of monitoring will be completed following offshore construction, but the duration of post-construction monitoring will also be informed by ongoing guidance for offshore wind monitoring that is being developed cooperatively through the Responsible Offshore Science Alliance (ROSA).

2.1 Survey Methods

The survey will be conducted from commercial fishing vessels with scientists onboard to process the catch. For-hire vessels will be selected based on criteria such as experience, safety record, knowledge of the area, and cost. The scientific contractor has applied for an Exempted Fishing Permit (EFP) from the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) in order to use the hired fishing vessels as a scientific platform and conduct scientific sampling that is not subject to the Atlantic Coastal Fisheries Cooperative Management Act, Magnuson-Stevens Fishery Conservation and Management Act, and fishery regulations in 50 CFR parts 648 and 697. All survey activities will be subject to rules and regulations outlined under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA). Marine mammal deterrent devices will be used on all gillnet gear as required under regulation. All gear restrictions, closures, and other regulations set forth by take reduction plans (e.g., Harbor Porpoise Take Reduction Plan, Atlantic Large Whale Reduction Plan, etc.) will be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury.

The requirements described in the Atlantic Large Whale Take Reduction Plan (NOAA, 2018a) for the Northeast gillnet fishery will be followed. At a minimum, the following measures will be used to avoid interactions between the gillnet survey and marine mammals, but additional modifications to the survey gear can be made at the discretion of NOAA:

- No buoy line will be floating at the surface.
- There will not be wet storage of the gear. All sampling gear will be hauled at least once every 30 days, and all gear will be removed from the water at the end of each sampling season.
- All groundlines will be constructed of sinking line.
- Fishermen contracted to perform the field work will be encouraged to use knot-free buoy lines.
- All buoy line will use weak links that are chosen from the list of NMFS approved gear.
- All gillnet strings will be anchored with a Danforth-style anchor with a minimum holding strength of 22 pounds.
- All buoys will be labeled as research gear, and the scientific permit number will be written on the buoy. All markings on the buoys and buoy lines will be compliant with the regulations, and instructions received from staff at the Protected Resources Division.
- Further modifications to the sampling gear can be made at the discretion of the Greater Atlantic Regional Fisheries Office.

2.2 Proposed Sampling Stations

An asymmetrical Before-After-Control-Impact (BACI) design is proposed with three sampling areas: a Project Area within the SFWF "Work Area" and two Reference Areas. The SFWF "Project Area" is defined as the maximum work area required to install the SFWF (yellow outline in Figure 3 below). This includes the maximum spatial extent where vessels or lift barges may anchor during construction around the wind turbines and foundations. Data will be collected in the Project Area (the blue square in Figure 3) and two Reference Areas with similar habitat characteristics as the Project Area. The Reference Areas will serve as an index of demersal fish abundance in Rhode Island Sound in an area outside of the direct influence of SFWF and other planned offshore wind farm development sites in the region. Concurrent sampling in the Project Area and the two Reference Areas will identify whether changes in the relative abundance and demographics of monkfish, winter skate, and other species observed within the Project Area are consistent with regional trends rather than representing a localized impact in the vicinity of SFWF. Several sources of information were used to determine the initial location of the Reference Areas. Bathymetry data was obtained from the Northwest Marine Ecoregional Assessment and the NOAA online bathymetric data viewer (https://maps.ngdc.noaa.gov/viewers/bathymetry/). Spatial information on fishing activity, including VTR data for the gillnet fishery and VMS data for the monkfish fishery was from the Northeast Ocean Data Portal was utilized, along with personal communication with local fishermen. Beam trawl data from Malek (2015) was also considered, and the SFW team sought feedback on the reference locations from staff at Rhode Island Department of Environmental Management and Massachusetts Division of Marine Fisheries.

Following feedback received in July 2020 from gillnet fishermen that are participating in the SFWF fisheries monitoring, the eastern Reference Area that was initially selected was moved to the south (Figure 3). The participating fishermen explained that moving the eastern Reference Area to the south would improve sampling of monkfish during their fall migration. The fishermen also expressed concerned that the eastern Reference Area that was initially selected would provide operational challenges, because of the large amount of macroalgae that is flushed out of Vineyard Sound every fall. The fishermen were concerned that this macroalgae would consistently foul the gillnets and prevent the gear from sampling in a representative manner.

The study design consists of sampling each of the treatment areas with gillnet strings. The proposed sampling areas were selected in consultation with regional stakeholders to ensure that:

1. There is comparability among all sampling areas with respect to current, habitat and depth conditions;
2. The Reference Areas are outside the area of influence from SFWF and other projects that may be constructed during the survey, but are still utilized by the same/similar fish populations;
3. Areas allow optimal operational execution of the survey (e.g., safe operation of the sampling gear, minimal travel times between sampling locations, habitats are suitable for the sampling gear); and
4. Space conflicts are minimized with other active uses to the extent practicable.

As mentioned above, several factors were taken in account when considering the location of the Reference Areas. One important consideration is that the Reference Areas must be located in an area that will not be developed in the future, which is especially pertinent in this case given that SFWF is adjacent to the larger Revolution Wind lease area. The submarine power cables (inter-array and export cables) will emit electric and magnetic fields (EMF) while the wind farm is operational. These impacts will persist over a relatively long temporal scale while the wind farm is operational, but the EMF decays very quickly with distance from the cable and is anticipated to have a negligible impact on fish species (Snyder et al., 2019). Therefore, EMF from the project will not affect the Reference Areas. Conversely, noise from offshore construction and High-Resolution Geophysical (HRG) surveys are a transient impact that occurs across a relatively large spatial scale. While the hearing capabilities of fish depend upon their physiology (Popper et al., 2014; Appendix C), the current guidelines are applied to all species of fish equally and use 150 dβ re 1 μPa as the behavioral threshold (Stadler and Woodbury, 2009). A paucity of experimental data has precluded the establishment of behavioral thresholds for invertebrates (Stadler and Woodbury, 2009). The sound levels associated with foundation installation will depend on several factors; including but not limited to the diameter of the pile, the type of hammer used, the hammer energy, the temperature of the water, and the noise attenuation techniques that are used. Therefore, the Reference Areas are well outside of the direct influence of the proposed activities, with the possible exception of pile-driving noise, which may have the potential to affect fish behavior at the Reference Areas during a brief time period when the foundations are being installed.

Within each area, fishable gillnet lines will be determined through consultation with the participating fishermen and an examination of geophysical survey data. Five gillnet lines per area will be randomly selected for each sampling event, resulting in 15 gillnet strings conducted per sampling event. The five gillnet strings per area are subsamples and catches will be averaged to estimate the CPUE per area per sampling event, which will be used in analyses. This sample size was chosen to minimize sampling error for the mean within each area, while considering practical constraints, such as the need to reduce the potential for interactions with protected species, and also avoid gear conflicts with active fisheries that occur in the Project Area and the Reference Areas. The location of gillnets may be subject to change due to seasonal location of other fixed fishing gear (e.g., lobster pots). If a survey line is found to have poor conditions for setting gillnets it may be moved based on the captain's professional judgement. Sample sizes and sampling strategies may be subsequently modified following data evaluation from the data collected through 2021, including the results of a mid-study power analysis using observed estimates of variance (Section 2.7), however the overall survey design will remain unchanged.

Gillnet sampling will occur each spring and fall, as the gillnets will be sampled twice per month from April-June and again from October-December, which coincides with the majority of commercial gillnet activity as monkfish and skates migrate through the area in spring and fall. The pre-construction monitoring is expected to begin in April 2021 and will continue through December 2022. Sampling in July-September will not occur in order to minimize interactions with protected species (e.g., large whales, sea turtles) and to reduce the likelihood of gear damage that can occur during the seasonal migration of spiny dogfish and larger shark species through the area. Based on feedback from local fishermen, efforts will be made to maintain spatial separation between the gillnet and ventless trap survey gears. Fishermen have expressed concern that dead fish in the gillnets may attract lobster away from the survey traps. Therefore, efforts will be made to avoid setting the survey gillnets near the survey lobster traps, during the months that those surveys are both occurring (May, June, October, and November).

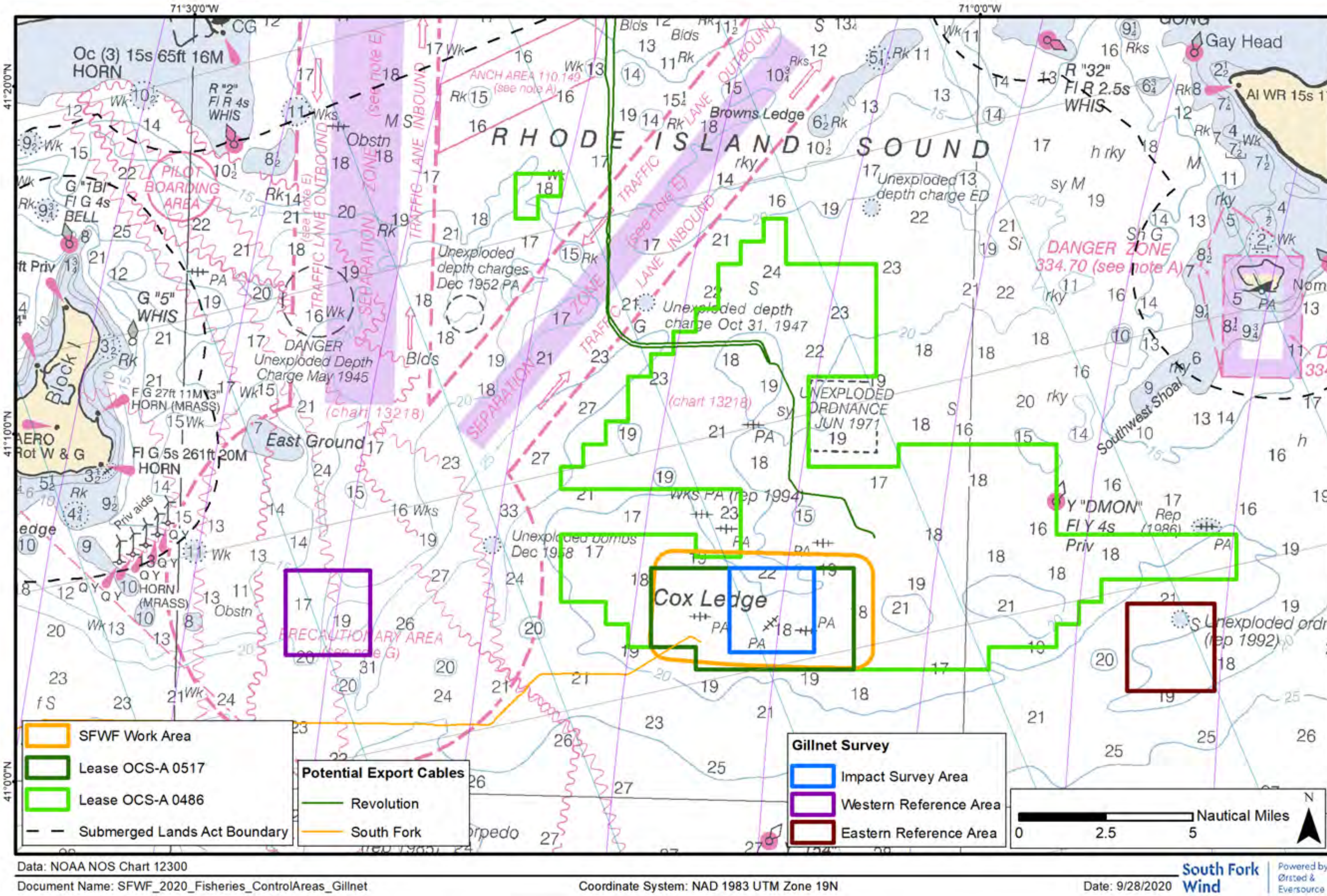


Figure 3. **Northeast lease areas including the South Fork Wind Farm with Gillnet Survey Areas.**

2.3 Gillnet Methods

A gillnet is a wall of netting that hangs in the water column and is typically made of monofilament or multifilament nylon. Mesh sizes are designed to allow fish to get only their head through the netting, but not their body. The fish's gills then get caught in the mesh as the fish tries to back out of the net. Factors that can influence the catch rate of gillnets for target species include: fish density in the vicinity of gears, the behavior of the target species, the ability of fish to detect and locate the gillnet, and environmental factors such as water temperature, visibility, current direction, and velocity. This survey will use standardized fishing gear and sampling strategies across time and space to standardize catch rates to the extent possible. However, comparison of this gillnet survey data to other pre-construction fishery independent sampling efforts (e.g., nearby federal Northeast Area Monitoring and Assessment Program [NEAMAP]and NEFSC bottom trawl survey stations) may be limited due to the differences in the selectivity and catch rates of the disparate gear types.

The gillnet survey may be conducted using gillnets that are typical of the commercial fishery in Rhode Island and Massachusetts. Each gillnet string will consist of six, 300-ft net panels of 12-inch mesh with a hanging ratio of 1/2 (50%) and using net tie-downs. After much deliberation and discussion with stakeholders, a decision was made to limit the gillnet survey to a single mesh size of 12-inches to target monkfish and skates of commercial sizes. While it was recognized that deploying experimental gillnets with multiple mesh sizes could potentially sample a wider range of species and size classes, this would also necessitate deploying more strings of gillnets, which may have increased the potential for protected species interactions. Further, given the small spatial extent of the Project Area, we were concerned that deploying additional gillnet strings would lead to increases in gear interactions with other user groups in the area. Therefore, the decision was made to utilize a single mesh size of 12-inches, with the primary objective to monitor changes in the relative abundance of monkfish and winter skate in the Project Area and the Reference Areas.

The standard soak time of approximately 48 hours is proposed after input from industry, to maximize catch and standardize catch rates, while also ensuring the gear fishes properly during the soak (i.e., not collapsed from saturation), to minimize depredation of catch, and to improve the logistics of the survey. Soak time will remain consistent throughout the duration of the survey, to the extent practicable. Each sampling event will be managed by a team of qualified scientists including a lead scientist with experience performing fisheries research. The catch will be removed from the gillnets by the boat crew for processing. The lead scientist will be responsible for collection of data and data recording.

Fish collected in each gillnet will be identified, weighed, and enumerated consistent with the sampling approach of NEAMAP. When large catches occur, sub-sampling may be used to process the catch, at the discretion of the lead scientist. The three sub-sampling strategies that may be employed are adapted from the NEAMAP survey protocols and include straight subsampling by weight, mixed subsampling by weight, and discard by count sampling (Bonzek et al., 2008). The type of sub-sampling strategy that is employed will be dependent upon the volume and species diversity of the catch. Scientists will sort and identify fish, and weigh each species by the following protocol:

All organisms will be identified to species. Taxonomic guides include *NOAA's Guide to Some Trawl-Caught Marine Fishes* (Flescher, 1980), *Bigelow and Schroeder's Fishes of the Gulf of Maine* (Collette and Klein-MacPhee, 2002), Kells and Carpenter's (2011) *Field Guide to Coastal Fishes from Maine to Texas*, and *Peterson's Field Guide to the Atlantic Seashore* (Gosner, 1999).

The catch will be sorted by species, and size categories (if appropriate) until the lead scientist verifies that the sorting areas are clear of all specimens. The following information will be collected for each gillnet string that is sampled; abundance and biomass for each species that is captured and length and weight measurements for individual fish belonging to the dominant species and vulnerable (e.g., Atlantic sturgeon) species present in the catch. Notwithstanding sub-sampling procedures, up to 50 individuals of each species/size class will be measured (+/- 0.5 cm) from each gillnet string that is sampled, and the rest counted. A subsample of these individuals will also be weighed (+/- 0.5 g) on a motion compensating marine scale, to evaluate individual fish condition. Individual lengths and weights are recorded on the field data sheet. Fork length is recorded for all fishes with a forked tail. Total length is measured for all other fishes with the exceptions of the following measurements for particular species: rays (disc width), sharks (straight-line fork length), dogfish (stretched total length), crabs (carapace width), lobsters (carapace length), and squids (mantle length). The catch from the gillnet survey will not be retained for sale by the participating vessels, and all animals will be returned to the water as quickly as possible once the sampling is completed.

Stomach content analysis will be performed for commercially important focal species (monkfish, winter skate, gadids, black sea bass) to determine the composition of their prey, and evaluate whether prey composition changes prior to and after construction. Up to 10 animals will be sacrificed for stomach content analyses from each string that is sampled, with no more than 5 individuals of any one species sampled from each string. Each fish sampled for stomach content analysis will be measured (+/- 0.5 cm) and weighed (+/- 0.5 g) individually before the stomach is removed to permit assessment of relative condition. All prey items will be identified to the lowest possible identification level (LPIL), counted, and weighed.

Atlantic cod are known to spawn on or near Cox Ledge (Zemeckis et al., 2014; Cadrin et al., 2020). Sex and reproductive stage will be assessed for the cod sacrificed for stomach sampling according to the protocols used for the 2018 and 2019 SFWF Atlantic Cod Spawning Survey (adapted from Burnett et al. [1989] and O'Brien et al. [1993]). Up to five cod may be sampled per string for sex and maturity and stomach contents. Maturity data from this sampling may be shared with local researchers to better understand the timing and distribution of cod spawning activity in Southern New England.

Should any interactions with protected species (e.g., marine mammals, sea birds, sea turtles) occur, the contracted scientists will follow the sampling protocols described for At-Sea Monitors (ASM) in the Observer On-Deck Reference Guide (Northeast Fisheries Science Center, 2016). Protected species interactions will be reported immediately to NOAA's stranding hotline via telephone (866-755-NOAA) or via the Whale Alert APP, and a follow up detailed written report will be provided to NMFS Greater Atlantic Regional Fisheries Office (incidental.take@noaa.gov) within 24 hours that includes the following information; date, time, area, gear, species, and animal condition and activity. The following protocol will also be followed:

- If a marine mammal take occurs, the entire animal will be retained as time and space allow. However, if there is insufficient space on board the vessel, the minimum sampling requirements described for at-sea monitors will be met.

- If any interactions with Atlantic sturgeon or shortnose sturgeon occur, the contracted scientists will follow the sampling protocols described for the Northeast Fisheries Observer Program (NEFOP) in the Observer On-Deck Reference Guide (Northeast Fisheries Science Center, 2016), which includes collecting a genetic sample and scanning the animal for a PIT tag. Interactions with sturgeon will be reported immediately to NOAA's stranding hotline via telephone (866-755-NOAA) or via the Whale Alert APP, and a follow up detailed written report will be provided to NMFS Greater Atlantic Regional Fisheries Office within 24 hours.

- If an Atlantic sturgeon or shortnose sturgeon carcass is retained, we will contact Fred Wenzel at the Northeast Fisheries Science Center. Any biological data collected during sampling of protected species will be shared as part of the written report that is submitted to the NMFS Greater Atlantic Regional Fisheries Office.
- Sightings of right whales, and observations of dead marine mammals and sea turtles in the water will be reported immediately to NOAA's stranding hotline via telephone (866-755-NOAA) or via the Whale Alert APP and a follow up detailed written report will be provided to NMFS Greater Atlantic Regional Fisheries Office within 48 hours.
- Sea birds will be sampled following the protocols outlined by the Northeast Fisheries Science Center (2016) and if a dead seabird is encountered, any 'dead, fresh' animals will be retained and provided to the US Fish and Wildlife Service for additional sampling.
- Due to the potential for communicable diseases all physical sampling and handling of marine mammals and seabirds will be limited to the extent Ørsted health and safety assessments and plans allow.

2.4 Environmental Data

Hydrographic data will be collected at each gillnet sampling location. A Conductivity Temperature Depth (CTD) sensor will be used to sample a vertical profile of the water column at each gillnet sampling location, following the methods used by the CFRF/WHOI Shelf Research Fleet (Gawarkiewicz and Malek Mercer, 2019). The CTD profile may be collected prior to the string being hauled, or after the string has been hauled, at the discretion of the chief scientist. Bottom water temperature (degrees C) will be recorded at regular intervals (e.g., every 30 seconds) throughout the duration of each gillnet set using a temperature logger mounted on the first panel in each string. Sea state and weather conditions are recorded from visual observations. Air temperature may be downloaded from a local weather station if not available onboard.

2.5 Gillnet Station Data

The following data will be collected during each sampling effort:

- Station number;
- Latitude and longitude;
- Soak start and end time and date;
- Water depth;
- Wind speed;
- Wind direction;
- Wave height;
- Air temperature ; and
- Vertical CTD profile, and continuous observations of bottom temperature while the gear is fishing (*See* Section 2.4).

2.6 Data Entry and Reporting

Data will be transcribed from hard copy datasheets into electronic worksheets. The data sheets will be reviewed for data entry errors prior to importing into a relational database. Quality control checks will be performed on database tables by running standardized, systematic queries to identify anomalous data values and input errors. Species names (common and scientific) will be verified and tabulated for consistency. All data used in analysis will be exported from the relational database.

Annual reports containing catch data will be prepared after the conclusion of each year of sampling and shared with State and Federal resource agencies. One final report will also be produced synthesizing the findings of the pre- and post-construction evaluations.

2.7 Data Analysis

The study will use an asymmetrical BACI experimental design, with statistical evaluation of the differences between reference and Project Areas contrasted in the before and after construction time periods (Underwood, 1994; Smith, 2002). A BACI design will allow for assessment of shifts in fish presence/absence, or relative abundance that correlate with proposed construction and operations at the SFWF site.

Results presented in annual reports will focus on comparing the fish communities in the Project and the Reference Areas to describe spatial and seasonal differences in relative abundance, species composition, and size distribution. For the dominant species in the catch, seasonal catch per unit effort (CPUE) will be compared among the three areas using graphics and descriptive statistics (e.g., mean and variance) and length frequency data by species will be compared among areas using descriptive statistics, graphical techniques (empirical cumulative distribution function [ECDF] plots), and appropriate statistical tests (e.g., the Kolmogorov-Smirnoff test). Species composition will be compared amongst the Project and Reference Areas using a Bray-Curtis Index and multivariate techniques (e.g., nMDS and ANOSIM).

Analysis presented in the final synthesis report will focus on identifying changes in the fish community in the Project Area between pre- and post- construction that did not also occur at the Reference Areas that could be attributed to either construction or operation of the wind turbines (Table 1). With regard to measuring for changes in relative abundance, the research question is to estimate the magnitude of the difference in the temporal changes in relative abundance for winter skate and monkfish observed between the Project and Reference Areas. The null hypothesis is that changes in CPUE (relative abundance) for monkfish and winter skate in both the Reference and Impact Areas will be statistically indistinguishable over time. The alternative hypothesis is that changes in CPUE will not be the same at the Reference and Impact Areas over time (two-tailed). Generalized Linear Models (GLMs) will be used to describe the data and estimate the 90% Confidence Interval (CI) on the BACI contrast. The interaction contrast that will be tested is the difference between the temporal change (i.e., average over the post-construction period minus the average over the pre-operation period) at the windfarm and the average temporal change at the Reference Areas. A statistically significant impact would be indicated by a 90% CI for the estimated interaction contrast that excludes zero. Using a 90% CI allows 95% confidence statements for the lower or upper bound (e.g., if the lower bound of the 90% CI for the mean is greater than 0, this indicates 95% confidence that the mean exceeds 0).

For diet data, the primary question that will be asked is whether the prey composition of monkfish, winter skate, and other focal species changes following the construction of the wind farm. The null hypothesis is that changes in diet between the Impact and Reference Areas are statistically indistinguishable over time. Monthly diet data for focal species will be obtained from stomach contents, and prey composition will be calculated separately for each species as the mean proportional contribution (W_k) of each prey item (Buckel et al. 1999a; Bonzek et al. 2008) by month and area, where:

$$\%W_k = \frac{\sum_{i=1}^{n} M_i q_{ik}}{\sum_{i=1}^{n} M_i} * 100$$

$$q_{ik} = \frac{w_{ik}}{w_i},$$

and where

> n is the total number of gillnet strings that collected the fish species of interest,
>
> M_i is the sample size (counts) of that predator species in the gillnet string i,
>
> w_i is the total weight of all prey items in the stomachs of all fish analyzed from gillnet string i, and
>
> w_{ik} is the total weight of prey type k in these stomachs.

Potential seasonal differences in prey composition will be explored for each focal species using multivariate techniques (e.g., nMDS, ANOSIM, and SIMPER). A stomach fullness index (FI) will be calculated for each fish analyzed. The difference between full and empty stomach weights will be determined to obtain the total weight of food (FW). The ingested food weight (FW) is expressed as a percentage of the total fish weight according to a formula defined by Hureau (1969) as cited by Ouakka et al. 2017.

$$FI = FW / \text{fish weight} \times 100$$

More detailed or appropriate analyses may be included as the Project progresses. Data analysis will be executed in accordance with the BOEM fishery guidelines.

Table 1. Summary of planned data analysis for the gillnet survey.

Design Overview	Design details	Metrics of Interest	Research Question	Post-Construction Statistical Methods
1 Impact, 2 Reference areas; 2 years Before Construction and ≥2 years After Operation; April-June and October-December (2x per month); 48-hour soak time.	**Sampling frame** = SFW and Reference areas of similar habitat and size. **Observational unit** = day-area (gillnet strings randomized each sampling event; individual strings are subsamples of day-area estimate) **Response variable** = mean catch per day-area. **Error variance** = temporal	**Catch of key species (monkfish, and winter skate)**	What is the magnitude of the difference in the temporal changes in the observed metric between SFW and reference areas?	Fit the GLM or GAM that best describes the data; estimate the 90% CI on the BACI contrast.
	Observational unit = individual fish **Response variables** = % contribution (by weight) of each species contributing to total diet/stomach contents. **Error variance** = among individual fish	**Diet (prey) composition** for key species (e.g., monkfish, winter skate, gadids, black sea bass)	How does diet composition change over time (B/A), or between areas (C/I)?	Bray-Curtis similarity between individual fish; ANOSIM to identify whether significant differences exist between fish from different seasons, years, or locations. Relationships graphically depicted with nMDS.
	Observational unit = individual fish/invertebrate **Response variable** = length **Error variance** = among individual fish/invertebrates	**Length frequency**	How does size structure change over time (B/A)? How does size structure compare between areas (C/I)?	1. descriptive (range, mean) 2. graphical and statistical comparison (between times and locations) of ECDFs using distributional comparison test (e.g., Kolmogorov-Smirnoff).
	Observational unit = individual fish **Response variable** = condition index **Error variance** = among individual fish	**Fish condition index** (i.e., deviations from log-length vs log-weight relationship) by species	What is the magnitude of change in fish condition over time (B/A), or between areas (C/I)?	Find the best fitting model to the condition values by species, and calculate 90% CI of the relevant contrasts.

Definitions:

BAG = before after gradient

90% CI = 90% confidence interval

ECDF = empirical cumulative distribution function

The SFW project team is not aware of any existing fishery-independent gillnet data sets from the region that could be used to perform a power analysis. Therefore, an adaptive sampling strategy is proposed. Upon completion of sampling in 2021, and again following sampling in 2022, a power analysis will be conducted to evaluate the power of the sampling design. The power analysis will be conducted using an approach similar to what was performed for the ventless trap survey (*see* Appendix D). The variance (e.g., RSE) associated with the relative abundance estimates for winter skates and monkfish will be calculated. Power curves will be used to demonstrate how statistical power varies as a function of effect size and sample size (i.e., number of gillnet samples per area). When analyzing changes in the relative abundance of monkfish and winter skate, we will aim to achieve a statistical power of at least 0.8, which is generally considered to be the standard for scientific monitoring (Cohen, 1992). This ensures that the monitoring will have a probability of at least 80% of detecting an effect that is present. A single two-tailed alpha (0.10) will be evaluated during the power analysis. There is a direct relationship between the magnitude of the effect size and the statistical power of the analysis, with greater power associated with larger effect sizes.

The results of the power analysis will be considered and can be used to modify the monitoring protocols in subsequent years. The decision to modify sampling will be made after evaluating several criteria including the amount of variability in the data, the statistical power associated with the study design, and the practical implications of modifying the monitoring protocols. For example, if the analysis demonstrates that the proposed sampling will not achieve the desired level of statistical power, sampling intensity may need to be increased, which could be achieved throughout the duration of the study by adding random sampling stations to the Reference and Impact Areas, by sampling the existing stations more often each month (e.g., three monthly samples, rather than two), or by increasing the duration of the post-construction monitoring.

3.0 Demersal Fisheries Resources Survey – Beam Trawl

Experienced local fishermen report that sections of the Project Area allow for data collection via beam trawl, as beam trawls are smaller and more maneuverable than otter trawls (R. Sykes, pers. comm.). Previous studies have used beam trawls to sample in the vicinity of the Project Area and beam trawls have proven to be an effective gear for sampling demersal species, including juveniles (Malek, 2015; Walsh and Guida, 2017). Based on the data collected by Malek (2015), the beam trawl survey is expected to capture a range of demersal fish and benthic invertebrates that are common to the waters of New England and the mid-Atlantic including sea scallops, summer flounder, windowpane flounder, winter flounder, fourspot flounder, winter skate, little skate, lobster, Jonah crabs, rock crabs, and silver hake.

The beam trawl survey will collect pre- and post-construction data on distribution, abundance and community composition, with a focus on demersal fish and macroinvertebrates species. The primary objective of the beam trawl survey is to evaluate whether the construction and operational activities associated with the Project lead to a significant change in the relative abundance of demersal fish and invertebrates within the Project Area relative to the Reference Areas.

At least two years of sampling (i.e., 24 monthly sampling trips) will be conducted prior to the commencement of offshore construction. The pre-construction monitoring is scheduled to begin in October, 2020. Similarly, a minimum of two years of monitoring will be completed following offshore construction, but the duration of post-construction monitoring will also be informed by ongoing guidance for offshore wind monitoring that is being developed cooperatively through the Responsible Offshore Science Alliance (ROSA).

3.1 Survey Design/Procedures

The survey will be conducted from commercial fishing vessel(s) with scientists onboard to process the catch. Two commercial vessels were selected based on criteria such as experience using a beam trawl, safety record, knowledge of the area, and cost. One vessel will serve as the primary survey vessel, and the other will be used as an alternate. The scientific contractor has applied for an Exempted Fishing Permit (EFP) from NOAA Fisheries in order to use the hired fishing vessel as a scientific platform and conduct scientific sampling that is not subject to the Atlantic Coastal Fisheries Cooperative Management Act, Magnuson-Stevens Fishery Conservation and Management Act, and fishery regulations in 50 CFR parts 648 and 697. All survey activities will be subject to rules and regulations outlined under the MMPA and ESA. Efforts will be taken to reduce marine mammal, sea turtle, and seabird injuries and mortalities caused by incidental interactions with fishing gear. All gear restrictions, closures, and other regulations set forth by take reduction plans (e.g., Harbor Porpoise Take Reduction Plan, Atlantic Large Whale Reduction Plan, etc.) will be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury.

3.2 Proposed Sampling Stations

As described for the gillnet survey (Section 2.2), an asymmetrical BACI design is proposed for the beam trawl survey to sample within three areas: one survey area within the SFWF Project Area (Figure 4) and two Reference Areas. The Reference Areas were initially identified in 2019, using the same data and process that was described for the gillnet survey (Section 2.2). Due to the complex bathymetry (e.g., hangs and boulders) present in the Project Area and the Reference Areas, a beam trawl survey would be difficult to execute safely using a simple random design. Conversations with fishermen indicate that there is a limited amount of benthic habitat that can be sampled safely and effectively within each area using a beam trawl. Therefore, in lieu of a simple random design, the input of commercial fishermen with experience fishing in these area, and detailed geophysical seafloor survey data, will be used to generate a map of tow tracks that can be safely sampled within the Project Area, and the two Reference Areas. From this map of potential tow tracks, random sampling locations will be selected during each sampling event.

Sampling will occur once per month within the Project and Reference Areas. During each sampling event, three beam trawl lines will be randomly selected from the universe of possible sampling locations in each area, resulting in nine beam trawls conducted per monthly sampling event (*see* Appendix B). This sample size was chosen to provide adequate replication within each area, while considering practical constraints, such as the need to avoid gear conflicts with active fisheries that occur in the Project and Reference Areas, and practical consideration of the amount of sampling that can be accomplished in a day at sea. Sample sizes and sampling strategies may be subsequently modified following the results of a mid-study power analysis (Section 3.7), however the overall sampling design will remain unchanged. During any given sampling event, the location of beam trawl sampling stations may be subject to change due to seasonal location of other fixed fishing gear (e.g., lobster pots). If a survey line is found to have poor conditions for beam trawling it may be moved based on the captain's professional judgement. In this instance an alternate trawling location will be chosen at random from the universe of potential sampling locations within that area.

The fishermen participating in the beam trawl survey provided feedback on the Reference Areas in July 2020. Their feedback indicated that fixed gear and 'broken bottom' is prevalent in portions of the eastern Reference Area that was initially identified in 2019. Based on this feedback, the eastern Reference Area was moved slightly to the north, in order to minimize interactions with fixed gear and broken bottom that may cause operational constraints and safety issues during the beam trawl survey (Figure 4).

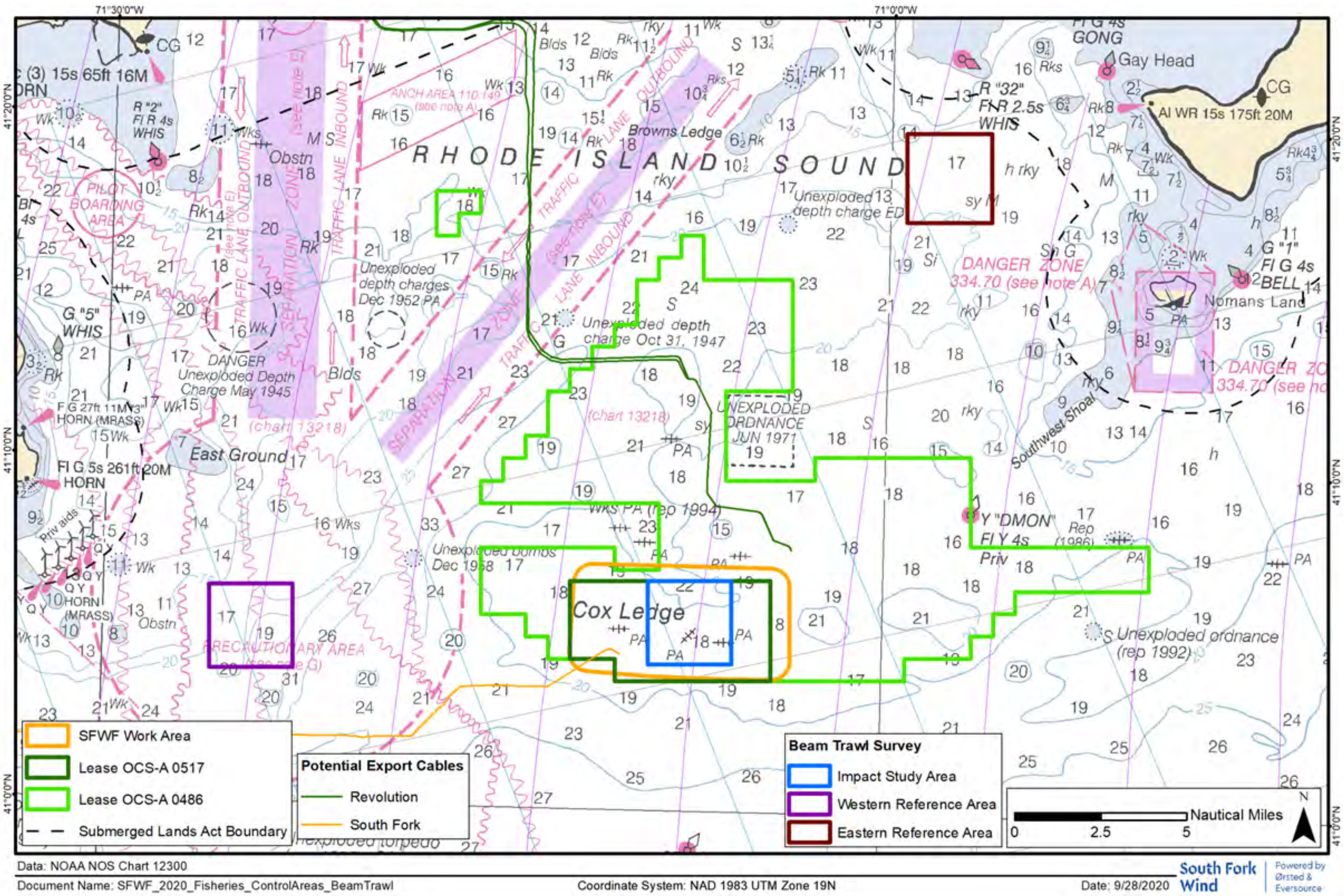


Figure 4. **Northeast lease areas including the South Fork Wind Farm with Beam Trawl Survey Areas.**

3.3 Beam Trawl Methods

Beam trawling will be conducted monthly by a commercial fishing vessel using a 3-m beam trawl, with a cod-end of double 4.75 inch mesh and a 1-inch (2.54-cm) knotless cod end liner (or similar; equivalent to NEAMAP cod end) to ensure retention of the smaller fish (Malek, 2015). A single vessel has been selected as the primary sampling vessel for the survey, and it is planned that this vessel will complete all of the sampling trips. However, an additional vessel has been identified as an alternate, and will be used if problems with the primary vessel preclude it from sampling in a given month. Rock chains will be fitted across the mouth of the beam trawl to prevent larger rocks from entering and damaging the catch or net. Once on station, the crew of the vessel lowers the net into the water fully and allows it to drag behind the boat. When the gear is fully deployed and the winch brakes are set, and the start coordinates, start time, date, tow direction, water depth, and tow speed are recorded. Upon completion of the tow, the end time and coordinates are recorded. At the outset of the survey a target towing speed of 4.0 knots and tow duration of 20 minutes will be used, based on the protocols described by Malek (2015). However, the tow speed and duration may be modified based on feedback received from the captain and scientific crew after initial sampling trips have been completed. The catch from the beam trawl survey will not be retained for sale by the participating vessels, and all animals will be returned to the water as quickly as possible once the sampling is completed.

Fish collected in each tow will be identified, weighed, and enumerated consistent with the sampling approach of NEAMAP. In the case of larger catches, one or multiple subsampling procedures may be used. Subsampling protocols for the beam trawl are adapted from the subsampling procedures of the NEAMAP survey and include straight subsampling by weight, mixed subsampling by weight, and discard by count sampling (Bonzek et al., 2008). The type of sub-sampling strategy that is employed will be dependent upon the volume and species diversity of the catch and will be determined at the discretion of the chief scientist. The scientists will sort and identify fish, and weigh each species according to the following protocol:

All organisms will be identified to species including fish and mega-invertebrates such as sea scallops, squid, lobsters, *Cancer* spp. crabs, sand dollars, and urchins. Taxonomic guides include NOAA's *Guide to Some Trawl-Caught Marine Fishes* (Flescher, 1980), *Bigelow and Schroeder's Fishes of the Gulf of Maine* (Collette and Klein-MacPhee, 2002), Kells and Carpenter's (2011) *Field Guide to Coastal Fishes from Maine to Texas* and *Peterson's Field Guide to the Atlantic Seashore* (Gosner, 1999).

The catch will be sorted by species. In the case of large catches with a range of size classes, the catch may be sorted by relative size categories within each species. The use of size categories is to ensure that all sizes are equally represented in the data if subsampling is used. The chief biologist will determine the categories and approximate length ranges to be used for each species.

The following data elements will be recorded for each tow: total biomass and total number of organisms caught, number and biomass caught for each species, species diversity, and length for dominant species and vulnerable species (e.g., Atlantic sturgeon, thorny skate). Notwithstanding sub-sampling procedures, up to 50 individuals of each species (and size category) are measured and the rest counted. Individual lengths (+/- 0.5 cm) are recorded on the field data sheet. Fork length is recorded for all fishes with a forked tail. Total length is measured for all other fishes. Exceptions to these rules are the measurement of rays (disc width), sharks (straight-line fork length), dogfish (stretched total length), crabs (carapace width), lobsters (carapace length), sea scallops (shell height), and squids (mantle length). Miscellaneous invertebrates (e.g., worms, hermit crabs, snails) will be counted but not measured.

Stomach content analysis will be performed for commercially important species (monkfish, winter skate, winter flounder, gadids) to determine the prey composition for these species during the pre-construction period. Up to 10 animals will be sacrificed for stomach content analyses from each tow that is sampled, with no more than 5 individuals of any one species sampled from each tow. Each fish sampled for stomach content analysis will be measured (+/- 0.5 cm) and weighed (+/- 0.5 g) individually before the stomach is removed to permit assessment of relative condition. All prey items will be identified to the LPIL, counted, and weighed. Atlantic cod are known to spawn on or near Cox Ledge (Zemeckis et al., 2014, Cadrin et al., 2020; Inspire Environmental, 2020). Sex and reproductive stage will be assessed for the cod sacrificed for stomach sampling according to the protocols used for the 2018 and 2019 SFWF Atlantic Cod Spawning Survey (adapted from Burnett et al. [1989] and O'Brien et al. [1993]). Up to five cod may be sampled per tow for sex and maturity and stomach contents. Maturity data from this sampling may be shared with local researchers to better understand the timing and distribution of cod spawning activity in Southern New England.

Should any interactions with protected species (e.g., marine mammals, sea birds, sea turtles) occur, the contracted scientists will follow the sampling protocols described for At-Sea Monitors (ASM) in the Observer On-Deck Reference Guide (Northeast Fisheries Science Center, 2016). Protected species interactions will be reported immediately to NOAA's stranding hotline via telephone (866-755-NOAA) or via the Whale Alert APP, and a follow up detailed written report will be provided to NMFS Greater Atlantic Regional Fisheries Office (incidental.take@noaa.gov) within 24 hours that includes the following information; date, time, area, gear, species, and animal condition and activity. The following protocol will also be followed:

- If a marine mammal take occurs, the entire animal will be retained as time and space allow. However, if there is insufficient space on board the vessel, the minimum sampling requirements described for at-sea monitors will be met.
- If any interactions with Atlantic sturgeon or shortnose sturgeon occur, the contracted scientists will follow the sampling protocols described for the Northeast Fisheries Observer Program (NEFOP) in the Observer On-Deck Reference Guide (Northeast Fisheries Science Center, 2016), which includes collecting a genetic sample and scanning the animal for a PIT tag.
- Interactions with sturgeon will be reported immediately to NOAA's stranding hotline via telephone (866-755-NOAA) or via the Whale Alert APP, and a follow up detailed written report will be provided to NMFS Greater Atlantic Regional Fisheries Office within 24 hours.
- If an Atlantic sturgeon or shortnose sturgeon carcass is retained, we will contact Fred Wenzel at the Northeast Fisheries Science Center. Any biological data collected during sampling of protected species will be shared as part of the written report that is submitted to the NMFS Greater Atlantic Regional Fisheries Office.
- Sightings of right whales, and observations of dead marine mammals and sea turtles in the water will be reported immediately to NOAA's stranding hotline via telephone (866-755-NOAA) or via the Whale Alert APP and a follow up detailed written report will be provided to NMFS Greater Atlantic Regional Fisheries Office within 48 hours.
- Sea birds will be sampled following the protocols outlined by the Northeast Fisheries Science Center (2016) and if a dead seabird is encountered, any 'dead, fresh' animals will be retained and provided to the US Fish and Wildlife Service for additional sampling.

- Due to the potential for communicable diseases all physical sampling and handling of marine mammals and seabirds will be limited to the extent Ørsted health and safety assessments and plans allow.

3.4 Environmental Data Collection

Hydrographic data will be collected at each beam trawl sampling location. A Conductivity Temperature Depth (CTD) sensor will be used to sample a vertical profile of the water column at each beam trawl sampling location. The chief scientist will have discretion to decide whether the CTD profile is collected prior to the start of the tow, or at the conclusion of the tow. Bottom water temperature (degrees C) will be recorded at regular intervals (e.g., every 30 seconds) throughout the duration of each beam trawl tow using a temperature logger mounted to the frame of the beam trawl. Sea state and weather conditions are recorded from visual observations. Air temperature may be downloaded from a local weather station if not available onboard.

3.5 Station Data

The following data will be collected during each sampling effort:

- Station number;
- Start latitude and longitude;
- Start time and date;
- Start water depth;
- Tow direction;
- Tow speed;
- Tow duration;
- End latitude and longitude;
- End time and date;
- Wind speed;
- Wind direction;
- Wave height; and
- Air temperature

Vertical CTD profile, and continuous observations of bottom temperature while the gear is fishing (*see* Section 3.4)

3.6 Data Entry and Reporting

Data will be transcribed from hard copy datasheets into electronic worksheets. The data sheets will be reviewed for data entry errors prior to importing into a relational database. Quality control checks will be performed on database tables by running standardized, systematic queries to identify anomalous data values and input errors. Species names (common and scientific) are verified and tabulated for consistency. All data used in analysis will be exported from the relational database.

Annual reports containing catch data will be prepared after the conclusion of each year of sampling and shared with State and Federal resource agencies. One final report will also be produced synthesizing the findings of the pre- and post-construction evaluations.

3.7 Data Analysis

The study will use an asymmetrical BACI experimental design, with statistical evaluation of the differences between reference and Project Areas contrasted in the before and after construction time periods (Underwood, 1994; Smith, 2002). A BACI design will allow for assessment of changes in relative abundance that correlate with proposed construction and operations at the SFWF site.

Results presented in annual reports will focus on comparing the fish and invertebrate communities in the Project Area and the Reference Areas to describe spatial and seasonal differences in relative abundance, species composition, and size distribution. For the dominant species in the catch, seasonal catch per unit effort (CPUE) will be compared among the three areas using graphics and descriptive statistics (e.g., mean and variance). Length frequency data by species will be compared among areas using descriptive statistics, graphical techniques (empirical cumulative distribution function [ECDF] plots), and appropriate statistical tests (e.g., the Kolmogorov-Smirnoff test). Species composition will be compared amongst the Project and Reference Areas using a Bray-Curtis Index and multivariate techniques (e.g., nMDS and ANOSIM).

Analysis presented in the final synthesis report will focus on identifying changes in the fish community in the Project Area between pre- and post- construction that did not also occur at the Reference Areas that could be attributed to either construction or operation of the wind turbines (Table 2). With regard to measuring for changes in relative abundance, the primary research question is to estimate the magnitude of the difference in the temporal changes in relative abundance for the dominant species in the catch observed between the Project and Reference Areas. The null hypothesis is that changes in CPUE (relative abundance) for the dominant species in both the Impact and Reference Areas will be statistically indistinguishable over time. The alternative hypothesis is that changes in CPUE will not be the same at the Impact and Reference Areas over time (two-tailed). Generalized Linear Models (GLMs) will be used to describe the data and estimate the 90% Confidence Interval (CI) on the BACI contrast. The interaction contrast that will be tested is the difference between the temporal change (i.e., average over the post-construction period minus the average over the pre-operation period) at the windfarm and the average temporal change at the Reference Areas. A statistically significant impact would be indicated by a 90% CI for the estimated interaction contrast that excludes zero. Using a 90% CI allows 95% confidence statements for the lower or upper bound (e.g., if the lower bound of the 90% CI for the mean is greater than 0, this indicates 95% confidence that the mean exceeds 0).

For the diet data, the primary question to be asked is whether the construction of the wind farm leads to changes in the diet composition of focal species. The null hypothesis is that changes in diet between the Reference and Impact Areas are statistically indistinguishable over time for the species that are sampled. Monthly diet data for focal species will be obtained from stomach contents, and prey composition will be calculated separately for each species as the mean proportional contribution (W_k) of each prey item (Buckel et al. 1999a; Bonzek et al. 2008) by month and area, where:

$$\%W_k = \frac{\sum_{i=1}^{n} M_i q_{ik}}{\sum_{i=1}^{n} M_i} * 100$$

$$q_{ik} = \frac{w_{ik}}{w_i},$$

and where

n is the total number of beam trawls that collected the fish species of interest,

M_i is the sample size (counts) of that predator species in beam trawl i,

w_i is the total weight of all prey items in the stomachs of all fish analyzed from beam trawl i, and

w_{ik} is the total weight of prey type k in these stomachs.

Potential seasonal differences in prey composition may also be explored for each focal species using multivariate techniques (e.g., nMDS, ANOSIM, and SIMPER). A stomach fullness index (FI) will be calculated for each fish analyzed. The difference between full and empty stomach weights will be determined to obtain the total weight of food (FW). The ingested food weight (FW) is expressed as a percentage of the total fish weight according to a formula defined by Hureau (1969) as cited by Ouakka et al. 2017.

FI = FW / fish weight x 100

Species composition will also be compared between the Before and After periods to determine if the construction and operation of the wind farm had any impacts on the species that are present in the area. Species composition will be compared before and after construction using a Bray-Curtis Index and multivariate techniques (e.g., ANOSIM). Additional data analyses will be performed as appropriate based on the nature of the data that are collected (i.e., normality).

Table 2. Summary of planned analyses for the beam trawl survey.

Design Overview	Design details	Metrics of Interest	Research Question	Post-Construction Statistical Methods
1 Impact, 2 Reference areas; 2 years Before Construction and ≥2 years After Operation; January-December (1x per month)	**Sampling frame** = SFW and Reference areas of similar habitat and size. **Observational unit** = day-area (trawl lines randomized each sampling event; individual trawls are subsamples of day-area estimate). **Response variable** = mean catch per day-area. **Error variance** = temporal	**Catch of dominant and commercially important species**	What is the magnitude of the difference in the temporal changes in the observed metric between SFW and reference areas?	Fit the GLM or GAM that best describes the data; estimate the 90% CI on the BACI contrast.
	Observational unit = sampling event **Response variables** = average abundance of each species **Error variance** = among sampling events	**Species assemblage composition**	How does species composition change over time (B/A), or between areas (C/I)?	Bray-Curtis similarity between sampling events; ANOSIM to identify whether significant differences exist between events from different seasons, years, or locations. Relationships graphically depicted with nMDS.
	Observational unit = individual fish **Response variables** = % contribution (by weight) of each species contributing to total diet/stomach contents. **Error variance** = among individual	**Diet (prey) composition** for key species (e.g., monkfish, winter skate, gadids, black sea bass)	How does diet composition change over time (B/A), or between areas (C/I)?	Bray-Curtis similarity between individual fish; ANOSIM to identify whether significant differences exist between fish from different seasons, years, or locations. Relationships graphically depicted with nMDS.
	Observational unit = individual fish/invertebrate **Response variable** = length **Error variance** = among individual fish/invertebrates	**Length frequency**	How does size structure change over time (B/A)? How does size structure compare between areas (C/I)?	1. descriptive (range, mean) 2. graphical and statistical comparison (between times and locations) of ECDFs using distributional comparison test (e.g., Kolmogorov-Smirnoff).
	Observational unit = individual fish **Response variable** = condition index **Error variance** = among individual fish	**Fish condition index** (i.e., deviations from log-length vs log-weight relationship) by species	What is the magnitude of change in fish condition over time (B/A), or between areas (C/I)?	Find the best fitting model to the condition values by species, and calculate 90% CI of the relevant contrasts.

Definitions:
90% CI = 90% confidence interval
ECDF = empirical cumulative distribution function
nMDS = non-parametric Multidimensional Scaling
ANOSIM = Analysis of Similarities

A power analysis was conducted using data from Malek (2015). These data provided approximate estimates of spatial variability in total abundance among independent tows, but the level of replication over time was insufficient to estimate temporal variability at the scale needed for the power analysis (Appendix B). Therefore, an adaptive sampling strategy will be employed. Upon completion of sampling in 2021, and again following sampling in 2022, a power analysis will be conducted to evaluate the power of the sampling design. The power analysis will be conducted using an approach similar to what was performed for the ventless trap survey (Appendix D). The variance (e.g., RSE) associated with the relative abundance estimates for dominant species in the catch will be calculated. Power curves will be used to demonstrate how statistical power varies as a function of effect size and sample size (i.e., number of beam trawl samples per area). When analyzing changes in the relative abundance of dominant species in the catch, we will aim to attain a statistical power of at least 0.8 to ensure that the monitoring will have a probability of at least 80% of detecting an effect that is present. A single two-tailed alpha (0.10) will be evaluated during the power analysis. There is a direct relationship between the magnitude of the effect size and the statistical power of the analysis, with greater power associated with larger effect sizes.

The results of the power analysis will be considered and can be used to modify the monitoring protocols in subsequent years. The decision to modify sampling will be made after evaluating several criteria including the amount of variability in the data, the statistical power associated with the study design, and the practical implications of modifying the monitoring protocols. For example, if the analysis demonstrates that the proposed sampling will not achieve the desired level of statistical power, sampling intensity may need to be increased, which could be achieved throughout the duration of the study by adding random sampling stations to the Reference and Impact areas, by sampling the existing stations more often each month (e.g., two monthly sampling events, rather than one), or by increasing the duration of the post-construction monitoring.

4.0 Demersal Fisheries Resources Survey – Ventless Trap, Lobster

Lobster and Jonah crab are targeted by fishermen in New England and the Mid-Atlantic and are managed by the Atlantic States Marine Fisheries Commission (ASMFC). Based on recommendations from BOEM's renewable energy fishery guidelines (BOEM, 2013) and stakeholders, this survey will quantify pre-construction data for lobster in the SFWF site (McCann, 2012; Petruny-Parker et al., 2015, MADMF, 2018) such that changes in the resource due to construction and operation of the wind farm can be evaluated. A BACI ventless trap survey will be conducted to collect pre- and post-construction data on lobster and crab resources in the proposed Project Area. The objective of the pre-construction monitoring is to evaluate the spatial and seasonal patterns of relative abundance of lobster, Jonah crab and rock crab in the Project Area and in the Reference Areas. In addition, the proposed study will classify the demographics of lobsters, Jonah crabs, and rock crabs, including size structure, sex ratios, reproductive status, and shell disease. Monitoring will continue after construction to quantify the magnitude of potential changes that may occur to the relative abundance and demographics of lobsters and crabs before and after construction.

At least two years of sampling (i.e., 14 semi-monthly sampling events) will be conducted prior to the commencement of offshore construction. The pre-construction monitoring is expected to commence in May, 2021. Similarly, a minimum of two years of monitoring will be completed following offshore construction, but the duration of post-construction monitoring will also be informed by ongoing guidance for offshore wind monitoring that is being developed cooperatively through the Responsible Offshore Science Alliance (ROSA).

4.1 Survey Design/Procedures

The sampling protocol proposed here is informed by the methods used by the Atlantic States Marine Fisheries Commission (ASMFC) and other regional groups to monitor lobster and crab resources in the region (Wahle et al., 2004; O'Donnell et al., 2007; Geraldi et al., 2009; Collie and King, 2016). While the current survey is focused upon SFWF, we also plan to conduct similar ventless trap monitoring at the adjacent Revolution lease area. Further, as part of an effort to standardize monitoring amongst offshore wind developers, the sampling methodologies proposed here are similar to sampling methods being used at the Vineyard Wind development site. All sampling will occur on commercial lobster vessels that are chartered by Commercial Fisheries Research Foundation and the University of Rhode Island for the survey.

The scientific contractors have applied for an EFP from NOAA Fisheries in order to use the commercial lobster vessels as a scientific platform and conduct scientific sampling that is not subject to the Atlantic Coastal Fisheries Cooperative Management Act, Magnuson-Stevens Fishery Conservation and Management Act, and fishery regulations in 50 CFR parts 648 and 697. All survey activities will be subject to rules and regulations outlined under the MMPA and ESA. Efforts will be taken to reduce marine mammal, sea turtle, and seabird injuries and mortalities caused by incidental interactions with fishing gear. All gear restrictions, closures, and other regulations set forth by take reduction plans (e.g., Harbor Porpoise Take Reduction Plan, Atlantic Large Take Whale Reduction Plan, etc.) will be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury.

The requirements described in the Atlantic Large Whale Take Reduction Plan (NOAA, 2018b) for the trap and pot fisheries will be followed. At a minimum, the following measures will be used to avoid interactions between the ventless trap survey and marine mammals, although additional gear modifications can be made at the discretion of NOAA:

- No buoy line will be floating at the surface.
- There will not be wet storage of the gear. All sampling gear will be hauled at least once every 30 days, and all gear will be removed from the water at the end of each sampling season.
- All groundlines will be constructed of sinking line.
- Fishermen contracted to perform the field work will be encouraged to use knot-free buoy lines.
- All buoy line will use weak links that are chosen from the list of NMFS approved gear.
- All buoys will be labeled as research gear, and the scientific permit number will be written on the buoy. All markings on the buoys and buoy lines will be compliant with the regulations. Gear will be marked according to instructions received from the Greater Atlantic Regional Fisheries Office.
- Missing line or trawls will be reported to the NOAA Protected Resources Division as quickly as possible.
- Further modifications to the sampling gear can be made at the discretion of the Greater Atlantic Regional Fisheries Office.

4.2 Sampling Stations

The ventless trap lobster survey will be conducted using an asymmetrical BACI experimental design, with quantitative comparisons made before and after construction and between reference and Project Areas (Underwood, 1994). We collaborated with the scientific contractors and participating fishermen that have been selected to perform the fisheries monitoring to select two Reference Areas for this survey (Figure 5), following the considerations described in Section 2.2. The two Reference Areas that were selected have similar bottom types, benthic habitat, and areal extent as the SFWF site. Data collected at the Reference Areas will serve as a regional index of lobster, rock crab, and Jonah crab abundance in locations outside of the direct influence of the Project.

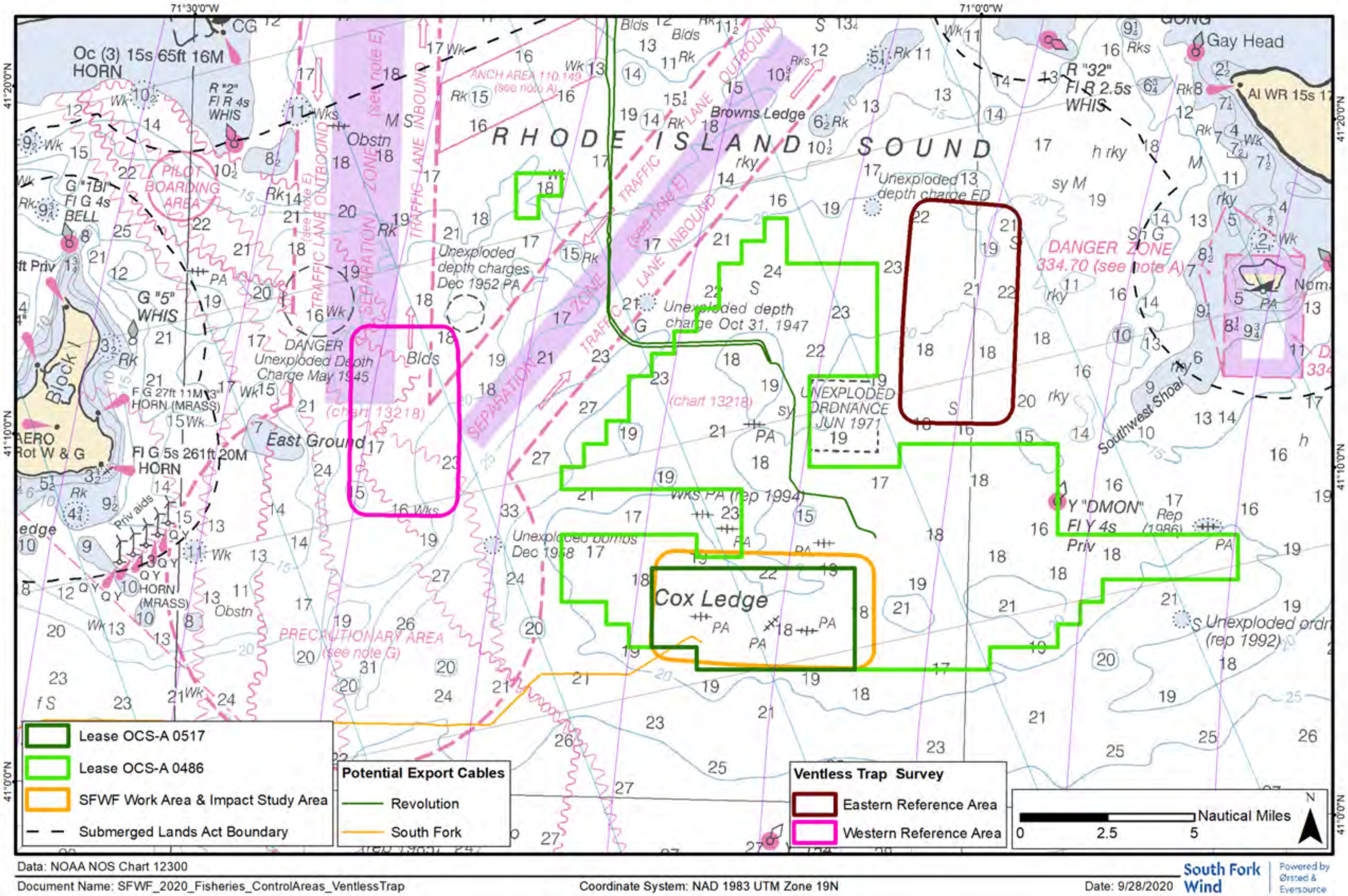


Figure 5. **Northeast lease areas including the South Fork Wind Farm with Ventless Trap Survey Areas.**

Sampling stations in the Project and Reference Areas will be allocated using a spatially balanced random design, with ten trawls (10 traps per trawl) deployed in each of the thee areas during each sampling event. The protocols proposed for the survey as consistent with those used during the Southern New England Cooperative Ventless Trap Survey (SNECVTS; Collie and King, 2016). The Project Area and Reference Areas will each be divided into a series of ten grid cells. Each grid cell will be further divided into aliquots (Figure 6). Through consultation with local industry members, a subset of the aliquots within each grid cell will be identified as suitable sampling sites based on the desire to minimize gear conflicts amongst fishermen in the area. At the beginning of each sampling season, an aliquot will be randomly selected for sampling within each grid cell. An alternative aliquot will also be selected within each grid cell, and the alternative aliquot will be sampled if needed based on local conditions (e.g., to avoid gear conflicts).

To achieve consistency with the ASMFC and SNECVTS protocols, the stations will be selected randomly at the start of each year of sampling, and the sampling locations will remain fixed for the remainder of the year. This sampling approach keeps the station occupied, reduces time spent moving traps between locations, and is generally similar to the routine operations of lobstermen in the region. To minimize gear interactions with other user groups in these areas, the lead scientist will work with the captain to ensure that the gear is set in accordance with local fishing practices.

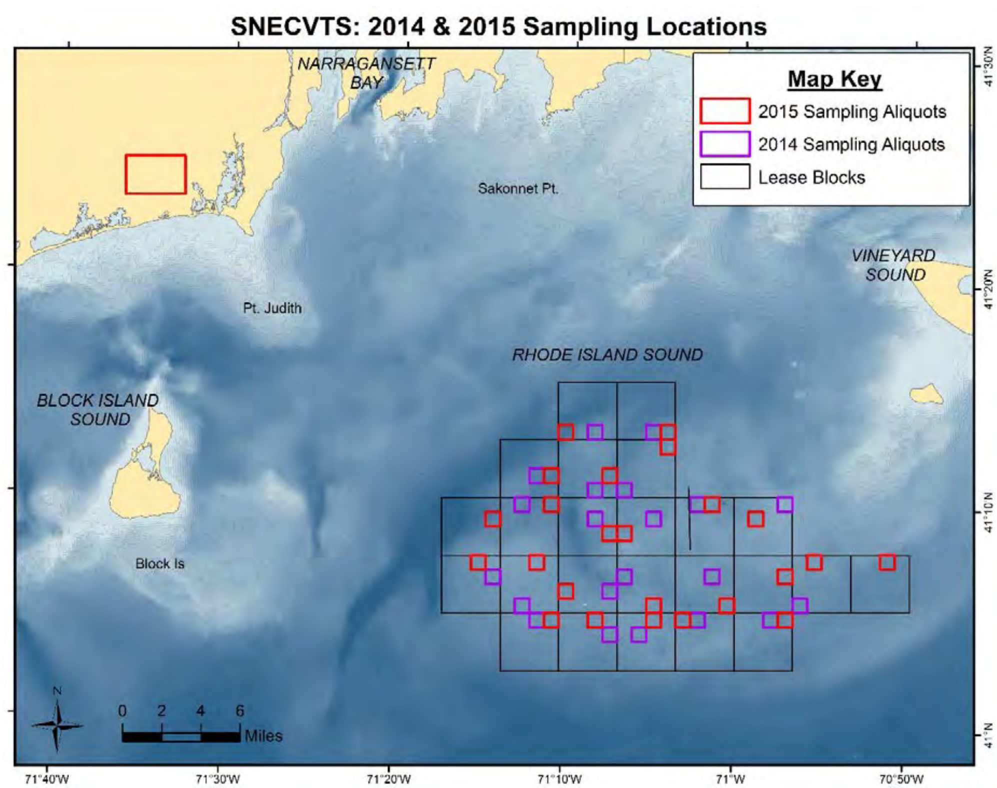


Figure 6. Example of the station selection method employed during the Southern New England Cooperative Ventless Trap Survey. The study area was stratified into 24 sampling grid cells, and each grid cell was further divided into aliquots. One aliquot from each grid was randomly selected for sampling in each year. Figure from Collie and King (2016).

4.3 Ventless Trap Methods

Lobster and crab resources in SFWF and the Reference Areas will be surveyed using commercial lobster vessels with scientists onboard to process the catch. Local lobster vessels have been contracted to conduct the sampling using a trap that is consistent with that used in the ASMFC and SNECVTS ventless trap surveys. This trap is a single parlor trap, 16 inches high, 40 inches long, and 21 inches wide with 5-inch entrance hoops and is constructed with 1-inch square rubber coated 12-gauge wire. The trap is constructed with a disabling door that can close off the entrance during periods between samples when the trap is on the bottom but not sampling. Local fishermen provided input that fishing longer trawls (i.e., 10 pot vs., 6 pot) should reduce the likelihood of gear losses during the study. Trawls will be configured with 10 traps on each trawl – six ventless (v) and four vented (or standard, S) in the following pattern: V-S-V-S-V-V-S-V-S-V; this is consistent with the gear configuration used in the SNECVTS (Collie and King, 2016). One trawl will be set in each of the 10 grid cells within the Project Area and two Reference Areas, for a total sampling intensity of 30 trawls (300 traps) per bimonthly sampling event. A power analysis based the data collected during the SNECVTS in 2014 and 2015 was completed to estimate the statistical power associated with this sampling design (*see* Appendix D for details). The results of the power analysis suggested that given a small to moderate effect size (0.25) the proposed BACI sampling design should have a statistical power of >0.8 to detect changes in the relative abundance of lobster, rock crabs, and Jonah crabs.

A temperature logger (Onset TidBit or similar) will be attached to the first trap in each trawl to record water temperature continuously throughout the monitoring period. A Conductivity Temperature Depth (CTD) sensor will be used to sample a vertical profile of the water column at each station.

Pre-construction sampling will occur twice per month from May through November. The sampling period of May through November was derived from a combination of feedback from commercial fishermen and to establish consistency with existing regional surveys (Rhode Island Department of Environmental Management [RIDEM], Massachusetts Division of Marine Fisheries [MADMF], SNECTVS). The standard soak time will be five nights, which is consistent with local fishing practices to maximize catch, and congruent with the protocols used on the SNECVTS survey. Soak time will remain consistent throughout the duration of the survey, to the extent practicable. Traps will be baited with locally available bait. At the start of each monthly sampling event, the lobsterman will retrieve and bait the traps. After the five-day soak period, the traps will be hauled and the catch will be processed for sampling, and the traps will be rebaited for another five-night soak. Each survey event will be managed by a team of qualified scientists including a lead scientist with experience performing lobster research. The catch will be removed from the traps by the vessel crew for processing. The lead scientist will be responsible for collection and recording of all data. The catch from the ventless trap survey will not be retained for sale by the participating vessels, and all animals will be returned to the water as quickly as possible once the sampling is completed.

The catch will be processed in a manner consistent with the ASMFC and SNECVTS ventless trap surveys. The following data elements will be collected for each trawl sampled during the survey; total number and biomass of individuals sampled, number and biomass for each species, and length of dominant invertebrate species (lobster, Jonah crab, and rock crab) and fish (+/- 0.5cm) that are captured in the traps. Data collected for individual lobsters will include:

- Carapace length: Measured to the nearest mm using calipers.
- Sex: Determined by examining the first pair of swimmerets.

- Eggs: Examine the underside of the carapace for the presence or absence of eggs.
- V-notch status: present or absent
- Cull status: Examine the claws for condition (claws missing, buds, or regenerated)
- Incidence of shell disease: absent, moderate, or severe
- Mortality: alive or dead

Biological information will also be collected for Jonah crabs and rock crabs. One ventless trap will be randomly selected in each string, and biological data will be recorded for all of the Jonah crabs and rock crabs that are captured in that randomly selected ventless trap. Counts and weights will be recorded for Jonah crabs and rock crabs from the other nine traps in each string. The following data elements will be recorded for each rock crab and Jonah crab that are sampled in the one randomly selected ventless trap in the trawl:

- Carapace width: Measured to the nearest mm using calipers.
- Sex: Determined by examining the width of the abdomen (apron). For female crabs, it is noted that there will be small differences in the width of the abdomen between mature and immature animals.
- Ovigery status: Presence/absence of eggs. Egg color recorded for females with eggs present.
- Incidence of shell disease: absent or present (3 categories: 1-10%, 11-50%, >50%)
- Cull status: Examine the claws for condition (claws missing, buds, or regenerated)
- Mortality: alive or dead

Should any interactions with protected species (e.g., marine mammals, sea birds, sea turtles) occur, the contracted scientists will follow the sampling protocols described for At-Sea Monitors (ASM) in the Observer On-Deck Reference Guide (Northeast Fisheries Science Center, 2016). Protected species interactions will be reported immediately to NOAA's stranding hotline via telephone (866-755-NOAA) or via the Whale Alert APP, and a follow up detailed written report will be provided to NMFS Greater Atlantic Regional Fisheries Office (incidental.take@noaa.gov) within 24 hours that includes the following information; date, time, area, gear, species, and animal condition and activity. The following protocols will also be followed:

- If a marine mammal take occurs, the entire animal will be retained as time and space allow. However, if there is insufficient space on board the vessel, the minimum sampling requirements described for at-sea monitors will be met.
- If any interactions with Atlantic sturgeon or shortnose sturgeon occur, the contracted scientists will follow the sampling protocols described for the Northeast Fisheries Observer Program (NEFOP) in the Observer On-Deck Reference Guide (Northeast Fisheries Science Center, 2016), which includes collecting a genetic sample and scanning the animal for a PIT tag.
- Interactions with sturgeon will be reported immediately to NOAA's stranding hotline via telephone (866-755-NOAA) or via the Whale Alert APP, and a follow up detailed written report will be provided to NMFS Greater Atlantic Regional Fisheries Office within 24 hours.

- If an Atlantic sturgeon or shortnose sturgeon carcass is retained, we will contact Fred Wenzel at the Northeast Fisheries Science Center. Any biological data collected during sampling of protected species will be shared as part of the written report that is submitted to the NMFS Greater Atlantic Regional Fisheries Office.

- Sightings of right whales, and observations of dead marine mammals and sea turtles in the water will be reported immediately to NOAA's stranding hotline via telephone (866-755-NOAA) or via the Whale Alert APP and a follow up detailed written report will be provided to NMFS Greater Atlantic Regional Fisheries Office within 48 hours.

- Sea birds will be sampled following the protocols outlined by the Northeast Fisheries Science Center (2016) and if a dead seabird is encountered, any 'dead, fresh' animals will be retained and provided to the US Fish and Wildlife Service for additional sampling.

- Due to the potential for communicable diseases all physical sampling and handling of marine mammals and seabirds will be limited to the extent Ørsted health and safety assessments and plans allow.

4.4 Environmental Data

Hydrographic data will be collected at each trawl that is sampled. A Conductivity Temperature Depth (CTD) sensor will be used to sample a vertical profile of the water column at each ventless trap sampling location, following the methods used by the CFRF/WHOI Shelf Research Fleet (Gawarkiewicz and Malek Mercer, 2019). The CTD profile may be collected either before the first trap in each trawl is hauled, or after the last trap in the trawl is hauled, at the discretion of the chief scientist. Bottom water temperature (degrees C) will be recorded at regular intervals (e.g., every 30 seconds) throughout the duration of each trawl deployment set using a temperature logger mounted on the first trap in each trawl.

4.5 Ventless Trap Station Data

The following data will be collected during each sampling effort:

- Station number;
- Start latitude and longitude;
- Start time and date;
- Start water depth;
- End latitude and longitude;
- End time and date;
- Wind speed;
- Wind direction;
- Wave height;
- Air temperature;
- Type of bait that was used; and

- Vertical CTD profile, and continuous observations of bottom temperature while the gear is fishing (Section 4.4).

4.6 Data Management and Analysis

The ventless trap survey will supplement the available pre-construction data on lobster and crab resources in the proposed SFWF site (i.e., SNECVTS survey dataset). The pre-construction monitoring data will be analyzed to evaluate the spatial and seasonal patterns of relative abundance of lobster, Jonah crab and rock crabs in the Project and Reference Areas. Results reported in annual reports will focus on comparing relative abundance, size frequencies, and demographic parameters between the Project and Reference Areas. For lobster, Jonah crab, and rock crab, CPUE (average annualized catch per trawl) will be compared amongst the Project and Reference Areas using descriptive statistics (e.g., mean, variance and range); and length frequency data by species will be compared among areas using descriptive statistics, graphical techniques (eCDF plots), and appropriate statistical tests (e.g., Kolmogorov-Smirnoff tests). Sex ratios will be reported for each sampling event for each area and compared amongst areas. The abundance and distribution of lobster, Jonah crab, and rock crab will be mapped each month, and descriptive statistics will be used to report on monthly trends in biological information such as shell disease or egg status.

Sampling after construction will allow for quantification of changes in the relative abundance and demographics of the lobster and crab resources due to construction activities as well as operation of the windfarm. For lobster, Jonah crab, and rock crab, the primary research question is the magnitude of difference in the temporal changes in relative abundance that are observed between the Project and Reference Areas. The null hypothesis for this design is that the changes in relative abundance in both the Project and Reference Areas will be statistically indistinguishable over time for lobster, Jonah crabs, and rock crabs. The alternative hypothesis is that changes in CPUE will not be the same at the Impact and Reference Areas over time (two-tailed). GLMs or GAMs will be used to describe the data and estimate the 90% Confidence Interval (CI) on the interaction contrast (Table 3). The interaction contrast that will be tested is the difference between the temporal change (i.e., average over the post-operation period minus the average over the pre-operation period) at the windfarm and the average temporal change at the Reference Areas. A statistically significant impact would be indicated by a 90% confidence interval for the estimated interaction contrast that excludes zero.

Spatial and temporal patterns in the biological data for lobsters and crabs (shell disease, sex ratios, reproductive status) will be summarized and reported. Similar to the methods described for relative abundance, GLMs or GAMs may also be used to test for the magnitude of the difference in the temporal change between the Project and Reference Areas for the biological parameters that will be collected (e.g., shell disease, cull status). The null hypothesis is that changes in demographic parameters (e.g., shell disease) for lobsters and crabs in both the Reference and Impact Areas will be statistically indistinguishable over time. The alternative hypothesis is that changes in demographic parameters will not be the same at the Reference and Impact Areas over time (two-tailed). GLMs or GAMs will be used to describe the data and estimate the 90% Confidence Interval (CI) on the interaction contrast. The interaction contrast that will be tested is the difference between the temporal change (i.e., average over the post-operation period minus the average over the pre-operation period) at the windfarm and the average temporal change at the References Areas. A statistically significant impact would be indicated by a 90% confidence interval for the estimated interaction contrast that excludes zero.

Table 3. Summary of the planned analyses for the ventless trap survey.

Design Overview	Design details	Metrics of Interest	Research Question	Post-Construction Statistical Methods
1 Impact, 2 Reference areas; 2 years Before Construction and ≥2 years After Operation; May-November (2x per month); 5-day soak time.	**Sampling frame** = SFW and Reference areas of similar habitat and size. **Observational unit** = Trawl (trawl locations randomized for first sampling event of each year, then fixed for remainder of year). **Response variable** = annual mean CPUE per trawl. **Error variance** = among replicate trawls within year and area.	**Lobster**: catch, ovigery rates, ovigery status, shell disease, cull status; **Jonah crab**: catch, ovigery status (color code eggs), shell disease; **Rock crab**: catch, ovigery status (color code eggs), shell disease	What is the magnitude of the difference in the temporal changes in the observed metric between SFW and reference areas?	Fit the GLM or GAM that best describes the data; estimate the 90% CI on the BACI contrast.
	Observational unit = individual fish/invertebrates **Response variable** = length **Error variance** = among individual fish/invertebrates	**Length frequency**	How does size structure change over time (B/A)? How does size structure compare between areas (C/I)?	1. descriptive (range, mean) 2. graphical and statistical comparison (between times and locations) of ECDFs using distributional comparison test (e.g., Kolmogorov-Smirnoff).

Definitions:
90% CI = 90% confidence interval
ECDF = empirical cumulative distribution function

5.0 Demersal Fisheries Resource Survey – Ventless Fish Pot

Black sea bass, scup, and tautog are important target species in both the commercial and recreational fisheries in southern New England and the Mid-Atlantic. Black sea bass and scup are jointly managed by the Mid-Atlantic Fisheries Management Council (MAFMC) and the Atlantic States Marine Fisheries Commission (ASMFC), while tautog are managed by the ASMFC. Black sea bass and tautog are typically associated with complex bottom habitats and not often well represented in trawl survey catches. There is also a significant pot fishery for these species in the region. Therefore, a fish pot survey will be a suitable gear type for monitoring these species at SFWF. The emphasis on sampling for black sea bass is justified given that this species has Essential Fish Habitat (EFH) throughout the Project Area and is considered to be vulnerable to potential habitat disturbance from offshore wind construction and operation activities (Guida et al., 2017).

Fish pots are a transportable, cage-like, stationary fishing gear, which typically use bait as an attractant for target species, along with retention devices to prevent the escape of captured individuals (Suuronen et al., 2012). Fish pots possess many characteristics that are desirable in a sampling gear: they can be highly selective for targeted species, and fish can generally be returned after sampling in healthy condition and with low rates of post-capture mortality (Bjordal, 2002; Pol and Walsh, 2005; ICES, 2006; Rotabakk et al., 2011). Fish pots also provide an alternative survey and harvest method for areas inaccessible to otter-trawling, such as reefs and other hard bottom habitats (ICES, 2009; Petruny-Parker et al., 2015). As static gears, pots exhibit low impact to habitats (Thomsen et al., 2010).

Fish pots are often designed to target specific species, or subgroupings of species. This is accomplished through the structural design of the pot openings, the pot holding areas, and the bait selected to attract species. Due to these characteristics, pots do not provide a comprehensive assessment of fish and invertebrates in a study area. However, they do provide important additional sampling data in areas where bottom trawling is not an option. In addition, as a static gear, fish pots are well-suited for sampling along a spatial gradient, particularly in close proximity to the turbine foundations.

The SFWF fish pot survey will be conducted to determine the spatial scale of potential impacts on the abundance and distribution of juvenile and adult fish, particularly black sea bass, scup, and tautog, within the proposed SFWF site. The main question to be addressed is whether the relative abundance and distribution of these three species changes before and after construction. In particular, we are interested in determining whether the areas closest to the turbine foundations demonstrate increased relative abundance of these structure-oriented species following construction. An increase in abundance would be suggestive of a 'reef effect', whereby the addition of offshore wind foundations and scour protection creates new habitat for fish, which leads to subsequent increases in abundance in the Project Area (Anderson and Ohman, 2010; Bergstrom et al., 2013). This 'reef effect' has been documented in roughly half of the offshore wind farm monitoring studies that have tested for this impact (Glarou et al., 2020).

In particular, black sea bass are a suitable focal species to assess questions related to introduced habitat. Black sea bass may be associated with relatively shallow, complex habitats that are characterized by placed materials (i.e., artificial reefs; Fabrizio et al., 2013b). Black sea bass off the coast of New Jersey appeared to use artificial reefs primarily for shelter, rather than for feeding (Steimle and Figley, 1996). Previous research has shown that black sea bass (especially adult males) on complex habitats generally exhibit relatively small home ranges, and typically exhibit limited movements during the summer months (<0.1km/day; Moser and Shepherd, 2009; Fabrizio et al., 2013a).

At least two years of sampling (i.e., 14 monthly sampling events) will be conducted prior to the commencement of offshore construction. It is anticipated that the fish pot survey will commence in April, 2021. Similarly, a minimum of two years of monitoring will be completed following offshore construction, but the duration of post-construction monitoring will also be informed by ongoing guidance for offshore wind monitoring that is being developed cooperatively through the Responsible Offshore Science Alliance (ROSA).

5.1 Survey Design/Procedures

A Before-After-Gradient (BAG) survey will be conducted at SFWF using fish pots to assess the spatial scale and extent of wind farm effects on habitat preferred by structure associated species like black sea bass, scup, and tautog. The survey will be conducted from commercial fishing vessels with scientists onboard to process the catch. Local commercial fishing vessels were selected based on criteria such as experience, safety record, knowledge of the area, and cost. The scientific contractor has applied for an EFP from NOAA Fisheries in order to use the hired fishing vessels as a scientific platform and conduct scientific sampling that is not subject to the Atlantic Coastal Fisheries Cooperative Management Act, Magnuson-Stevens Fishery Conservation and Management Act, and fishery regulations in 50 CFR parts 648 and 697. All survey activities will be subject to rules and regulations outlined under the MMPA and ESA. Efforts will be taken to reduce marine mammal, sea turtle, and seabird injuries and mortalities caused by incidental interactions with fishing gear. All gear restrictions, closures, and other regulations set forth by take reduction plans (e.g., Harbor Porpoise Take Reduction Plan, Atlantic Large Whale Reduction Plan, etc.) will be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury.

The requirements described in the Atlantic Large Whale Take Reduction Plan (NOAA, 2018b) for the trap and pot fisheries will be followed. At a minimum, the following measures will be used to avoid interactions between the fish pot survey and marine mammals, although additional modifications to the sampling gear can be made at the discretion of NOAA:

- No buoy line will be floating at the surface.
- There will not be wet storage of the gear. All sampling gear will be hauled at least once every 30 days, and all gear will be removed from the water at the end of each sampling season.
- All groundlines will be constructed of sinking line.
- Fishermen contracted to perform the field work will be encouraged to use knot-free buoy lines.
- All buoy line will use weak links that are chosen from the list of NMFS approved gear.
- All buoys will be labeled as research gear, and the scientific permit number will be written on the buoy. All markings on the buoys and buoy lines will be compliant with the regulations. Gear will be marked according to instructions received from the Greater Atlantic Regional Fisheries Office.
- Further modifications to the sampling gear can be made at the discretion of the Greater Atlantic Regional Fisheries Office.

5.2 Sampling Stations

To accomplish the goals of this survey, data will be collected before and after installation and operation of SFWF using a BAG survey design. The study design will sample at increasing distances from turbine locations to examine the spatial scale of effects from construction and operation of a turbine on the surrounding habitat and associated fish species (Ellis and Schneider, 1997). The proposed survey design eliminates the need for a Reference Area as is typical in a BACI design. Sampling effort is focused on sampling sites along a spatial gradient within the work area, rather than using a control location that may not be wholly representative of the conditions within the work area (Methratta, 2020). This design also allows for the examination of spatial variation and does not assume homogeneity across sampling sites within the Project Area (Methratta, 2020).

The methodologies and sampling distances employed in previous offshore wind studies were considered in the design of the fish pot survey. Transect studies using visual observations of SCUBA divers have been able to compare fish densities immediately adjacent to the turbine with nearby locations (e.g., 0m vs. 20m; Wilhelmson et al., 2006; Anderson and Ohman, 2010). Bergstrom et al (2013) used fyke nets to sample along transects that spanned a distance range of 20 to 1350m from a turbine foundation and observed that four of the seven fish species examined demonstrated increased densities near the turbine. Griffin et al., (2016) used Baited Remote Underwater Video (BRUVs) to compare fish abundance and species assemblage at locations adjacent to the turbine foundation with locations 100m from turbine foundations in the Irish Sea. Lefaible et al (2019) used grab sampling to classify macrobenthic communities and sampled at two distance categories from the foundations ('very close' = 37.5m and 'far' = 350-500m). Using gillnets, Stenberg et al (2015) sampled at three increasing distance categories from the turbine foundations ('near' = 0-100m, 'middle' = 120-200m, and 'far' = 230-330m) and demonstrated that fish with an affinity to rocky habitats were most abundant close to the turbine foundations, while the opposite effect was observed for whiting. In a review paper based on European case studies, Methratta (2020) noted that the majority of direct effects associated with turbine foundations (e.g., habitat provision, attraction, food provision) are expected to occur on a local scale (i.e., 10 - 100s of meters from the turbine foundation). Artificial reef studies also offer some information to inform the sampling strategy. For example, Rosemond et al. (2018) compared fish biomass and species richness using SCUBA between artificial reefs and adjacent sandy habitats and found that the abundance and species richness of fish was highest on the reefs and gradually declined across adjacent sand habitats from 30m to 120m away from the reef. It is important to note that many of the studies referenced above investigated wind farms that were built on relatively homogenous habitats (e.g., sand). Given the availability of naturally occurring complex habitat (e.g., boulders and ledge) within SFWF, it is uncertain whether the introduction of novel habitat associated with the turbine foundation and scour protection will cause a detectable change in abundance or distribution for these structure-oriented species.

Eight turbine locations will be randomly selected for sampling prior to the first year of the survey. Those turbines and trawl positions will remain fixed for the duration of the survey (preconstruction and post-construction). Each trawl will be 900 meters in length. The length of the trawl was chosen to cover approximately half of the distance between adjacent turbines. The turbines will be positioned in a grid pattern, with one nautical mile of spacing between adjacent turbines. The intent of choosing this trawl length was to ensure that there was adequate sampling of both the habitat in the close proximity of a turbine foundation, while also sampling areas within the wind farm where the habitat will not be altered for comparison. During the pre-construction monitoring, the first trap of the trawl will be placed within the buffer zone around the planned location of turbine, and the trawl will be set in a straight line extending away from the turbine. During the post-construction monitoring, the first pot of the string will be placed as close to the turbine foundation as possible (given safety considerations) to sample the habitat immediately adjacent to the turbine.

Each trawl will have 18 pots. The spacing between pots along the length of each trawl will not be identical; and the pot spacing intervals were selected based on information about the home range of black sea bass and consideration was also given to the results of prior offshore wind monitoring studies discussed above which often showed that the greatest effects on abundance and distribution occurred in close proximity to the turbine foundation. Using acoustic telemetry, Fabrizio et al (2013) reported a median home range for black sea bass (of unknown sex) of 137 hectares (436,085m^2), at an artificial reef off New Jersey. If it is assumed that the foundation of the turbine serves as the focal point for the home range of a sea bass (post-construction), then the home range can be represented by a circle with a radius of 660m. The first five fish pots will sample within 50m of the turbine foundation at 10m intervals (e.g., 10, 20, 30, 40, and 50m from the turbine). The intention is to intensely sample the locations directly adjacent to the turbine foundation, where the greatest effects on fish abundance and distribution would be anticipated. The remaining thirteen fish pots will be spaced 65m apart and will sample at distances of approximately 115m to 900m from the turbine foundation. The intent is to sample in areas of the wind farm that are both within and beyond the assumed median home range of black sea bass (Fabrizio et al., 2013), and also sample at distances that are outside of any habitat alteration associated with the installation of the turbine foundation and the addition of the scour protection. To minimize gear interactions with other user groups in these areas, the lead scientist will work with the captain to ensure that the gear is set in accordance with local fishing practices.

5.3 Fish Pot Methods

The fish pot survey will be conducted using typical rectangular fish pots commonly used in Rhode Island and Massachusetts fisheries and these fish pots are also used in other regional pot surveys (R. Balouskus, RIDEM, pers comm.). The ventless fish pots measure 43.5 inches long, 23 inches wide, and 16 inches high and are made from 1.5-inch coated wire mesh. Each pot will be baited with whole clam bellies and the entire trawl allowed to soak for 24 hours. Sampling will take place once per month from April through October. The Contractor selected to carry out the survey will take efforts to ensure that the timing of sampling is approximately consistent within each month, to the extent practicable. Soak time will remain consistent throughout the duration of the survey. Each survey event will be managed by a team of qualified scientists including a lead Scientist with experience performing fisheries research. The catch will be removed from the pots by the boat crew for processing. The Lead scientist will be responsible for collection of data and data recording. The catch from the fish pot survey will not be retained for sale by the participating vessels, and all animals will be returned to the water as quickly as possible once the sampling is completed.

Fish collected in each pot will be identified to species, weighed, and enumerated. The following data elements will be recorded for each fish pot; total biomass and total number of organisms caught, number and biomass caught for each species, number of species, and length for species caught. Subsampling for length may occur, at the discretion of the chief scientist, if there is a large number of fish captured in a given pot.

The catch from each pot will be sorted by species and size (if appropriate) into baskets or fish totes as needed. This process continues until all animals are sorted, and the chief biologist verifies that the sorting areas are clear of all animals. Notwithstanding sub-sampling procedures, up to 50 individuals of each species/size are measured (+/- 0.5 cm) and the rest counted. A subset of the individual fish that are measured will also be weighed (+/- 5.0g) to evaluate individual fish condition. Fork length is recorded for all fishes with a forked tail. Total length is measured for all other fishes. Dominant invertebrate species will be measured as follows: crabs (carapace width) and lobsters (carapace length). Miscellaneous invertebrates (e.g., worms, hermit crabs, snails) will be counted but not measured.

Should any interactions with protected species (e.g., marine mammals, sea birds, sea turtles) occur, the contracted scientists will follow the sampling protocols described for At-Sea Monitors (ASM) in the Observer On-Deck Reference Guide (Northeast Fisheries Science Center, 2016). Protected species interactions will be reported immediately to NOAA's stranding hotline via telephone (866-755-NOAA) or via the Whale Alert APP, and a follow up detailed written report will be provided to NMFS Greater Atlantic Regional Fisheries Office (incidental.take@noaa.gov) within 24 hours that includes the following information; date, time, area, gear, species, and animal condition and activity. The following protocols will also be followed:

- If a marine mammal take occurs, the entire animal will be retained as time and space allow. However, if there is insufficient space on board the vessel, the minimum sampling requirements described for at-sea monitors will be met.

- If any interactions with Atlantic sturgeon or shortnose sturgeon occur, the contracted scientists will follow the sampling protocols described for the Northeast Fisheries Observer Program (NEFOP) in the Observer On-Deck Reference Guide (Northeast Fisheries Science Center, 2016), which includes collecting a genetic sample and scanning the animal for a PIT tag.

- Interactions with sturgeon will be reported immediately to NOAA's stranding hotline via telephone (866-755-NOAA) or via the Whale Alert APP, and a follow up detailed written report will be provided to NMFS Greater Atlantic Regional Fisheries Office within 24 hours.

- If an Atlantic sturgeon or shortnose sturgeon carcass is retained, we will contact Fred Wenzel at the Northeast Fisheries Science Center. Any biological data collected during sampling of protected species will be shared as part of the written report that is submitted to the NMFS Greater Atlantic Regional Fisheries Office.

- Sightings of right whales, and observations of dead marine mammals and sea turtles in the water will be reported immediately to NOAA's stranding hotline via telephone (866-755-NOAA) or via the Whale Alert APP and a follow up detailed written report will be provided to NMFS Greater Atlantic Regional Fisheries Office within 48 hours.
- Sea birds will be sampled following the protocols outlined by the Northeast Fisheries Science Center (2016) and if a dead seabird is encountered, any 'dead, fresh' animals will be retained and provided to the US Fish and Wildlife Service for additional sampling.
- Due to the potential for communicable diseases all physical sampling and handling of marine mammals and seabirds will be limited to the extent Ørsted health and safety assessments and plans allow.

5.4 Environmental Data

Hydrographic data will be collected at sampling location. A Conductivity Temperature Depth (CTD) sensor will be used to sample a vertical profile of the water column at each fish pot sampling location. The CTD may be collected either before the first fish pot in each trawl is hauled, or after the last pot in the trawl is hauled, at the discretion of the chief scientist. A temperature logger (Onset TidBit or similar) will be attached to the first fish pot on each trawl to record water temperature continuously throughout the monitoring period. Sea state and weather conditions are recorded from visual observations. Air temperature may be downloaded from a local weather station if not available onboard.

5.5 Fish Pot Station Data

The following data will be collected during each sampling effort:

- Station number;
- Start latitude and longitude;
- Start time and date;
- Start water depth;
- End latitude and longitude;
- End time and date;
- Wind speed;
- Wind direction;
- Wave height;
- Air temperature; and
- Vertical CTD profile, and continuous observations of bottom temperature while the gear is fishing (*see* Section 5.4).

5.6 Data Entry and Reporting

Data will be transcribed from hard copy datasheets into electronic worksheets. The data sheets will be reviewed for data entry errors prior to importing into a relational database. Quality control checks will be performed on database tables by running standardized, systematic queries to identify anomalous data values and input errors. Species names (common and scientific) are verified and tabulated for consistency. All data used in analysis will be exported from the relational database.

Annual reports containing catch data will be prepared after the conclusion of each year of sampling and shared with State and Federal resource agencies. One final report will also be produced synthesizing the findings of the pre- and post-construction evaluations.

5.7 Data Analysis

The BAG survey design will allow for characterization of pre-construction community structure of fish species associated with complex bottom habitats and will continue sampling after construction to allow for quantification of any changes in relative abundance associated with installation and operation of wind turbines in the SFWF site. The primary question to be asked is, what is the pattern of temporal change in relative abundance, relative to distance from a turbine foundation? The null hypothesis associated with this design is that relative abundance will remain the same over time and remain consistent with respect to the distance from a turbine (i.e., the coefficient describing the influence of distance from a turbine on catch is not different from zero). Several statistical models will be compared (e.g., GLM, GLMM, or GAM) with distance treated as a main effect (continuous variable), and the best fitting model for each species will be used to estimate the 90% CI on the before-after change in the distance coefficient. Further, information on depth and bottom temperature collected at sea may be considered as covariates in the model to evaluate their influence on CPUE. Habitat data collected during the benthic SPI/PV surveys (Section 7.0), from Orsted geophysical surveys, or at sea (using the sounder to broadly classify habitat) can also be considered as covariates in the model to evaluate the influence of habitat on CPUE. Graphical methods and descriptive statistics will be used to assess changes in CPUE over time, as a function of distance from the turbine foundations. These graphical techniques may help to elucidate the spatial scale at which relative abundance changes the most with distance from the turbine foundation. Data analysis will be performed in accordance with the BOEM fishery guidelines.

This study design assumes that each fish pot along a trawl will sample independently from the other pots on the trawl. However, given the desire to sample intensively at locations adjacent to the turbine foundations, the density of fish pots (and thus density of bait) will not be homogenous along the length of each trawl. Therefore, this assumption should be evaluated. Graphical comparisons of CPUE at each pot along a string, particularly during the pre-construction period (before the habitat associated with turbines and scour protection are introduced) will help to elucidate whether the density of pots along a string influences CPUE. In particular, given that the five pots that will be deployed closest to the turbine will only be spaced 10m apart, the CPUE in these five pots should be compared to the other pots along the string to determine the potential influence of fish pot density and spacing on catch rates.

Table 4. Summary of the planned analyses for the fish pot survey.

Design Overview	Design details	Metrics of Interest	Research Question	Post-Construction Statistical Methods
Impact only (no reference sites); pots at distances ranging from ~10m to ~900m from turbine; April - October (1x per month); 24 hour soak time	**Sampling frame** = single direction from turbines in SFW **Observational unit** = individual pot (turbines and string locations fixed throughout study). **Response variable** = annual mean CPUE per distance **Error variance** = among replicate pots at the same distance (turbines provide replication).	**Catch** of key species (black sea bass, scup, tautog)	What is the pattern of temporal change (B/A) in catch as a function of distance from turbine?	Fit the GLM (or GLMM or GAM) that best describes the data; estimate the 90% CI on the B/A contrast for the distance effect. Biological and physical covariates (from Benthic SPI/PV Survey) will be considered, along with other covariates (T, depth). Graphical assessment of changes (B/A) in catch over distance and time.
	Observational unit = individual fish/invertebrate **Response variable** = length **Error variance** = among individual fish/invertebrates	**Length frequency**	How does size structure change over time (B/A)? How does size structure compare between areas (C/I)?	1. descriptive (range, mean) 2. graphical and statistical comparison (between times and locations) of ECDFs using distributional comparison test (e.g., Kolmogorov-Smirnoff).
	Observational unit = individual fish **Response variable** = condition index **Error variance** = among individual fish	**Fish condition index** (i.e., deviations from log-length vs log-weight relationship) by species	What is the magnitude of change in fish condition over time (B/A), or between areas (C/I)?	Find the best fitting model to the condition values by species, and calculate 90% CI of the relevant contrasts.

Definitions:
BAG = before after gradient
90% CI = 90% confidence interval
ECDF = empirical cumulative distribution function

An adaptive sampling strategy is being proposed as part of this monitoring plan. Upon completion of sampling in 2021, and again following sampling in 2022, an evaluation will be conducted of the statistical power associated with this sampling design. This analysis will use an approach similar to what was performed for the ventless trap lobster survey (Appendix D) but made relevant to the study design and model used for this survey. Potential impacts on relative abundance from windfarm operation may include: an overall change in the mean CPUE over time, a step change in the mean at some distance from the turbine foundations during the operation period, or a gradual change in abundance expressed as a function of distance from the foundations (e.g., a slope in a regression equation). The variance (e.g., RSE) associated with the relative abundance estimates for black sea bass and scup will be calculated for the data from years 1 and 2. Using the observed variance estimates, power curves will be used to demonstrate how expected statistical power varies as a function of effect size (i.e., the magnitude of change) and sample size (i.e., number of turbines sampled). For this assessment of the potential impact on the relative abundance of black sea bass and scup, 90% confidence (two-tailed $\alpha = 0.10$) and at least 80% power ($\beta = 0.20$) will be used to ensure that the monitoring will have a probability of at least 80% of detecting a targeted effect size, if it is present.

The results of the power analysis may be used to modify the monitoring protocols in subsequent years. The decision to modify sampling will be made after evaluating several criteria including the amount of variability in the data, the statistical power associated with the study design to detect a targeted effect size, and the practical implications of modifying the monitoring protocols. For example, if the power analysis demonstrates that the proposed sampling will not achieve the desired level of statistical power, sampling intensity may need to be increased, which could be achieved throughout the remainder of the study by sampling additional turbines, by sampling the existing stations more often each month (e.g., two monthly sampling events, rather than one), or by increasing the duration of the post-construction monitoring.

6.0 Acoustic Telemetry

Passive acoustic telemetry can monitor animal presence and movements across a range of spatial and temporal scales. For instance, each acoustic receiver provides information on the fine-scale (tens to hundreds of meters) residence and movement of marine organisms. Acoustic receivers also offer continuous monitoring, allowing for behavior, movements, and residence to be investigated at a fine temporal scale (e.g., diel, tidal, etc.). By leveraging observations collected across individual receivers, and receiver arrays, telemetry can also monitor animal presence and movement over a broad spatial and temporal extent. Therefore, passive acoustic telemetry is an ideal technology to not only collect pre-construction data on species presence within WEAs, but also to monitor and evaluate short and long-term impacts of wind energy projects on species presence, distribution, and persistence.

The use of passive acoustic telemetry has grown dramatically over the past decade and continues to grow each year (Hussey et al. 2015). As a result of this rapid growth, hundreds to thousands of acoustic receivers are deployed each year in the northwest Atlantic from the Gulf of St Lawrence to the Gulf of Mexico, each of which is capable of detecting the thousands of active transmitters that are currently deployed on at least 40 species including, among many others, sturgeon, striped bass, sea turtles, sharks, bluefin tuna, and black sea bass.

In particular, acoustic telemetry has proven to be a valuable research tool to understand the seasonal movements, spawning behavior, and spawning site fidelity of Atlantic cod in the Gulf of Maine (e.g., Dean et al., 2014, Zemeckis et al., 2014; Zemeckis et al., 2019). Cod have been observed to spawn in the waters of southern New England, primarily between December and March, with evidence of spawning on Cox Ledge and also in the surrounding areas to the south and west of Cox Ledge (Dean et al., 2020; Cadrin et al., 2020; Langan et al., 2020; Inspire Environmental, 2020). In addition, the Atlantic Cod Stock Structure Working Group concluded that cod in southern New England likely comprise a unique biological stock, that is distinct from the adjacent Georges Bank and Gulf of Maine stocks (McBride et al., 2020). Therefore, monitoring for the impacts of offshore wind development for cod in SFWF has been recognized as a priority.

Inspire Environmental recently completed a rod and reel survey of cod in the SFWF project Area and nearby locations over two winters, to identify spawning aggregations and examine the spatial distribution of cod during the spawning season (Inspire Environmental, 2020). While the rod and reel study provided valuable information, inferences were generally limited by the low sample sizes (e.g., mean daily catch rates of <1 cod per angler) obtained using this method. Given our inability to conduct a trawl survey within SFWF, and the sample size limitations that would likely be associated with an additional rod and reel survey, SFW considered acoustic telemetry to be the most suitable tool to collect high-resolution information on the seasonal distribution of Atlantic cod in SFWF and surrounding areas.

6.1 Ongoing Telemetry Research

SFW will coordinate with, and provide contributions to, ongoing acoustic telemetry projects in and around the SFWF site. There is an ongoing BOEM-funded study that is using passive acoustic telemetry to monitor the seasonal distribution and spawning activity of Atlantic cod on and around Cox Ledge, including within the SFWF work area (Figure 7). This Project includes scientists from the Massachusetts Division of Marine Fisheries, the UMass Dartmouth School for Marine Science and Technology, Rutgers University, the Nature Conservancy, Woods Hole Oceanographic Institute, and the NEFSC. To date, approximately 40 adult cod have been tagged with Vemco V16-4H acoustic transmitters, and additional tagging trips are planned for the fall and winter of 2020 to deploy the remaining transmitters. All tagging trips have been conducted on local for-hire recreational fishing vessels.

The movements and residency patterns of tagged cod are being monitored using fixed-station passive acoustic receivers, as well as a receiver that is attached to an autonomous glider. Ten acoustic receivers were deployed from a commercial gillnet vessel in November 2019, and the receiver array will remain in the water until at least May 2021. The autonomous glider allows for tagged fish to be detected over a wider area than is possible using the fixed-station receivers. In addition, the glider also collects environmental data including temperature, dissolved oxygen, and turbidity. In addition to the acoustic receiver and environmental sensors, the glider is also equipped with a Passive Acoustic Monitoring device, which is used to record and document the vocalizations of whale species in the study area, and the glider data is available in near real-time on the web (http://dcs.whoi.edu/cox1219/cox1219_we16.shtml). The glider deployments were scheduled to coincide with the presumed peak spawning season for Atlantic cod in southern New England. The autonomous glider was deployed in December 2019 and remained in the water until March 20th, 2020. The glider will be deployed again during the next two winters (December 2020-March 2021, and December 2021-March 2022).

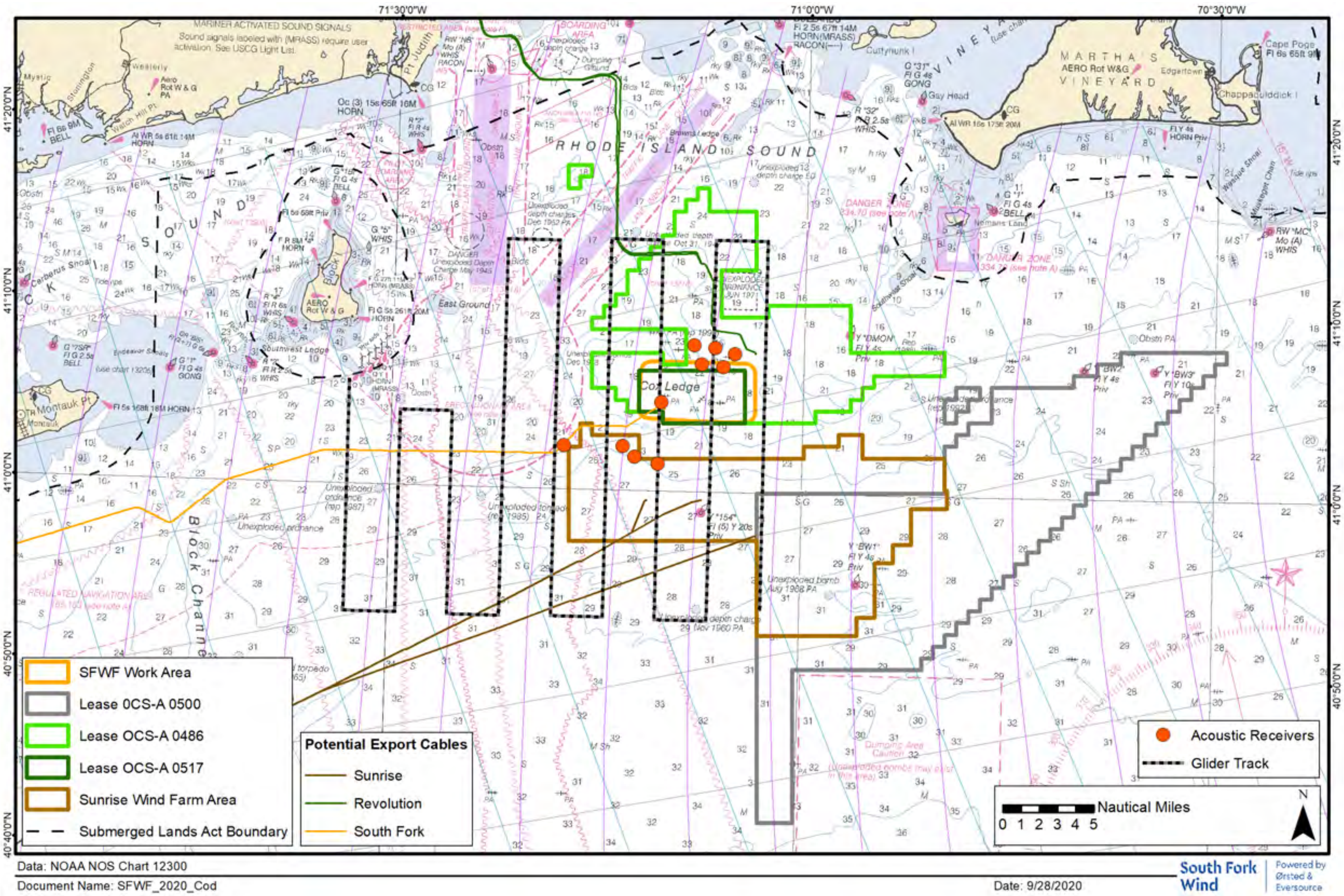


Figure 7. **Study site for the Atlantic cod acoustic telemetry study, including the location of the fixed-station acoustic receivers. The general track of the autonomous glider is also shown.**

A second acoustic telemetry study, which began in the summer of 2020 and is scheduled to continue through 2021, will examine the presence and persistence of Highly Migratory Species (HMS) at popular recreational fishing grounds in the southern New England WEAs. INSPIRE Environmental has partnered with the Anderson Cabot Center for Ocean Life (ACCOL) at the New England Aquarium to use passive acoustic telemetry to monitor the pre-construction presence and persistence of bluefin tuna, blue sharks, and shortfin Mako sharks in the southern New England WEAs. These species have been identified as three of the most commonly captured and targeted species by the offshore recreational community in southern New England (NOAA, 2019). Fifteen acoustic receivers were deployed in July 2020 at three popular recreational fishing sites within the WEAs identified through a previous recreational fishing survey carried out by the ACCOL (Kneebone and Capizzano, 2020). The receivers were deployed strategically in conjunction with the Atlantic cod receiver array, to maximize spatial coverage for both projects. Tagging trips have been conducted collaboratively with the recreational fishing community to target and tag 20 individuals of each of the three HMS species listed above.

As part of the pre-construction monitoring, SFW will provide financial support to strengthen these ongoing telemetry projects and contribute more broadly to regional telemetry research in the northwest Atlantic.

6.2 Acoustic Telemetry Methods

SFW will contribute to these ongoing acoustic telemetry efforts by providing additional funding to support these projects. SFW will provide support to the cod telemetry project team to purchase additional VR2W receivers that can be used to replace receivers that are lost during the course of the project, allowing the project team to maintain the scope of the receiver array. Further, SFW will also provide funds to the cod telemetry project to purchase the mooring equipment (e.g., line, buoys, anchors, etc.) that is needed to retrofit the receiver moorings that are currently being used. The purpose of retrofitting the receiver moorings is to minimize the loss of receivers, which will increase the spatial and temporal extent of coverage, help maintain data integrity, and allow the project to meet its' monitoring objectives. As part of the ECO-PAM project, an acoustic receiver has also been deployed near SFWF (41.06N 70.83W).

Additionally, SFW will provide financial support to the HMS telemetry project. This support will be used to purchase an additional two VR2-AR receivers, as well as additional replacement receivers needed to maintain the array if receivers are lost. These two receivers will be placed strategically within the SFWF site in November 2020 to enhance the spatial coverage of the receiver array prior to the cod spawning season. These receivers will remain in the water until March or April of 2022 in order to detect tagged HMS species, and to bolster the resolution of the telemetry array in SFWF during the cod spawning season. In addition, SFW will provide the funds needed to keep some (e.g., n = 3 to 5) of the HMS project's receivers deployed year-round, rather than having the receivers removed from the water each November, as was initially planned. The purpose of keeping the receivers in the water year-round is to increase the spatial scope of the receiver array during the winter months when cod spawning occurs on Cox Ledge and in the surrounding areas (Dean et al., 2020; Langan et al., 2020). Receivers will be rigged using standard procedures outlined by Vemco for benthic deployment (https://www.vemco.com/wp-content/uploads/2015/01/vr2ar-deploy-tips.pdf). Further, SFW will provide salary support for the PI's from the HMS telemetry study (Dr. Kneebone and Mr. Gervelis) to compensate them for their time associated with the year-round maintenance of the receiver array, and analysis of the detection data.

These financial investments will bolster both ongoing telemetry projects and increase the spatial and temporal resolution of information that is collected, particularly during the cod spawning season (December through March). The high-resolution data collected using acoustic telemetry will provide a valuable supplement to the monitoring plan and improve our understanding of cod habitat use within the SFWF area, particularly during the spawning season, which is a time period that is not well sampled by the regional fishery independent surveys, and a time period for which there is limited fishery-dependent data collected for the recreational fishery.

6.3 Data Analysis and Data Sharing

The resulting detection data downloaded from acoustic receivers will be analyzed with the overall goal of establishing pre-construction information on species presence and persistence in SFWF. Short- and long-term presence, site fidelity (i.e., residency/persistence), fine- and broad-scale movement patterns, and inter-annual presence at SFWF (i.e., whether individuals return to the receiver array each year) will be examined. Any detection data obtained through our participation in regional telemetry data sharing networks will be incorporated into this analysis, particularly to examine the distribution and movements of species beyond the confines of SFWF. Deliverables include detailed detection history plots for each tagged individual that depict all detections logged for an animal over the course of a year. Summary tables and figures will be generated that describe: the number of times each fish was detected by receivers in SFWF, the detection history for each fish, the total number of receivers it was detected on, movements, and monthly patterns in presence and persistence. In addition to the local-scale acoustic monitoring achieved by the proposed receiver array, broad-scale movement data will be accomplished through participation in regional telemetry data sharing programs, in an attempt to obtain detection data from our tagged animals wherever else they are detected in the greater Atlantic region.

All detection data recorded by the acoustic receivers in this Project will be distributed to researchers through participation in regional telemetry networks such as the Ocean Tracking Network or the Mid-Atlantic Acoustic Telemetry Network (MATOS). We will compile any detection data that we collect for transmitters that are not deployed as part of the proposed Project and disseminate that information to the tag owners (it is the policy of regional data sharing programs that the 'owner' of the data is the entity that purchased and deployed the transmitter, not the entity that detected it on their receiver). We will also approach each transmitter's owner to request the inclusion of their data (i.e., metadata on the species detected, number of detections, amount of time the animal was detected in our receiver array, etc.) in any analyses performed. Ultimately, participation in these large data sharing networks will increase both the spatial and temporal extent of monitoring for species tagged as part of this research effort and permit the collection of data on the presence and persistence of other marine species tagged with acoustic transmitters (e.g., Atlantic sturgeon, striped bass, white sharks) in and around SFWF at no additional cost.

7.0 Benthic Survey – Sediment Profile Imaging – Plan View and Video

Installation and operation of OSW projects can disturb existing benthic habitats and introduce new habitats, with the level of impact and recovery from disturbance observed to vary depending on existing habitats at the site (HDR 2017, Wilhelmsson and Malm 2008). Habitat alteration during construction may include boulder relocation; mechanical or hydraulic disturbance of sediments; and placement of scour protection layers (Dannheim et al. 2020). After installation, the WTG structure introduces supratidal to subtidal hard habitat to the project site: hard vertical substrates and, depending on the type of foundation and the degree of scour protection used, a range of horizontal habitat complexity (Langhamer, 2012).

Over time (3-6 years), the introduction of the hard substrata (novel WTG surfaces, scour protection layers, cable protection layers, and natural boulders) can lead to extensive biological growth over the unoccupied surfaces with a complex pattern analogous to shoreline intertidal to subtidal zonation (artificial reef effect, Petersen and Malm 2006, Ruebens et al. 2013). This biological growth has led to dense accumulations of filter feeding mussels in the intertidal (i.e., on the turbines at the water surface) followed by amphipods, tunicates, sponges and sea anemones in the subtidal in Europe (De Mesel et al., 2015) and at the Block Island Wind Farm (BIWF, HDR 2020). The high-volume filter feeders (mussels) capture phytoplankton and marine snow and discharge large volumes of pseudofeces (organic mineral aggregates with high carbon content) that settle to the seafloor (Lefaible et al., 2019). Three to six years after installation, seafloor locations <50 m from the foundation showed evidence of finer sediments and increased organic matter compared to locations 350-500 m away (Lefaible et al., 2019).

The epifaunal species colonizing the new hard bottom substrata are also of direct interest. In New England waters, non-native species have been identified as potential competitors for space with native species and commercial harvests of shellfish (Lengyel et al. 2009, Valentine et al. 2007).There is evidence at BIWF that the introduction of mussels led to mussel colonization of adjacent subtidal hard and soft bottom habitats (HDR 2020, Wilber et al. 2020). At BIWF and European projects, native and non-native species (e.g., at BIWF colonial tunicates, *Didemnum vexillum*) have been observed to colonize new hard bottom substrate within six months to two years (HDR 2020, Guarinello and Carey, 2020). *D. vexillum* has been observed within the SFWF project area, but there is limited information available to understand the current abundance and distribution of *D. vexillum* on hard bottom habitats (Deepwater Wind South Fork 2020).

These observations from existing OSW projects lead to two prevailing hypotheses of likely effects:

1. Enrichment of seafloor conditions from WTG artificial reef effect within 3-6 years (1-100 m from WTG) leading to fining and higher organic content of soft bottom habitats.

2. Introduction of attached organisms (both native and non-native) to existing natural hard bottom habitats with potential for rapid colonization of relocated boulders.

The consequences of these predicted effects are to potentially affect the function of soft and hard bottom habitats to provide food resources, refuge, and spawning habitat for commercial fish and shellfish species (Reubens et al., 2014, Krone et al. 2017).

For this operational monitoring plan, monitoring of soft bottom habitats will focus on measuring physical changes and indicators of benthic function (bioturbation and utilization of organic deposits, Simone and Grant 2020) as a proxy for measuring changes in the community composition. Monitoring of hard bottom habitats will focus on measuring changes in macrofaunal attached communities (native vs. non-native species groups), percent cover, and physical characteristics (rugosity, boulder density) as a proxy for measuring changes in the complex food web. The schedule for monitoring these two benthic habitats is outlined in Table X and discussed in more detail in the following sections. These indicators of the function of soft and hard bottom habitats provide quantitative data, can support rapid data collection and analysis, and lead to effective management actions (mitigation). They are not designed to answer research questions.

Table 5. Schedule of soft bottom and hard bottom benthic surveys

Survey	Soft bottom WTG	Soft bottom SFEC	Hard bottom Turbine surface	Hard bottom IAC
Season	Late summer	Late summer	Late summer	Late summer
Pre seabed preparation	SPI/PV – within 6 months prior		SPI/PV – within 6 months prior	MBES, SSS, ROV – within 12 months (timed to avoid gear conflicts)
Post seabed preparation				MBES, SSS, ROV - within 1 month
Post construction Year 0	SPI/PV – earliest Late summer after construction	SPI/PV – earliest Late summer after construction	ROV – earliest Late summer after construction	ROV – earliest Late summer after construction
Post construction Year 1	SPI/PV	SPI/PV	ROV	ROV
Post construction Year 2			ROV	ROV
Post construction Year 3	SPI/PV	SPI/PV	TBD	TBD
Post construction Year 4				
Post construction Year 5	SPI/PV	SPI/PV		
Post construction Year 6	TBD	TBD		

TBD is adaptive monitoring if evidence that location is still changing from previous sampling period

7.1 Soft Bottom Monitoring

Soft bottom monitoring will be conducted within the project area and along the SFEC with a Sediment Profile and Plan View Imaging (SPI/PV) system. SPI/PV provides an integrated, multi-dimensional view of the benthic and geological condition of seafloor sediments and will support characterization of the function of the benthic habitat and physical changes that result from construction and operation of SFWF.

A SPI/PV survey will characterize the geological (sediment size and type) and benthic (animal habitat) characteristics of the soft-sediment areas with consideration of potential effects from wind farm operation. A PV survey will characterize surficial geological and biotic (epifaunal) features of hard-bottom areas within the sample area but will not replace a dedicated hard bottom survey (Section 7.2).

Existing benthic data from the SFWF area and the SFEC were primarily collected in late summer or fall (August to November), when biomass and diversity of benthic organisms is greatest (Deepwater Wind South Fork 2020, HDR 2017, 2019, NYSERDA, 2017, Stokesbury, 2013, 2014; LaFrance 2010, 2014). In contrast to fish communities and harvestable benthic species, benthic habitats in the NE Atlantic are generally stable in the absence of physical disturbance or organic enrichment (Theroux and Wigley 1998, Reid et al. 1991, Steimle 1982, HDR 2019). A BAG survey design will be used to determine the spatial scale of potential impacts on benthic habitats and biological communities within the proposed SFWF site and along the SFEC. A single benthic survey conducted in late summer (August to October) six months prior to the start of construction activity will be used to represent benthic habitats prior to potential disturbance. Subsequent surveys will be conducted in the same seasonal time frame at intervals of 1 year, 3 years and 5 years after completion of construction (Table X).

7.1.1 Survey Design/Procedures

The SPI/PV surveys will be conducted at SFWF using fixed stations to assess the spatial scale and extent of wind farm effects on benthic habitat over time. The surveys will be conducted from research vessel(s) with scientists onboard to collect images utilizing a SPI/PV camera system. This system was utilized exclusively for ground-truth imagery of high-resolution geophysical surveys to support benthic habitat mapping within SFWF for EFH characterization and was very effective (Deepwater Wind South Fork 2020). Collecting seafloor imagery does not require disturbance of the seafloor or collection of physical samples. For-hire vessels will be selected based on criteria such as survey suitability, experience, safety record, knowledge of the area, and cost. All survey activities will be conducted with strict adherence to Orsted health and safety protocols to reduce the potential for environmental damage or injury.

Replicate SPI/PV images will be collected at each station, with the number of replicates specific to survey type (*see* Sections 7.1.2 and 7.1.3). Results from the targeted number of replicates with suitable quality images will be aggregated to provide a summary value for each metric by station.

7.1.2 Sampling Stations – Turbine Foundations

The objectives for the soft bottom benthic survey are to measure changes over time in the benthic habitat and physical structure of sediments at varying spatial scales relative to turbine foundations. To accomplish the goals of this survey, data will be collected before and after installation and operation of SFWF using a BAG survey design with statistical evaluation of the spatial and temporal changes in the benthic habitat (Underwood, 1994; Methratta, 2020). The selection of a BAG design is based on an understanding of the complexities of habitat distribution at South Fork and an analysis of benthic data results from European wind farms and the RODEO study at BIWF (HDR 2017, 2019, 2020, Coates et al., 2014; Dannheim et al., 2019; Degraer et al., 2018; LeFaible et al., 2019; Lindeboom et al., 2011). SPI/PV surveys have been conducted within the SFWF and along the SFEC to provide detailed assessment of benthic habitat for EFH consultation (Deepwater Wind South Fork 2020). This information on habitat distribution at SFWF was used to design the surveys specified in this and the following section.

The proposed BAG survey design eliminates the need for a Reference Area, as this design is focused on sampling along a spatial gradient within the area of interest rather than using a control location that may not be truly representative of the conditions within the area of interest (Methratta, 2020). This design also allows for the examination of spatial variation within the wind farm and does not assume homogeneity across sampling stations (Methratta, 2020).

Habitat types mapped within SFWF include glacial moraine, coarse sediment, sand and muddy sand, and a discrete area of mud and sandy mud at the northern boundary (Figure 8). The soft bottom benthic survey will focus only on the mobile sediment classes (sand, muddy sand), while hard bottom areas (glacial moraine with boulders and cobbles) will be addressed in a separate survey (Section 7.2). Turbine locations dominated by glacial moraine within 200m in one or both of the targeted NE-SW directions (i.e., WTG#1, #4, #5, #8 #9, #10, #16A, #17A) will be excluded from the soft sediment sampling frames. In addition, sampling transects will be specifically placed to avoid adjacency to the inter-array cable route (IAC); monitoring for the effects of a buried power cable is the focus of a separate survey (Section 7.1.3).

From the turbines with appropriate soft bottom habitat, any turbines that were randomly selected for the fish pot survey (Section 5.2) will be included in this survey with additional turbine locations randomly selected to achieve a total sample size of eight turbine locations. The selected turbine locations and transect positions will remain fixed for the duration of the survey.

This survey was designed to sample at increasing distances from turbine locations, based on the hypothesis that colonization of epifaunal growth on the turbines will result in changes to the surrounding soft bottom benthic habitat. Enrichment of soft bottom habitats from the artificial reef effect is expected to be most pronounced down current and weaker up current. A current meter record collected for the RI Ocean Special Area Management Plan (Ocean SAMP) indicated that monthly mean currents near SFWF are relatively strong from March through October and generally to the west-southwest (Ullman and Codiga, 2010). Two belt transects (25m wide) of SPI/PV stations will be established to the northeast (up current) and southwest (down current) of the eight selected turbine locations to avoid IAC locations (cable effects addressed in Section 7.4). Pre-construction transects will begin at the center point of the planned foundation with two stations at equal intervals up to the maximum planned extent of the scour protection area (34 m) and then at intervals of 0-10m, 15-25m, 40-50m, 90-100m, 190-200m, and 900m extending outward from the edge of the scour protection area (i.e., a single station at each of eight distance intervals in two directions from each turbine sampled; Figure 9). Post-construction transects will repeat this design at the same turbines and the same sampling intervals. These distances were chosen based on recent research indicating that effects of turbines on the benthic environment occur on a local scale (e.g., Lindeboom et al., 2011; Coates et al., 2014; Degraer et al., 2018; HDR 2019). In the Belgian part of the North Sea, gradient sampling of benthic habitat within wind farms was conducted at close stations and far stations that were up to 500 m away from the turbine foundations (LeFaible et al., 2019). However, recent unpublished data from Belgium indicates some level of enrichment has been recorded between 200-250 m from the turbines after eight years (personal comm. S. Degraer, 4/29/2020). The turbines are proposed to be built in a regular grid pattern, with 1nm spacing between adjacent turbines. The maximum sampling distance (900m) was selected to cover half of the distance between adjacent turbines. These stations characterize habitat changes over time within the wind farm in general, representing potential cumulative effects of the wind farm in aggregate but are not associated with the enrichment hypothesis adjacent to the turbines. Turbines that are part of the fish pot survey will be additionally sampled at distance intervals that coincide with the locations of the fish pots; care will be taken to avoid interaction between the two surveys.

Eight replicate SPI/PV image pairs will be collected at each station; results from six replicate pairs with suitable quality images will be aggregated to provide a summary value for each metric by station.

To provide context for assessment of the potential enrichment effect, the vertical surfaces of all turbines selected for sampling will be surveyed using ROV (*see* Section 7.3.2). These visual surveys of the foundation (around the circumference and at different elevations from sediment surface to water surface) will provide information about cover of epifauna/epiflora on the turbine itself (the presumed source of benthic enrichment) and identification to the lowest practicable taxa without direct sampling of the turbine surface. This information will be considered as explanatory variables for the magnitude and range of benthic enrichment observed in the soft bottom habitat surrounding the turbines.

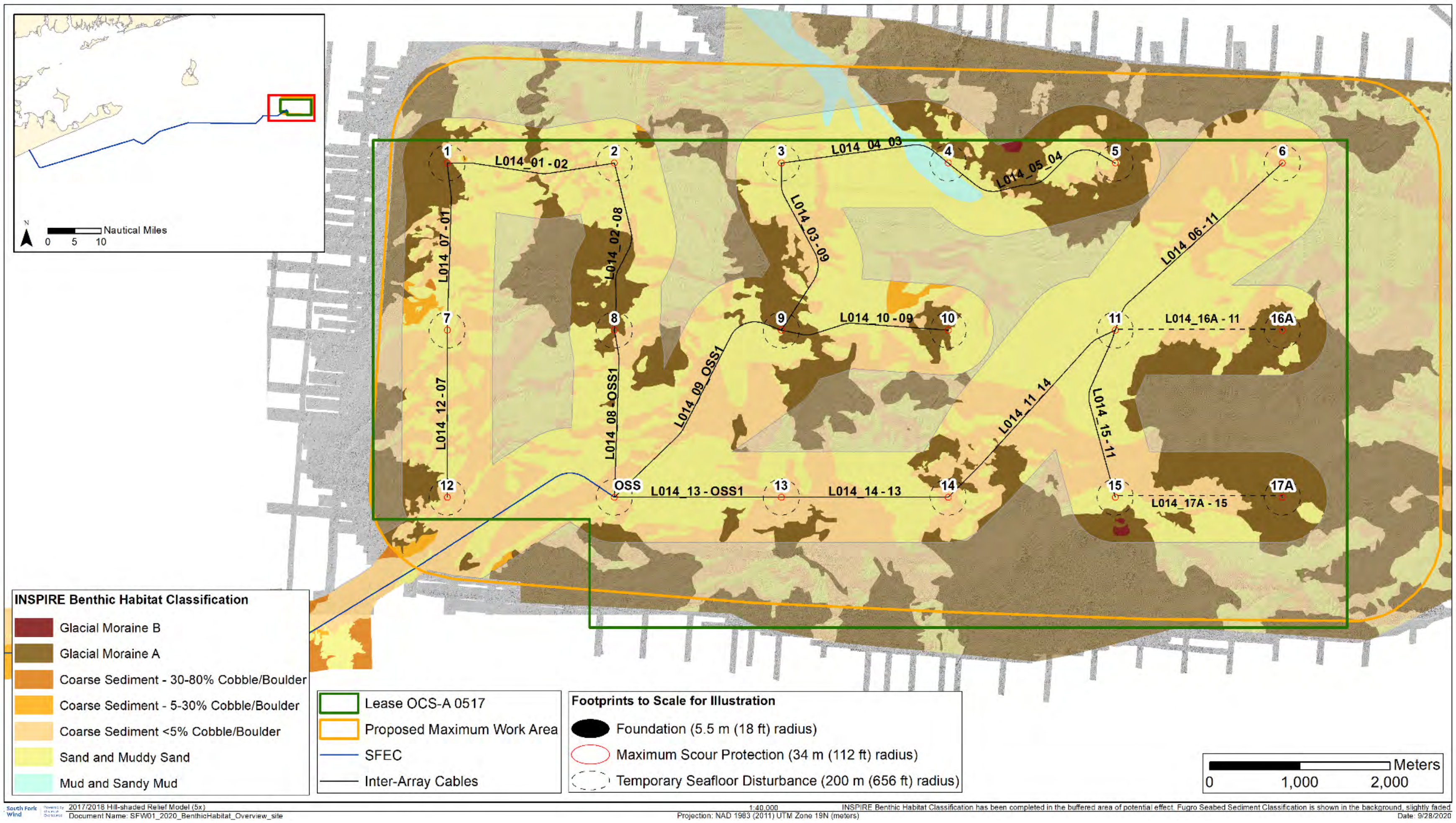


Figure 8. **Benthic habitat map around planned turbine and cable installations. For softbottom benthic survey, eight turbine foundations will be selected from this set to avoid boulder areas (glacial moraine), with consideration and coordination with fish pot survey planning.**

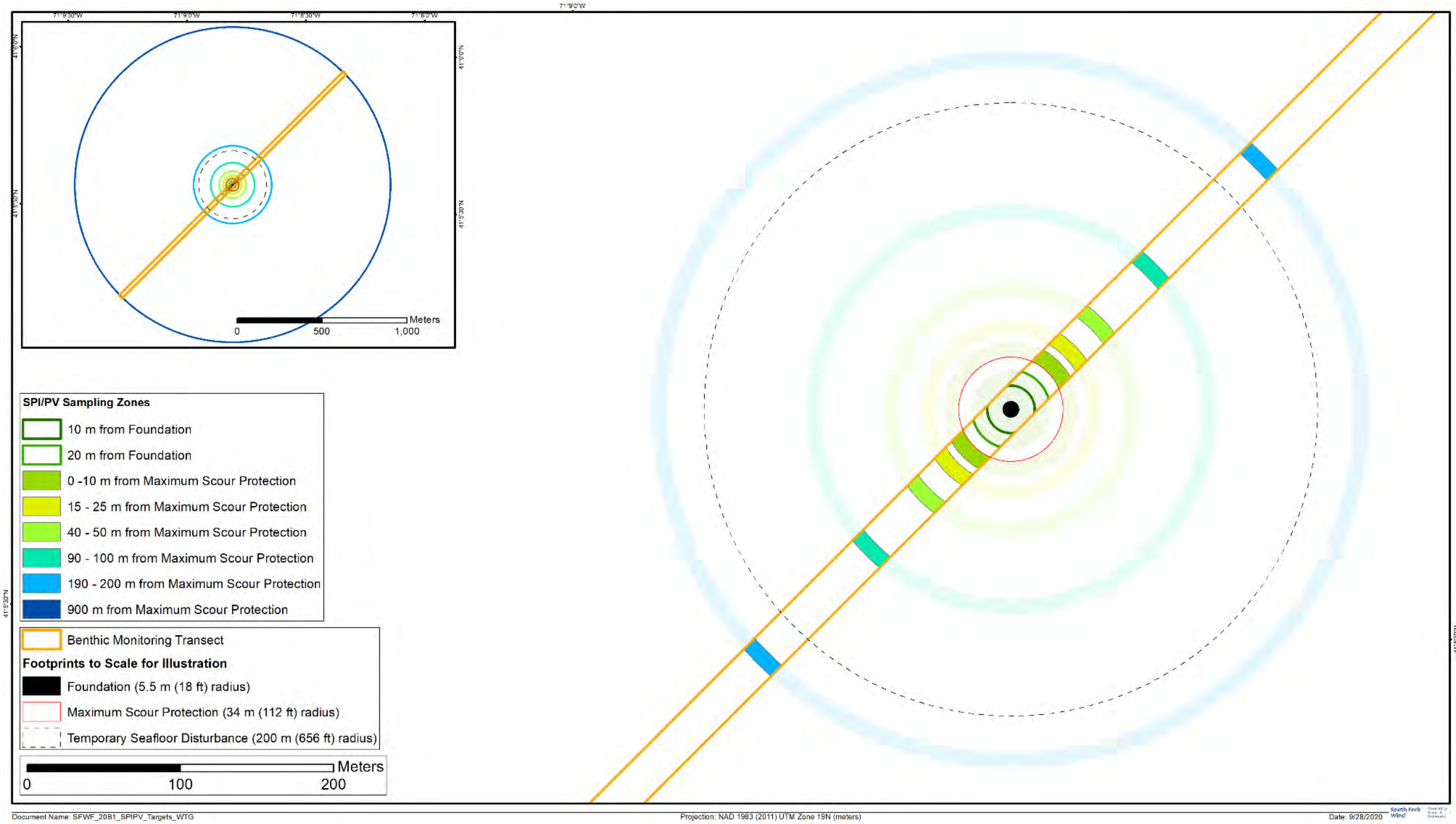


Figure 9. **Proposed soft bottom benthic survey sampling distances.**

7.1.3 Sampling Stations – South Fork Export Cable

The SFEC corridor includes a mix of soft bottom habitats ranging from coarse sand to sandy mud (Deepwater Wind South Fork 2020). The export cable transits areas with active commercial fishing with mobile gear including scallop dredging and trawling for groundfish and squid (Deepwater Wind South Fork 2020). The soft bottom survey sample design is focused on representative sections of the SFEC within areas with historically high fishing activity and areas with lower fishing activity.

Areas of coarse sand with > 30% cobbles or boulders are limited to the first 12 km of the cable route from the SFWF project site and a one km area near the NYS boundary (Figure 10). The effect of boulder relocation will be addressed in the hard bottom survey conducted within SFWF project area (Section 7.2).

The objectives of the soft bottom benthic survey at the SFEC are to examine the effects of installation and operation of an export cable on the benthic habitat using a BAG design (Ellis and Schneider, 1997). Any effects of installation and operation of the cable are expected to be roughly equivalent along the length of the cable. Some effects of installation may be altered by dredging or trawling activities as well as bottom sediment transport from tides and waves. The sampling design is intended to estimate effects along a spatial gradient away from the cable and will not estimate mean changes along the entire SFEC route. To accomplish the goals of this survey, data will be collected before construction and after operation of the SFEC at selected locations, using a BAG design similar to that proposed for the turbine foundations (Section 7.1.2). A 25m wide belt transect will be laid perpendicular to the cable route at six locations along the SFEC (Figure 9). A reconnaissance survey will be conducted prior to the first survey to define transect locations within sand habitats where there is a high expectation of sufficient fine sediment to support a robust benthic community with a measurable response to key variables of benthic health and sediment effects (aRPD, Successional Stage, grain size, sediment layering; *see* Section 7.5.1).

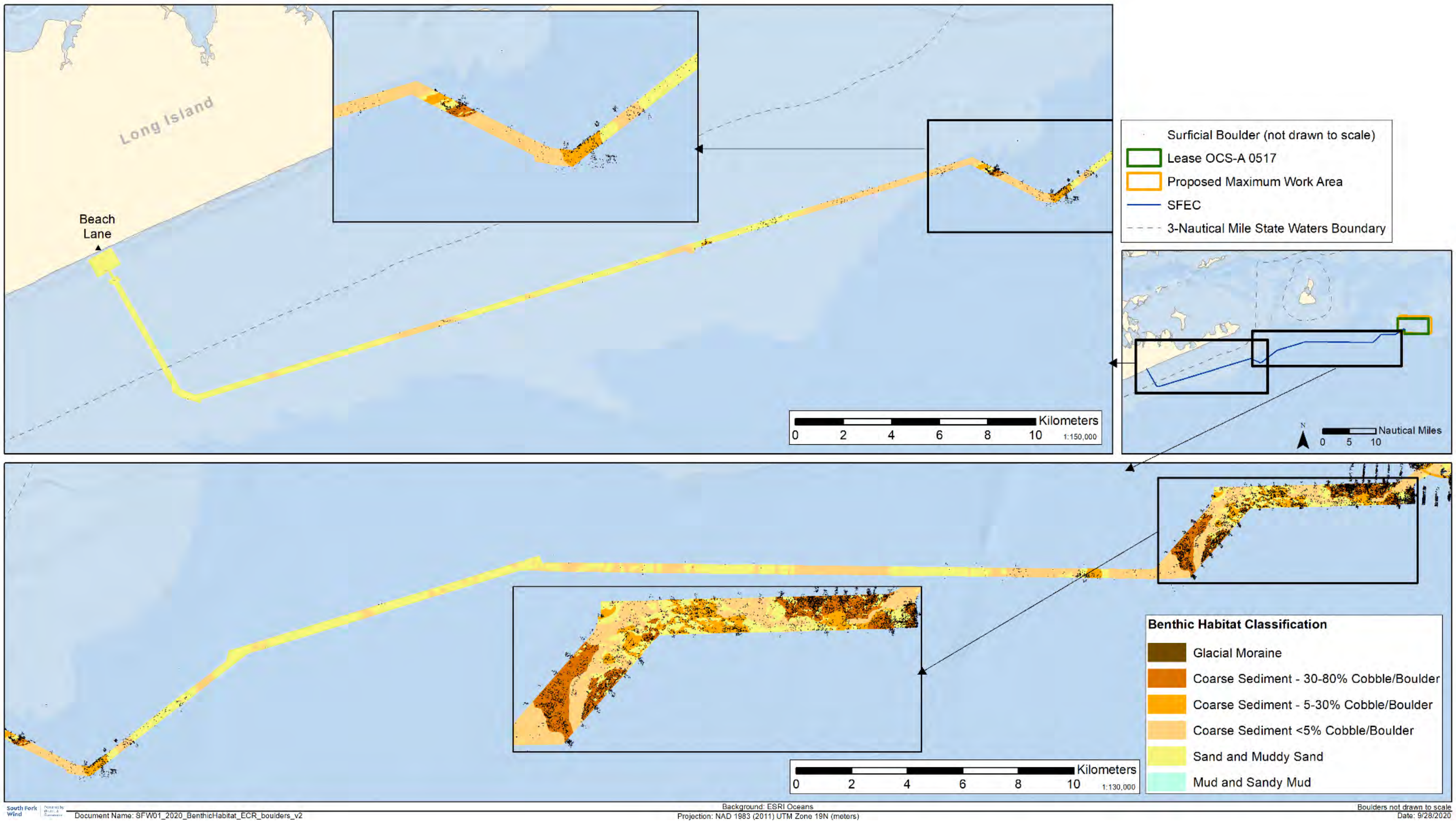


Figure 10. Distribution of benthic habitats along the SFEC with black dots indicating locations of surficial boulders > 0.5 m.

Three of the sampling locations will be distributed in an area where VTR data (2015-2016 or the most recent available) indicated an increased density of fishing activity, and the other three sampling locations will be distributed in similar habitat in areas with lower density of bottom contact mobile gear fishing activity. The process of cable installation will fluidize the sediments within an approximately ten meter wide band around the cable, altering the characteristics of the surface sediments down to two meters. Within the two areas (mobile gear fishing activity present or absent), sampling locations along the cable will be approximately one km apart. At each sampling location, SPI/PV images will be collected at intervals of 0-5, 10-15, 20-25, 30-40, 50-60, 90-100, 190-200, and 1000 meters on either side of the cable. The two sides of the cable are considered separate transects, for a total of six belt transects per area. The selected sampling locations and sampling intervals relative to the cable will remain fixed for the duration of the survey (Figure 11, Table 6). In previous SPI surveys of the SFEC (Deepwater Wind South Fork 2020), variability of habitat characteristics (i.e., aRPD, successional stage) was low among replicate SPI images, so fewer replicates are needed than for the survey at the turbine foundations were variability is expected to be higher. Four replicate SPI/PV images will be collected at each station; results from three replicates with suitable quality images will be aggregated to provide a summary value for each metric by station. An additional benthic survey of the SFEC will be conducted within NYS waters, which is presented in a separate monitoring plan (INSPIRE 2020).

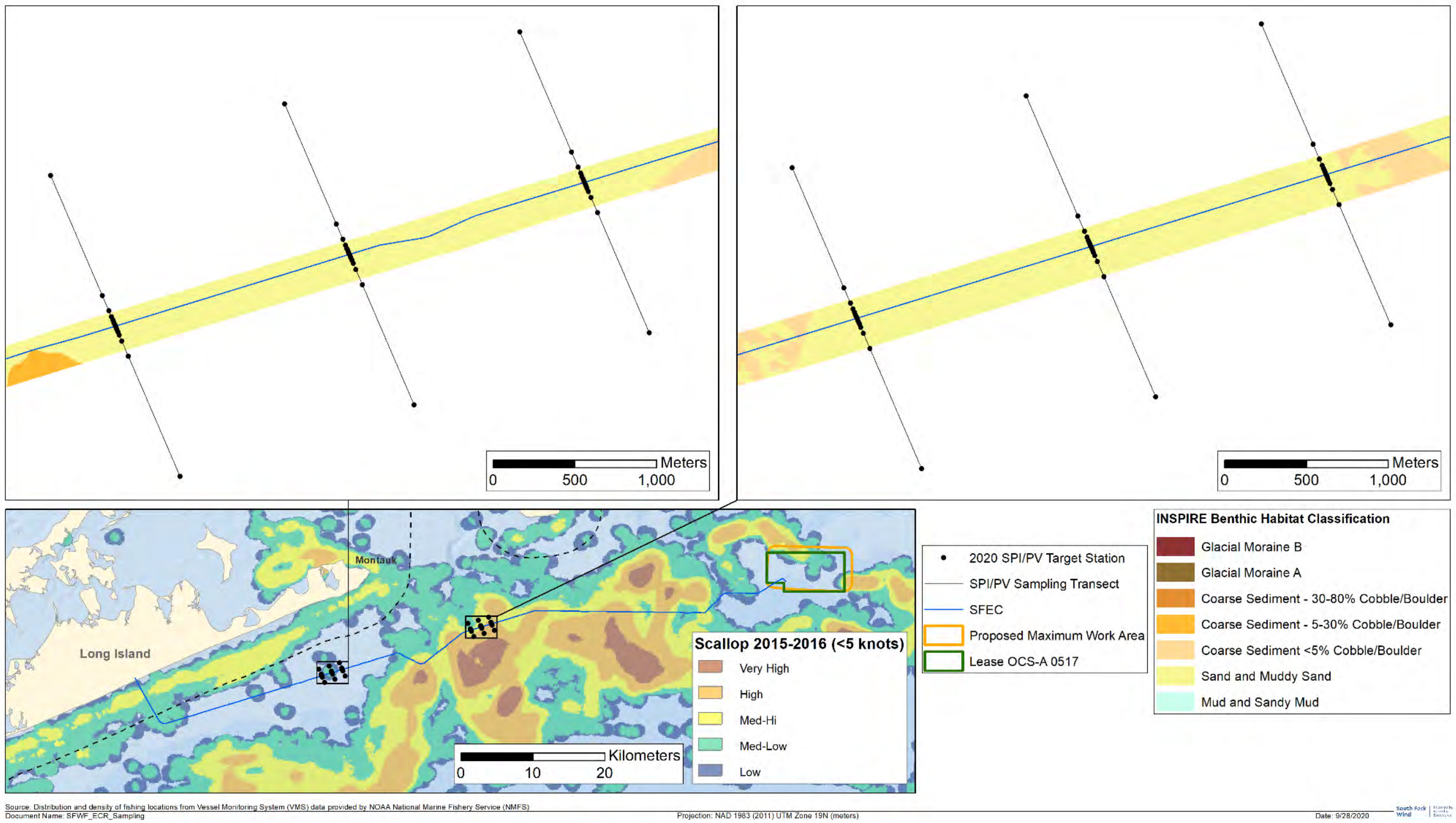


Figure 11. Proposed soft bottom benthic survey sampling design along the SFEC with black dots indicating SPI/PV stations situated along transect perpendicular to the SFEC.

7.2 Hard Bottom Monitoring

An acoustic and ROV video survey is planned to monitor hard bottom substrata within subareas of the SFWF project area. The SFWF benthic habitat includes areas with scattered boulders and cobbles on sandy substrata (Glacial Moraine A, Figure 6). Preparation of the seafloor for installation of the WTGs and IAC is expected to create clusters of natural hard bottom habitat subject to recolonization as well as discrete areas with increased rugosity and boulder density which can provide structural complexity and refuge for finfish and shellfish. Utilizing existing information about hard bottom habitat in areas expected to experience disturbance within the SFWF project area, two areas will be targeted for this survey: the IAC route south of WTG1 and IAC route north of WTG8 (Figures 12 and 13).

The primary objective for the hard bottom survey is to measure changes over time in the nature and extent of macrobiotic cover of hard bottom (i.e., percent cover and relative abundance of native vs. non-native organisms), contrasting undisturbed boulder areas with boulder areas disturbed by seafloor preparation activities for cable installation. The secondary objective is to characterize changes to the physical attributes of habitats in areas disturbed by seabed preparation for installation/construction: rugosity, boulder height, boulder density in relation to structural complexity and potential refuge for finfish and decapods.

Multibeam Echosounder (MBES) and side-scan sonar (SSS) surveys will be used to map hard bottom habitat within 12 months before (timed to avoid conflict with other surveying activities in the project area) and within one month after construction/installation is complete. From these detailed before-after acoustic maps, areas with modified boulder density (boulders > 1m in diameter) can be identified to form the sampling frames for the ROV video and imaging survey, as well as to characterize overall changes to the physical habitat attributes within the areas surveyed.

An ROV survey of boulders will be used to characterize macrobiotic cover of native vs. non-native species in the disturbed and undisturbed areas. A systematic random sample of boulders will occur within the sampling frames of disturbed/undisturbed areas approximately one month after seabed preparation (i.e. boulder relocation) has been completed, and again at six, 12, and 24 months (Table 5, based on observations at BIWF, Guarinello and Carey 2020). This design is based on an understanding of macrobiotic colonization of recently disturbed hard bottom habitat (Guarinello and Carey, 2020; De Mesel et al., 2015, Coolen et al., 2018), and detailed information of the distribution of hard bottom benthic habitat within the SFWF project area (Deepwater Wind South Fork 2020).

7.2.1 Survey Design/Procedures

Within the targeted areas (IAC routes south of WTG1 and north of WTG8), acoustic surveys will provide detailed maps of the seafloor and identify areas where boulders were undisturbed; and areas where boulders were relocated directly adjacent to the prepared IAC route (representing disturbed hard bottom; Figures 10 and 11). A single sampling frame will be identified within each of the disturbed and undisturbed areas for the two WTGs, placed to align with the presence of boulders based on the acoustic survey conducted immediately following seabed preparation for the cable installation. This type of non-probability (opportunistic) sampling will indicate macrobiotic cover within these areas but does not allow inference to the windfarm in general. A total of 20 random boulders from each sampling frame will be sampled using a systematic design.

Within one month after WTGs have been installed, an ROV will be used to collect reference images of the underwater surface of the turbine foundation to determine percent cover of macrofauna and microflora, native and non-native organisms and distribution of key suspension feeding organisms that could contribute to benthic enrichment (mussels, tube-building amphipods, etc.). ROV description and video collection methods are in Section 7.3.2.

The acoustic (SSS and MBES) and ROV surveys will be conducted from a research vessel with scientists onboard to collect acoustic data and images. The acoustic surveys of the two targeted areas will be collected in a single day and processed the following day; the ROV survey will be conducted immediately after processing of the acoustic data. Collecting seafloor imagery does not require disturbance of the seafloor or collection of physical samples. For-hire research vessels will be selected based on criteria such as survey suitability, experience, safety record, knowledge of the area, and cost. All survey activities will be conducted with strict adherence to Orsted health and safety protocols to reduce the potential for environmental damage or injury.

7.2.2 Sampling Stations

The primary objective for the hard bottom survey is to measure changes over time in the nature and extent of macrobiotic cover of hard bottom (i.e., percent cover and relative abundance of native vs. non-native organisms), in disturbed and undisturbed areas. A secondary objective is to characterize overall changes to physical hard bottom habitat as a result of seabed preparation for cable installation. Acoustic methods (SSS and MBES) will be used to map the distribution of hard bottom habitat before and within 1 month after seabed preparation for the cable installation. From these detailed before-after acoustic maps, areas with modified boulder density (boulders > 1m in diameter) can be identified to form the sampling frame for the ROV survey. The sampling will be conducted at regular distance intervals within a single sampling frame (5m wide and 200m or more in length) within each area (1 each in disturbed/undisturbed areas at WTG1 and WTG8, for a total of four frames), placed to capture sufficient density of boulders to sample. The ROV will progress along the centerline of each frame sampling boulders at 10m intervals until 20 samples have been obtained. Boulders may not be present at every planned interval, so sampling will progress as follows: the ROV will search within the 5m width of the sampling area in order to find a boulder to sample; the closest boulder to the target interval will be sampled, and the 10m interval will be reset. At each boulder, a photo image of a minimum 0.5m x 0.5m field of view of the visible portions of the boulder will be collected from which cover and native/non-native species will be identified. Data collected to inform the habitat characteristics for each sampling frame will include: rugosity and percent hard bottom to soft bottom from the acoustic surveys; height of boulder and percent cover of native and non-native species from the ROV survey.

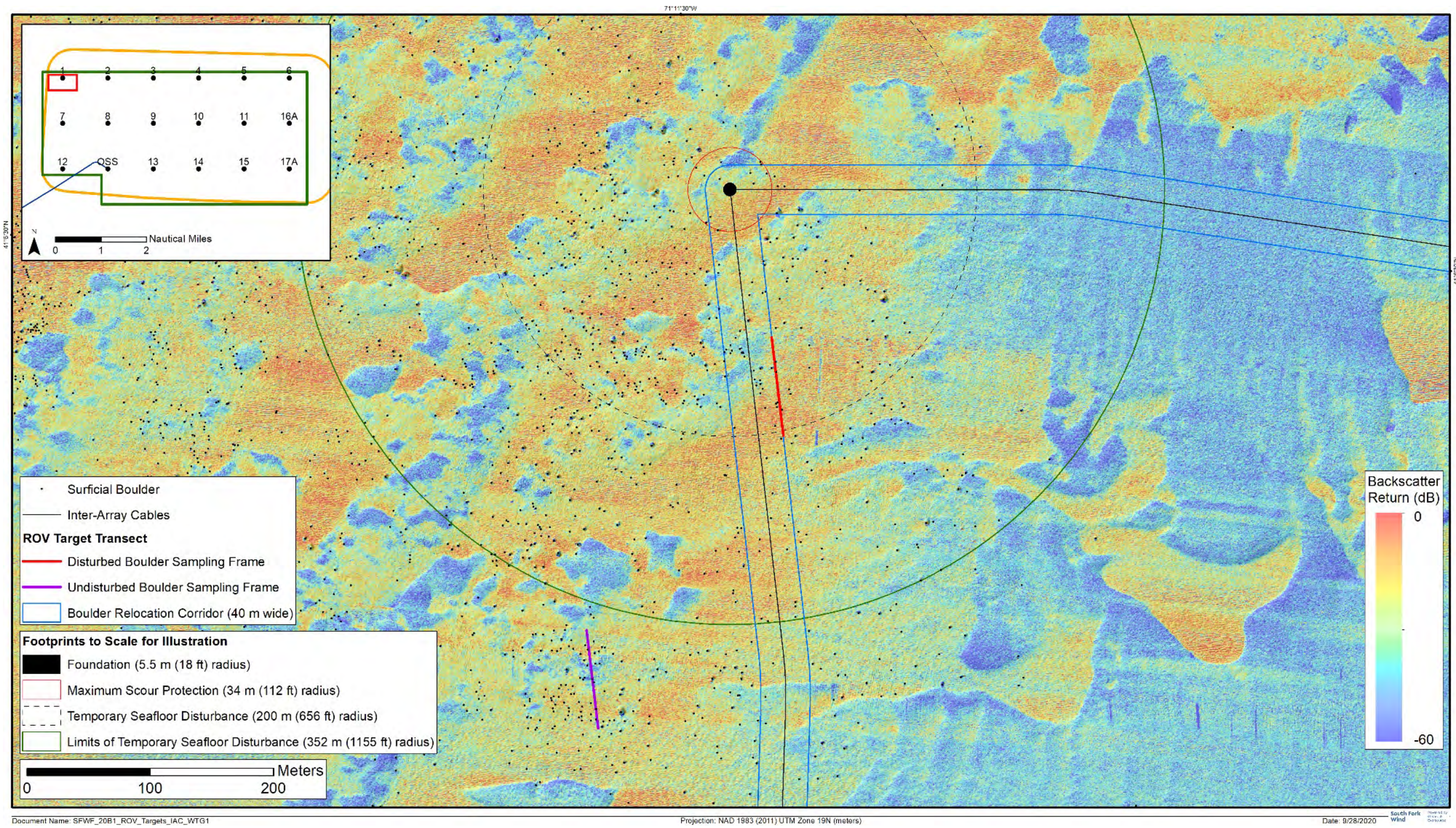


Figure 12. **Proposed hard bottom benthic survey sampling design along the IAC at WTG1.**

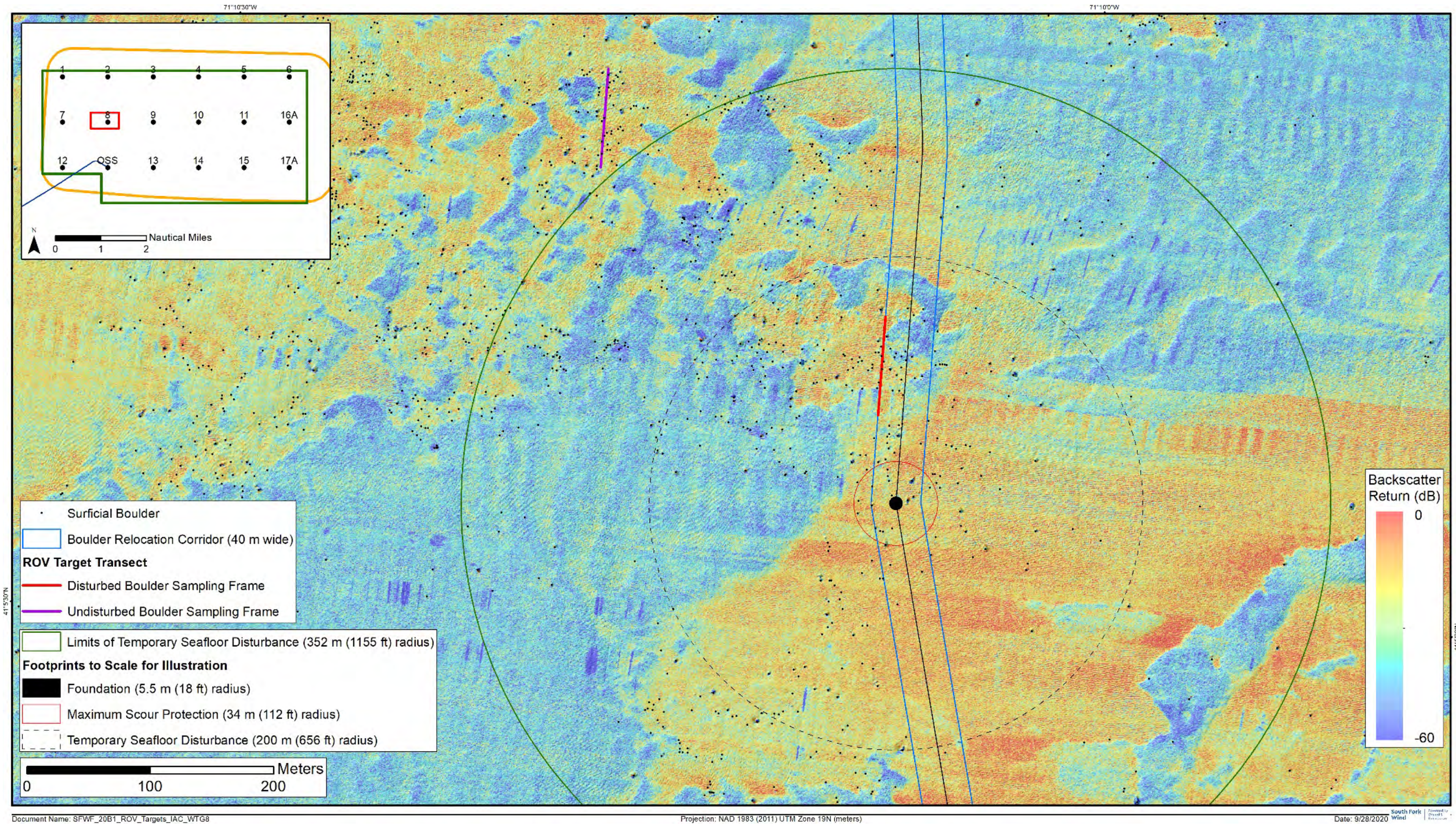


Figure 13. **Proposed hard bottom benthic survey sampling design along the IAC at WTG8.**

7.3 Field Methods General

A V102 Hemisphere vector antenna (or equivalent) will be deployed on the vessel to allow for accurate vessel heading as well as a differential position accuracy to within a meter. During mobilization, the navigator will conduct a positional accuracy check on the antenna by placing the antenna on a known GPS point and ensuring the antenna's position falls within a meter of the known coordinates. During operations, HYPACK Ultralite software will receive positional data from the antenna in order to direct the vessel to sampling stations.

The Field Lead Scientist will ensure that samples are taken according to the established protocols and that all forms, checklists, field measurements, and instrument calibrations are recorded correctly during the field sampling.

7.3.1 SPI/PV Field Data Collection

The SPI and PV cameras are state-of-the-art monitoring tools that collect high-resolution imagery over several meters of the seafloor (plan view) and the typically unseen, sediment–water interface (profile) in the shallow seabed. PV images provide a much larger field-of-view than SPI images and provide valuable information about the landscape ecology and sediment topography in the area where the pinpoint "optical core" of the sediment profile is taken. Unusual surface sediment layers, textures, or structures detected in any of the sediment profile images can be interpreted considering the larger context of surface sediment features. The scale information provided by the underwater lasers allows accurate density counts or percent cover of attached epifaunal colonies, sediment burrow openings, or larger macrofauna or fish which may have been missed in the sediment profile cross section. A field of view is calculated for each PV image and measurements taken of parameters outlined in the survey workplan.

Once the vessel is within a 5 m radius of the target location, the SPI/PV camera system will be deployed to the seafloor. As soon as the camera system has made contact with the seafloor the navigator will record the time and position of the camera electronically in HYPACK as well as the written field log. This process will be repeated for the targeted number of SPI/PV replicates per sampling station (i.e., eight at the turbine foundations, four at the SFEC). After all stations have been surveyed the navigator will export all recorded positional data into an Excel sheet. The Excel sheet will include the station name, replicate number, date, time, depth, and position of every SPI/PV replicate.

Acquisition and quality assurance/quality control of high-resolution SPI images will be accomplished using a Nikon D7100 or D7200 digital single-lens reflex (DSLR) camera with a 24.1-megapixel image sensor mounted inside an Ocean Imaging Model 3731 pressure housing system. An Ocean Imaging Model DSC PV underwater camera system, using a Nikon D7100 or D7200 DSLR, will be attached to the SPI camera frame and used to collect PV photographs of the seafloor surface at the location where the SPI images are collected. The PV camera housing will be outfitted with two Ocean Imaging Systems Model 400 37 scaling lasers. Co-located SPI and PV images will be collected during each "drop" of the system. The ability of the PV system to collect usable images is dependent on the clarity of the water column, the ability of the SPI system to collect usable images is dependent upon the penetration of the prism.

7.3.2 Acoustic and Video Data Collection

Targeted high-resolution acoustic surveys (SSS and MBES) will be conducted over the selected IAC corridors after boulder relocation and again after all construction has been completed to map boulder locations within the survey areas. Survey areas will include existing undisturbed boulder distributions in selected areas adjacent to the IAC corridor to facilitate comparison between disturbed and undisturbed boulders. Existing MBES and SSS data will be used to define the survey areas (Figures 12 and 13).

High resolution video and still images will be acquired at targeted hard bottom areas and turbine foundations with a small remotely operated video system (ROV) comparable to a Seatronics Valor ROV (https://geo-matching.com/rovs-remotely-operated-underwater-vehicles/valor). The positioning components of the ROV would include a surface differential positioning system, an Ultra Short Baseline (USBL), as well as ROV-mounted motion and depth sensors. The USBL transceiver will communicate with acoustic beacons mounted onto the ROV allowing for the vehicle's depth and angle in relation to the transceiver to be known. Adding in the motion and depth sensors on the ROV, all this information will be connected into the ROV navigation software simultaneously tracking both the vessel's position and the ROV's position accurately.

In addition to accurate ROV positioning components, the vehicle will be equipped with powerful thrusters in both horizontal and vertical directions, creating confidence for operating in areas with higher currents. The vehicle will also be equipped with several pilot aids including, auto heading, auto depth, and auto hover. Using these tools, the ROV cameras can focus on any specifically selected habitat features during the survey allowing for better visual observations by scientists. The ROV will also allow location of boulders independent of the vessel and without relying on the vessel speed. With an umbilical and ROV operator controls, the hard bottom habitats can be mapped thoroughly in a shorter time span than a towed video system.

The ROV will supply live video feed to the surface using HD video and UHD still cameras. One pair of cameras will be downward facing to observe and capture high resolution images of seafloor surface conditions while another pair will face forward to collect data on vertical surfaces and avoid collisions. Aiding in the visual data will be high lumen LED lights that will be mounted onto the ROV frame. With sufficient lighting the images transferred to the surface will be clear, allowing for real time observations and adaptive sampling. The recorded video will be transferred to the surface through the ROV's umbilical and recorded using a Digital SubSea Edge DVR video inspection system (or equivalent). The system will provide simultaneous recording of both high definition cameras as well as the ability to add specific transect data overlays during operations. The data overlay will include ROV positioning, heading, depth, data and time as well as field observations.

The ROV will also contain a manipulator arm and basket to collect voucher specimens of encrusting species to ensure accurate identification. Some species such as *D. vexillum* require microscopic investigation to accurately identify.

7.4 Data Entry and Reporting

Data management and traceability is integral to analysis and accurate reporting. The surveys will follow a rigorous system to inspect data throughout all stages of collection and analysis to provide a high level of confidence in the data being reported. Following data entry, all spreadsheets will be proofread using the original handwritten field log. This review will be performed by someone other than the data entry specialist.

SPI and PV image QC checks include comparison of date/time stamps embedded in the metadata of every SPI and PV image to the field log and navigation times to ensure that that all images are assigned to the correct stations and replicates. Computer-aided analysis of SPI/PV images will be conducted to provide a set of standard measurements to allow comparisons among different locations and surveys. Measured parameters for SPI and PV images will be recorded in Microsoft Excel© spreadsheets. These data will be subsequently checked by senior scientists as an independent quality assurance/quality control review before final interpretation is performed. Spatial distributions of SPI/PV parameters will be mapped using ArcGIS.

During field operations, daily progress reports will be reported through whatever means are available (email, text, phone). Upon completion of the survey all analyzed images as well as a data report with visualizations will be provided.

7.5 Data Analysis

7.5.1 Soft Bottom SPI/PV

Seafloor geological and biogenic substrates will be described from SPI/PV using the Coastal and Marine Ecological Standard (CMECS; FGDC, 2012). The Substrate and Biotic components of CMECS will be used to characterize sediments and biota observed. The SPI/PV image analysis approach is superior to benthic infaunal sampling approaches because SPI/PV is more cost effective and more comprehensive. Analysis costs for benthic biological characterization using SPI/PV can be up to 75% lower than those of infaunal abundance counts derived from grab samples. Infaunal abundance assessments provide a limited view of benthic conditions whereas SPI/PV provides a more holistic assessment of the benthos that includes the relationship between infauna and sediments (Germano et al., 2011). Although infaunal abundance values are not generated from SPI/PV analysis, lists of infaunal and epifaunal species observed in SPI/PV images, the percent cover of attached biota visible in PV images, presence of sensitive and invasive species, and the infaunal successional stage (Pearson and Rosenberg, 1978; Rhoads and Germano, 1982; and Rhoads and Boyer, 1982) will be provided as part of the benthic biological assessment.

Indicators of benthic function (bioturbation and utilization of organic material) include infaunal succession stage, feeding voids, methane, *Beggiatoa* and apparent redox potential discontinuity.

The boundary between colored ferric hydroxide surface sediments and underlying gray to black sediments is called the apparent redox potential discontinuity (aRPD). The aRPD is described as "apparent" because of the potential discrepancy between where the sediment color shifts and the complete depletion of dissolved oxygen concentration occurs due to the lag time between when the redox potential (Eh) reaches 0 millivolts (mV) and the precipitation of darker sulfidic sediments (Jorgensen and Fenchel, 1974). However, the mean aRPD measured in SPI is a suitable proxy for the RPD with the depth of the actual Eh = 0 horizon generally either equal to or slightly shallower than the depth of the optical reflectance boundary (Rosenberg et al., 2001; Simone and Grant, 2017). Factors that influence the depth of the aRPD include biological processes such as respiration and bioturbation and physical processes including advection and diffusion. The mean aRPD depth also can be affected by local erosion or physical disturbance. Scouring can wash away fines and shell or gravel lag deposits and can result in a very thin surface oxidized layer. In sandy sediments that have very low sediment oxygen demand (SOD), the sediment may lack a visibly reduced layer even if an RPD is present. Because the determination of the aRPD requires discrimination of optical contrast between oxidized and reduced particles, it is difficult, if not impossible, to determine the depth of the aRPD in well-sorted sands of any size that have little to no silt or organic matter in them. When using SPI technology on sand bottoms, estimates of the mean aRPD depths are often indeterminate with conventional white light photography. For these reasons, the SFEC transects will be located in sandy sediments with sufficient silt to measure aRPD.

Additionally, the benthic macrohabitat (*sensu* Greene et al. 2007) types observed in the SPI/PV survey of the project area will be described. Differences in abiotic and biotic composition of macrohabitats will be compared between pre- and post-construction surveys. In particular, composition and total percent cover of attached fauna on the scour mat and changes in benthic community with distance from the scour mat will be evaluated.

The approach for data analysis of the SPI/PV dataset will include modeling (e.g., GLM, GLMM, or GAM) of individual metrics that are consistently measured across stations (e.g., aRPD, Successional Stage, feeding voids). Covariates in the model for the turbine foundation dataset will include direction (categorical) and distance (continuous) from the turbine; variability among turbines will provide site-wide random error. Additionally, graphical methods and descriptive statistics will be used to assess changes in these metrics over time, as a function of distance and direction from the turbines. These graphical techniques may help to elucidate the spatial scale at which the greatest changes in benthic habitat quality occur.

7.5.2 Hard bottom Video

Video imagery will be reviewed during acquisition and observations will be logged to document biological species and geological features for each video transect. A video viewer will be used to view logs, photos and videos and confirm or add annotations. The system has the capability of taking stills from all the input video signals to document features of interest.

Hard bottom habitat quality will be summarized using the acoustic dataset. For each sampling frame rugosity, boulder height and the ratio of hard bottom to soft bottom habitat will be mapped and quantified. Video from ROV will be used to provide additional qualitative details of habitat quality including presence of fish and decapods, presence of refuge and surrounding substrata (sediment type).

Growth of macrobiotic cover will be summarized for each sampling frame from observations taken with the ROV survey. Mean macrobiotic cover and relative abundance of native vs. non-native species will be summarized for each sampling frame. The mean values may be statistically compared between disturbed and undisturbed areas, specifically for changes over time.

Table 6. Summary of planned analyses for the benthic monitoring surveys.

Report Section	Survey	Design type	Design Overview	Design details	Metrics of Interest	Research Question	Post-Construction Statistical Methods
7.1.2	Benthic Survey (SPI/PV) - SFW	BAG	Impact only (no reference sites); stns at distances ranging from ~10m to ~900m from turbines; 2 directions from each turbine along prevailing current (NE-SW); single season	**Sampling frame** = turbines with soft bottom in NE-SW directions **Observational unit** = SPI/PV station (turbines randomized first survey event, then fixed throughout study; stations randomized every survey; replicate images are subsamples) **Response variable** = mean or max per station depending on metric. **Error variance** = among stations at the same distance-direction (turbines provide replication)	**SPI**: aRPD, Successional Stage, penetration, methane, beggiatoa **PV**: cover (macrobiota, shells, cobble), presence/absence of sensitive or invasive species	What is the pattern of temporal change (B/A) in metrics relative to direction and/or distance from turbine?	Fit the GLM (or GLMM or GAM) that best describes the data; compare the coefficient (B/A) for the distance effect. Calculate similarity between stations; graphically depict relationships between stations from different years, directions, or distances with nMDS.
7.1.3	Soft Bottom Benthic Survey (SPI/PV) - SFEC	BAG	Impact only (no reference sites); stns at distances ranging from ~5m to ~1km from cable; 6 transects in each area with/without bottom disturbance from fishing activity; single season.	**Sampling frame** = two soft bottom areas of SFEC **Observational unit** = SPI/PV station (transects randomized first survey event, then fixed throughout study; stations randomized every survey; replicate images are subsamples) **Response variable** = mean or max per station depending on metric. **Error variance** = among stations at the same distance-direction (transects provide replication)	**SPI**: aRPD, Successional Stage, penetration, methane, beggiatoa **PV**: cover (macrobiota, shells, cobble), presence/absence of sensitive or invasive species,	What is the pattern of temporal change (B/A) in metrics relative to distance from cable?	Fit the GLM (or GLMM or GAM) that best describes the data; compare the coefficient (B/A) for the distance effect. Calculate similarity between stations; graphically depict relationships between stations from different years or distances with nMDS.
7.2	Hard Bottom Benthic Survey (ROV)	SS	Disturbed and Undisturbed at two WTGs; random samples; single season.	**Sampling frame** = Boulders within Disturbed and Undisturbed hardbottom near WTG1 and WTG8 **Observational unit** = imaged quadrat (on systematically sampled boulders within frame) **Response variable** = macrobiotic cover, relative abundance of native vs invasive. **Error variance** = among samples within same treatment (disturbed/ undisturbed) and turbine	**ROV**: cover (macrobiota, relative abundance of native vs. invasive).	What is the magnitude of difference in mean response between disturbed and undisturbed areas, at each survey event?	Estimate 90% CI on the difference of means for disturbed and undisturbed areas, at each survey event.

Definitions:
BAG = before after gradient
90% CI = 90% confidence interval
SS = Systematic (random) sampling

7.5.3 Regional Comparable Datasets

SPI/PV surveys have been conducted for the Block Island, South Fork, Revolution, and Sunrise Wind Farms, and their respective cable routes. Vineyard Wind has a drop camera survey planned for both of their offshore wind leases. The SPI/PV survey will be conducted using methods comparable to those developed by the UMASS Dartmouth School for Marine Science & Technology (SMAST) as part of a regional sea scallop survey (Bethoney and Stokesbury, 2018). The method has been utilized for other image-based surveys and is appropriate for this use. A camera system is dropped to the seafloor and samples four quadrats at defined stations in an area and captures digital images analogous to the PV images outlined above.

8.0 Data Sharing Plan

The fisheries monitoring data associated with the gillnet survey, beam trawl survey, ventless trap survey, fish pot survey, and benthic habitat monitoring are being stored and curated by Inspire Environmental. Fisheries monitoring data will be shared with regulatory agencies and interested stakeholders upon request. Data sharing will occur on an annual cycle, which may be unique to each survey, and all data will be subject to rigorous quality assurance and quality control criterion prior to dissemination.

Individuals seeking access to the data will be required to provide a formal written data request to Inspire Environmental. As part of the data request, a brief proposal will be required which includes a description of the data that is being requested (e.g., survey type, timeframe, geographic boundaries), the intended use of the data, a list of coauthors and their affiliations, and details regarding the anticipated products of the work (e.g., stock assessment, fishery management plan, thesis, manuscripts). Data Access Conditions and Protocols are also being developed, which will outline specific conditions associated with obtaining access to the data. Raw data (i.e., station level catch, biological data, and environmental data) can be requested, and will be distributed, provided that the criteria outlined in the Data Access Conditions and Protocols are met. In most cases, the SFW team anticipates that data requests can be accommodated electronically on an individual basis, and that individuals requesting data access will be given a unique username and password, which will be used to securely facilitate electronic data transfers.

The SFW team acknowledges that regional guidance related to data sharing and data storage for fisheries monitoring studies is being developed cooperatively through ROSA. To that end, the data sharing agreement outlined above may evolve over time as regional guidance is developed.

SFW will coordinate with our scientific contractor to host an annual workshop at the conclusion of each year of field work. This event will help to explain the methodology and disseminate the results of the monitoring and will provide a forum by which the project team can receive input and feedback. The event will be open to all regional stakeholders, but efforts will be made to encourage the attendance of regional fishermen, particularly those individuals whom have been contracted to conduct the field work.

9.0 References

Adams, T.P., R.G. Miller, D. Aleynik, and M.T. Burrows. 2014. Offshore marine renewable energy devices as stepping stones across biogeographical boundaries. Journal of Applied Ecology 51:330-338.

Andreson, M.H., and Ohman, M.C. 2010. Fish and sessile assemblages associated with wind turbine constructions in the Baltic Sea. Marine and Freshwater Research, 61: 642-650.

Bailey, H., Senior, B., Simmons, D., Rusin, J., Picken, G., and Thompson, P.M. 2010. Assessing underwater noise levels during pile-driving at an offshore windfarm and its potential effects on marine mammals. Marine Pollution Bulletin, 60: 888-897.

Bergstrom, L., Sundqvist, F., and Bergstrom, U. 2013. Effects of an offshore wind farm on temporal and spatial patterns in the demersal fish community. Marine Ecology Progress Series. 485: 199-210.

Bethoney, N.D. and K.D.E. Stokesbury. 2018. Methods for Image-based Surveys of Benthic Macroinvertebrates and Their Habitat Exemplified by the Drop Camera Survey for the Atlantic Sea Scallop. J Vis Exp. 2018; (137): 57493.

Birchenough, S. N. R., Reiss, H., Degraer, S., Mieszkowaska, N., Borja, A., Buhl-Mortensen, L., Braeckman, U. et al. 2015. Climate change and marine benthos: a review of existing research and future directions. WIREs Climate Change, 6: 203–223.

Bishop, M.J., M. Mayer-Pinto, L. Airoldi, L.B. Firth, R.L. Morris, L.H.L. Loke, S.J. Hawkins, L.A. Naylor, and R.A. Coleman. 2017. Effects of ocean sprawl on ecological connectivity: impacts and solutions. Journal of Experimental Marine Biology and Ecology 492: 7-30.

Bjordal, Å. 2002. The Use of Technical Measures In Responsible Fisheries: Regulation of Fishing Gear in K. Cochrane (ed.), A Fishery Manager’s Guidebook – Management Measures and Their Application. FAO Fisheries Technical Paper 424, Rome, Italy.

BOEM (Bureau of Ocean Energy Management). 2013. Guidelines for providing information on fisheries for renewable energy development on the Atlantic outer continental shelf pursuant to 30 CFR Part 585. Office of Renewable Energy Programs. August 13, 2013.

BOEM (Bureau of Ocean Energy Management). 2019. Guidelines for providing information on fisheries for renewable energy development on the Atlantic outer continental shelf pursuant to 30 CFR Part 585. Office of Renewable Energy Programs. June, 2019.

Bonzek, C. F., J. Gartland, D. J. Gauthier, and R. J. Latour. 2008. Northeast Area Monitoring and Assessment Program (NEAMAP) Data Report Fall 2007 – Fall 2012. Award Number Na12NMF4540017. 274 pp.

Buckel, J.A., D.O. Conover, N.D. Steinberg, and K.A. McKown. 1999a. Impact of age-0 bluefish (*Pomatomus saltatrix*) predation n age-0 fishes in the Hudson River estuary: evidence for density-dependent loss of juvenile striped bass (*Morone saxatilis*). Canadian Journal of Fisheries and Aquatic Science, 56:275-287.

Burnett, J., L. O'Brien, R.K. Mayo, J. Darde, and M. Bohan. 1989. Finfish maturity sampling and classification schemes used during Northeast Fisheries Center bottom trawl surveys, 1963–1989. NOAA Tech. Mem. NMFS-F/NEC, vol. 76. 14 p.

Cadrin, S.X., Zemeckis, D.R., Dean, M.J., and Cournane, J. Chapter 7. Applied Markers. 2020. In: An Interdisciplinary Assessment of Atlantic Cod (Gadus morhua) Stock Structure in the Western Atlantic Ocean (McBride, R.S., and R.K. Smedbol, eds.). NOAA Technical Memorandum (in press).

Coates, D.A., Y. Deschutter, M. Vincx, and J. Vanaverbeke. 2014. Enrichment and shifts in macrobenthic assemblages in an offshore wind farm area in the Belgian part of the North Sea. Marine Environmental Research, 95: 1–12.

Cohen, J. 1992. Statistical Power Analysis for the Behavioral Sciences (Second Edition). Lawrence Erlbaum Associates, USA. 459 pp.

Collette, B.B., and Klein-MacPhee, G. 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine. Third Edition. Smithsonian Institution Press. Washington D.C. 748 pp.

Collie, J. and J. King. 2016. Spatial and temporal distributions of lobsters and crabs in the Rhode Island Massachusetts wind energy area. OCS Study BOEM 2016-073. 58pp.

Coolen, J.W.P., B. van der Weide, J.Cuperus, M.Blomberg,G.W.N.M. van Moorsel, M.A. Faasse, O.G. Bos, S. Degraer, and H.J. Lindeboom. 2018. Benthic biodiversity on old platforms, young wind farms and rocky reefs. ICES Journal of Marine Science 77(3):1250-1265.

Dannheim, J., L. Bergström, S.N.R. Birchenough, R. Brzana, A.R. Boon, J.W.P. Coolen, J. Dauvin, I. De Mesel, J. Derweduwen, A.B. Gill, Z.L. Hutchison, A.C. Jackson, U. Janas, G. Martin, A. Raoux, J.Reubens, L. Rostin, J. Vanaverbeke, T.A. Wilding, D. Wilhelmsson, and S. Degraer. 2019. Benthic effects of offshore renewables: identification of knowledge gaps and urgently needed research. ICES Journal of Marine Science 77: 1092–1108.

Dean, M., Hoffman, W.S., Zemeckis, D.R., and Armstrong, M.P. 2014. Fine-scale and gender-based patterns in behavior of Atlantic cod (*Gadus morhua*) on a spawning ground in the western Gulf of Maine. ICES Journal of Marine Science, 71(6): 1474-1489.

Dean, M., DeCelles, G., Zemeckis, D., and Ames, T. 2020. Chapter 2: Early Life History: Spawning to Settlement. In: An Interdisciplinary Review of Atlantic Cod (*Gadus morhua*) stock structure in the western North Atlantic Ocean (McBride, R.S., and R.K. Smedbol, eds.). NOAA Technical Memorandum. U.S. Department of Commerce. Woods Hole, MA.

Jacobs, 2018. South Fork Wind Farm Commercial and Recreational Fisheries Technical Report. Prepared by Jacobs Engineering Group Inc.

Deepwater Wind South Fork. 2020. Construction and Operations Plan, South Fork Wind. Prepared by Jacobs Engineering Group Inc., Providence, RI. Submitted to the Bureau of Ocean Energy Management, Sterling, VA. Revision 3. February 2020.

Degraer, S., Brabant, R., Rumes, B., and Vigin, L. 2018. Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea: Assessing and Managing Effect Spheres of Influence. Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management, Brussels, Belgium. 136 pp.

De Mesel, I., F. Kerckhof, A. Norro, B. Rumes, and S. Degraer. 2015. Succession and seasonal dynamics of the epifauna community on offshore wind farm foundations and their role as stepping stones for non-indigenous species. Hydrobiologia, 756(37):37–50.

Ellis, J. I., and Schneider, D. C. 1997. Evaluation of a gradient sampling design for environmental impact assessment. Environmental Monitoring and Assessment, 48: 157–172.

Fabrizio, M.C., Manderson, J.P., and Pessutti, J.P. 2013a. Home range and seasonal movements of black sea bass (*Centropristis striata*) during their inshore residency at a reef in the mid-Atlantic bight. Fishery Bulletin, 112: 82-97.

Fabrizio, M.C., Manderson, J.P., and Pessutti, J.P. 2013b. Habitat associations and dispersal of black sea bass from a mid-Atlantic reef. Marine Ecology Progress Series, 482: 241-253.

FGDC (Federal Geographic Data Committee). 2012. Coastal and Marine Ecological Classification Standard. FGDC-STD-018-2012. Marine and Coastal Spatial Data Subcommittee. June 2012. 343 pp. Reston, VA.

Flescher, D.D. 1980. Guide to Some Trawl Caught Marine Fishes from Maine to Cape Hatteras, North Carolina. NOAA Technical Report NMFS Circular 431. March 1980.

Gawarkiewicz, G., and Malek Mercer, A. 2019. Partnering with fishing fleets to monitor ocean conditions. Annual Reviews of Marine Science, 11: 391-411.

Geraldi, N.R., R.A. Wahle, and M.J. Dunnington. 2009. Habitat effects on American lobster catch and movement: Insights from geo-referenced trap arrays, seabed mapping, and tagging. Can. J. Fish. Aquat. Sci. 66: 460-470.

Germano, J.D., D.C. Rhoads, R.M. Valente, D. Carey, and M. Solan. 2011. The use of Sediment Profile Imaging (SPI) for environmental impact assessments and monitoring studies: Lessons learned from the past four decades. Oceanography and Marine Biology: An Annual Review 49: 247-310.

Gill, A.B., Bartlett, M., and Thomsen, F. 2012. Potential interactions between diadromous fishes of U.K. conservation importance and the electromagnetic fields and subsea noise from marine renewable energy developments. Journal of Fish Biology. 81: 664-695.

Glarou, M., Zrust, M., and Svendsen, J.C. 2020. Using artificial-reef knowledge to enhance the ecological function of offshore wind turbine foundations: implications for fish abundance and diversity. Journal of Marine Science and Engineering, 8: 332; doi:10.3390/jmse8050332.

Gosner, K.L. 1999. A Field Guide to the Atlantic Seashore: From the Bay of Fundy to Cape Hatteras. Houghton Mifflin Harcourt, 329 p.

Greene, H.G., J.J. Bizzarro, V.M. O'Connell, C.K. Brylinksky. 2007. Construction of Digital Potential Marine Benthic Habitat Maps Using a Coded Classification Scheme and its Application. in Todd, B.J., and Greene, H.G., eds., Mapping the Seafloor for Habitat Characterization: Geological Association of Canada, Special Paper 47.

Griffin, R.A., Robinson, G.J., West, A., Gloyne-Phillips, I.T., and Unsworth, R.K.F. 2016. Assessing fish and motile fauna around offshore windfarms using stereo baited video. PLoS ONE, 11(3): e0149701.

Guarinello M.G., D.A. Carey. 2020. Multi-modal approach for benthic impact assessments in moraine habitats: A case study at the Block Island Wind Farm. Estuaries and Coasts. DOI: 10.1007/s12237-020-00818-w

Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, E. Estela-Gomez. 2017. Habitat Mapping and Assessment of Northeast Wind Energy Areas. Sterling, VA: US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088. 312 p.

Hamley, J.M. 1975. Review of gillnet selectivity. Journal of the Fisheries Board of Canada. 32(11): 1943-1969.

Haulsee DE, Fox DA, Oliver MJ. 2020. Occurrence of Commercially Important and Endangered Fishes in Delaware Wind Energy Areas Using Acoustic Telemetry. Lewes (DE): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2020-020. 80 p.

HDR. 2019. Benthic Monitoring during Wind Turbine Installation and Operation at the Block Island Wind Farm, Rhode Island – Year 2. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2019- 019. 318 pp.

Hureau J.C., 1969 Biologie compare de quelques poisons antarctiques (Nothotheniidae). Bulletin de l'Institut Océanographique Monaco 68:1-44.

Hussey, N.E., S.T.Kessel, K. Aarestrup, S.J. Cooke, P.D. Cowley, A.T. Fisk, R.G. Harcourt, K.N. Holland, S.J. Iverson, J.F. Kocik, and J.E.M. Flemming. 2015. Aquatic animal telemetry: a panoramic window into the underwater world. Science, 348(6240), p.1255642.

ICES. 2006. Report of the ICES-FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB), 3–7 April 2006, Izmir, Turkey. ICES CM 2006/FTC:06, Ref. ACFM. 180 pp.

ICES. 2009. Report of the Study Group on the Development of Fish Pots for Commercial Fisheries and Survey Purposes (SGPOT), 16–17 May 2009, Ancona, Italy. ICES CM 2009/FTC:10. 13 pp.

Inspire Environmental, 2020. South Fork Wind Farm: Atlantic Cod Spawning Survey. Final Report, December 2018 through April 2019. 47 p.

Jorgensen, B.B. and T. Fenchel. 1974. The sulfur cycles of a marine sediment model system. Mar. Biol. 24: 189-201.

Kells, V. and K. Carpenter. 2011. A Field Guide to Coastal Fishes from Maine to Texas. Johns Hopkins University Press, 448 p.

Krone, R., L. Gutow, T. Brey, J. Dannheim, and A. Schröder. 2013. Mobile demersal megafauna at artificial structures in the German Bight - Likely effects of offshore wind farm development. Estuarine, Coastal and Shelf Science 125: 1-9.

Krone, R., G. Dederer, P. Kanstinger, P. Krämer, and C. Schneider. 2017. Mobile demersal megafauna at common offshore wind turbine foundations in the German Bight (North Sea) two years after deployment - increased production rate of Cancer pagurus. Marine Environmental Research, 123:53–61, https://doi.org/10.1016/j.marenvres.2016.11.011.

Kneebone, J., and Capizzano, C. 2020. A comprehensive assessment of baseline recreational fishing effort for highly migratory species in southern New England and the associated wind energy area. Final report submitted to Vineyard Wind LLC. May 4, 2020. Available online at: https://www.vineyardwind.com/fisheries-science.

Langan, J.A., McManus, M.C., Zemeckis, D, R., and Collie, J.S. 2020. Abundance and distribution of Atlantic cod (*Gadus morhua*) in a warming southern New England. Fishery Bulletin, 118: 145-156.

LaFrance, M., King, J.W., Oakley, B.A. & Pratt, S. (2014). A comparison of top-down and bottom-up approaches to benthic habitat mapping to inform offshore wind energy development. Continental Shelf Research (2014). http://dx.doi.org/10.1016/j.cer.2014.007.

LaFrance, M., Shumchenia, E., King, J.W., Pockalny, R., Oakley, B. Pratt, S. & Boothroyd, J. (2010). Chapter 4. Benthic habitat distribution and subsurface geology in selected sites from the Rhode Island Ocean Special Area Management Study Area In: Rhode Island OCEAN SAMP. Volume 2. Coastal Resources Management Council, October 12, 2010.

Lengyel NL, Collie JS, Valentine PC (2009) The invasive colonial ascidian Didemnum vexillum on Georges Bank: ecological effects and genetic identification. Aquatic Invasions 4: 143–152.

LeFaible, N., L. Colson, U. Braeckman, and T. Moens. 2019. Evaluation of turbine-related impacts on macrobenthic communities within two offshore wind farms during the operational phase. In Degraer, S., Brabant, R., Rumes, B. & Vigin, L. (eds). 2019. Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea: Marking a Decade of Monitoring, Research and Innovation. Brussels: Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management, 134 p.

Lindeboom, H.J., H.J. Kouwenhoven, M.J.N. Bergman, S. Bouma, S. Brasseur, R. Daan, R.C. Fijn, et al. 2011. Short-term ecological effects of an offshore wind farm in the Dutch coastal zone; a compilation. Environmental Research Letters, 6: 1-13.

MADMF (Massachusetts Division of Marine Fisheries). 2018. Recommended regional scale studies related to fisheries in the Massachusetts and Rhode Island-Massachusetts offshore Wind Energy Areas. 57pp.

Malek, A. 2015. An Investigation of the Fisheries Ecosystem Dynamics in Rhode Island's Nearshore Waters. Open Access Dissertations. Paper 352. https://digitalcommons.uri.edu/oa_diss/352

McBride, R., Ames, E., Andruschenko, I., Cadrin, S., Cournane, J., Dean, M., DeCelles, G., Kerr, L., Kovach, K., Overgaard Therkildsen, N., Smedbol, K., Wang, Y., and Zemeckis, D. 2020. Chapter 9: Synthesis. In: An Interdisciplinary Review of Atlantic Cod (*Gadus morhua*) stock structure in the western North Atlantic Ocean (McBride, R.S., and R.K. Smedbol, eds.). NOAA Technical Memorandum. U.S. Department of Commerce. Woods Hole, MA.

McCann, J. 2012. Developing Environmental Protocols and Modeling Tools to Support Ocean Renewable Energy and Stewardship. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA., OCS Study BOEM 2012-082, 626 pp.

Methratta, E. 2020. Monitoring fisheries resources at offshore wind farms: BACI vs. BAG designs. ICES J. Mar. Sci. doi:10.1093/icesjms/fsaa026.

NOAA (National Oceanic and Atmospheric Administration). 2018a. Atlantic Large Whale Take Reduction Plan: Northeast Gillnet Fisheries Requirements and Management Areas. Outreach Guide. 27 pp.

NOAA (National Oceanic and Atmospheric Administration). 2018b. Atlantic Large Whale Take Reduction Plan: Northeast Trap/Pot Fisheries Requirements and Management Areas. Outreach Guide. 41 pp.

NOAA (National Oceanic and Atmospheric Administration). 2019. 2018 Stock Assessment and Fishery Evaluation (SAFE) Report for Atlantic Highly Migratory Species. Highly Migratory Species Management Division. Silver Spring, MD. 250p.

Northeast Fisheries Science Center. 2016. Fisheries Sampling Branch Observer On-Deck Reference Guide 2016. U.S. Department of Commerce, NOAA Fisheries Service. Woods Hole, MA.

NYSERDA (New York State Energy Research and Development Authority). 2017. New York State Offshore Wind Master Plan: Fish and Fisheries Study. NYSERDA Report 17-25j. 140 pp.

O'Brien, L., J. Burnett, and R. Mayo. 1993. Maturation of nineteen species of finfish off the northeast coast of the United States, 1985-1990. NOAA Technical Report NMFS-113. June 1993.

O'Donnell, K.P., R.A. Wahle, M.J. Dunnington, and M. Bell. 2007. Spatially referenced trap arrays detect sediment disposal impacts in a New England estuary. Mar. Ecol. Prog. Ser. 348: 249–260.

Ouakka, K., A. Yahyaoui, A. Mesfioui, S. El Ayoubi. 2017. Stomach fullness index and condition factor of European sardine (*Sardina pilchardus*) in the south Moroccan Atlantic coast. AACL Bioflux 10: 56-63.

Pearson, T.H. and R. Rosenberg. 1978. Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. Oceanography and Marine Biology an Annual Review 16: 229–311.

Petersen, J.K., and Malm, T. 2009. Offshore wind farms: threats to or possibilities for the marine environment. Ambio, 35(2): 75-80.

Petruny-Parker, M., A. Malek, M. Long, D. Spencer, F. Mattera, E. Hasbrouck, J. Scotti, K. Gerbino, and J. Wilson. 2015. Identifying Information Needs and Approaches for Assessing Potential Impacts of Offshore Wind Farm Development on Fisheries Resources in the Northeast Region. US Dept. of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2015-037. 79 pp.

Pol, M. and P. Walsh. 2005. Cod Potting in Massachusetts. In: Pol, M. Fishermen Assisting Gear Technologists and Scientists. Final report submitted to the Northeast Consortium. www.northeastconsortium.com.

Popper, A.N., Hawkins, A.D., Fay, R.R. and 12 others. 2014. ASA S3/SC1.4TR-2014 Sound Exposure Guidelines for Fishes and Sea Turtles: A technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. Spring Briefs in Oceanography. Springer Science + Business Media. 87 pp.

Reid, R.N., D.J. Radosh, A.B. Frame, and S.A. Fromm. 1991. Benthic macrofauna of the New York Bight, 1979-1989. NOAA Technical Report NMFS-103; 50 p.

Reubens, J.T., U. Braeckman, J. Vanaverbeke, C. Van Colen, S. Degraer, and M. Vincx. 2013. Aggregation at windmill artificial reefs: CPUE of Atlantic cod (*Gadus morhua*) and pouting (*Trisopterus luscus*) at different habitats in the Belgian part of the North Sea. Fish. Res. 139:28-34.

Reubens, J.T., S. Degraer, and M. Vincx. 2014. The ecology of benthopelagic fishes at offshore wind farms: A synthesis of 4 years of research, Hydrobiologia 727:121-136,

Rhoads, D.C. and L.F. Boyer. 1982. The effects of marine benthos on physical properties of sediments. pp. 3-52. In: Animal-Sediment Relations. McCall, P.L. and M.J.S. Tevesz (eds). Plenum Press, New York, NY.

Rhoads, D.C. and J.D. Germano. 1982. Characterization of organism-sediment relations using sediment profile imaging: An efficient method of remote ecological monitoring of the seafloor (REMOTS System). Marine Ecology Progress Series 8:115–128.

RICRMC (Rhode Island Coastal Resources Management Council). 2018. Regulatory Standards of the Ocean SAMP (650-RICR-20-05-11.10). Subsequently amended effective October 6, 2019.

Rosemond, R.C., Paxton, A.B., Lemoine, H.R., Fegley, S.R., and Peterson, C.H. 2018. Fish use of reef structures and adjacent sand flats: implications for selecting minimum buffer zones between new artificial reefs and existing reefs. Marine Ecology Progress Series, 587: 187-199.

Rosenberg, R., H.C. Nilsson, and R.J. Diaz. 2001. Response of benthic fauna and changing sediment redox profiles over a hypoxic gradient. Estuar. Coast. Shelf Sci. 53: 343-350.

Rotabakk, B.T., D. Skipnes, L. Akse, and S. Birkeland. 2011. Quality assessment of Atlantic cod (*Gadus morhua*) caught by longlining and trawling at the same time and location. Fisheries Research 112: 44–51.

Simone, M. and J. Grant. 2017. Visual assessment of redoxcline compared to electron potential in coastal marine sediments. Estuar. Coast. Shelf Sci. 188: 156-162.

Simone, M. and J. Grant. 2020. Visually-based alternatives to sediment environmental monitoring. Mar. Poll. Bull. 158. https://doi.org/10.1016/j.marpolbul.2020.111367

Smith, E.P. 2002. BACI Design. In: Encyclopedia of Envirometrics, Vol. 1, pp 141-148. Edited by: Abdel H. El-Shaarawi and Walter W. Piegorsch. John Wiley & Sons, Ltd, Chichester, 2002.

Snyder, D.B., Baily, W.H., Palmquist, K., Botts, B.R.T., and Olsen, K.R. 2019. Evaluation of potential EMF effects on fish species of commercial or recreational importance in southern New England. U.S. Department of the Interior, Bureau of Ocean Energy Management, Headquarters, Sterling, VA. OCS Study BOEM 2019-049. 59pp.

Stadler, J.H., and Woodbury, D.P. 2009. Assessing the effects to fishes from pile driving: application of new hydroacoustic criteria. Inter-Noise 2009, Applications in Practical Noise Control. Ottawa, Canada. 8 pp.

Steimle, F.W., and Figley, W. 1996. The importance of artificial reef epifauna to black sea bass diets in the Middle Atlantic Bight. North American Journal of Fisheries Management, 16: 433-439.

Stenberg, C., Stottrup, J.G., van Deurs, M., Berg, C.W., Dinesen, G.E., Mosegaard, H., Grome, T.M., and Leonhard, S.B. 2015. Long-term effects of an offshore wind farm in the North Sea on fish communities. Marine Ecology Progress Series, 257-265.

Stokesbury, K. D. E. 2013. MA Windfarm Survey, Final Report. School for Marine Science and Technology (SMAST), University of Massachusetts Dartmouth.

Stokesbury, K. D. E. 2014. MA Windfarm Survey, Final Report. School for Marine Science and Technology (SMAST), University of Massachusetts Dartmouth.

Suuronen P., F. Chopin, C. Glass, S. Løkkeborg, Y. Matsushita, D. Queirolo, and D. Rihan. 2012. Low impact and fuel efficient fishing-Looking beyond the horizon. Fisheries Research 119–120:135–146. doi: 10.1016/j.fishres.2011.12.009.

Theroux, RB and R.I. Wigley. 1998. Quantitative composition and distribution of macrobenthic invertebrate fauna of the continental shelf ecosystems of the Northeastern United States. NOAA Technical Report NMFS-140; 240 p

Thomsen B., O.B. Humborstad, and D.M. Furevik. 2010. Fish pots: fish behaviour, capture processes, and conservation issues. In Behaviour of Marine Fishes: Capture Processes and Conservation Challenges, pp. 143–158. Ed. by He P. John Wiley and Sons, Iowa. 392 pp.

Ullman, D.S. and Codiga, D.L. 2010. Characterizing the Physical Oceanography of Coastal Waters Off Rhode Island, Part 2: New Observations of Water Properties, Currents, and Waves. Prepared for the Rhode Island Ocean Special Area Management Plan 2010. University of Rhode Island, December 21, 2010

Underwood, A.J. 1994. On beyond BACI: sampling designs that might reliably detect environmental disturbances. Ecol Appl 4: 3–15.

Valentine PC, Collie JS, Reid RN, Asch RG, Guida VG, et al. (2007) The occurrence of the colonial ascidian Didemnum sp. on Georges Bank gravel habitat: ecological observations and potential effects on groundfish and scallop fisheries. Journal of Experimental Marine Biology and Ecology 342: 179–181.

Wahle, R.A., M. Dunnington, K. O'Donnell, and M. Bell. 2004. Impact of dredged sediment disposal on lobster and crab abundance and movements at the Rockland disposal site, Penobscot Bay, Maine. Disposal Area Monitoring System Contribution 154, US Army Corps of Engineers, New England District, Waltham, MA. DACW33–03-D-007 TO5 09000–351–260. Available at www.nae.usace.army.mil/damos/pdf/154.pdf

Walsh, H.J. and V.G. Guida. 2017. Spring occurrence of fish and macro-invertebrate assemblages near designated wind energy areas on the northeast U.S. continental shelf. Fishery Bulletin 115:437-450.

Wilding, T. A., Gill, A. B., Boon, A., Sheehan, E., Dauvin, J. C., Pezy, J.-P., O'Beirn, F. et al. 2017. Turning off the DRIP ('Data-rich, information-poor')—rationalizing monitoring with a focus on marine renewable energy developments and the benthos. Renewable and Sustainable Energy Reviews, 74: 848–859.

Wilhelmson, D., Malm, T., and Ohman, M.C. 2006. The influence of offshore wind power on demersal fish. ICES Journal of Marine Science, 63: 775-784.

Zemeckis, D.R., M.J. Dean, and S.X. Cadrin. 2014. Spawning dynamics and associated management implications for Atlantic cod. North American Journal of Fisheries Management, 34: 424-442.

Zemeckis, D.R., Hoffman, W.S., Dean, M.J., Armstrong, M.P., and Cadrin, S.X. 2014. Spawning site fidelity by Atlantic cod (*Gadus morhua*) in the Gulf of Maine: implications for population structure and rebuilding. ICES Journal of Marine Science, 71(6): 1356-1365.

Zemeckis, D.R., Dean, M.J., DeAngelis, A.I., van Parijs, S.M., Hoffman, W.S., Baumgartner, M.F., Hatch, L.T., Cadrin, S.X., and McGuire, C.H. 2019. Identifying the distribution of Atlantic cod spawning using multiple fixed and glider-mounted technologies. ICES Journal of Marine Science, 76(6): 1610-1625.

APPENDIX A
Record of Stakeholder Engagement

September 2020

South Fork Wind | Powered by Ørsted & Eversource

Date	Organizations/Individuals Contacted[1]	Location/Form of Contact and Response	Purpose of Contact	Summary of Key Comments[2]	Response Summary
11/14/18	BOEM, CFRF, CT DEEP, MA DMF, MA CZM, NMFS, NYS DEC, NYS DOS, NYS DPS, RI CRMC, RI DEM, RISAA, Individual fishermen	Emails from SFW and recipient responses are attached to Exhibit 1 to Appendix A	Distribution of Gillnet monitoring plan for comment	• Need for power analysis to determine level of sampling • Seasonal sampling inadequate • More specifics needed on gear used • More detail needed on survey of and impacts on specific species • Gillnets alone not enough to sample area	• Power analysis attempted but lack of comparable data prevents adequate analysis; later conducted for beam trawl and ventless trap survey (see Appendices B and D) • Monthly sampling added • Gear specifics added to plan • Additional gear types considered for sampling at SFWF; later incorporated into Fisheries Monitoring Plan (FMP) (Sections 3.0, 4.0, 5.0, 6.0, 7.0)
3/25/19	BOEM, CT DEEP, MA CZM, MA DMF, NMFS, NYS DEC, NYS DOS, RI DEM, USACE	Webinar; See Exhibit 2 to Appendix A	Review of FMP and received comments	• Additional sampling types needed including benthic • Better definition of research questions • Need to consider regional approach to sampling • More detail on how reference areas selected • Talk one on one with gillnetters to refine reference areas • Request for comment tracker	• Several other gear types under consideration for surveys; later incorporated into FMP • Regional research plan under development but permitting requirements dictate project-level plans • Language updated to address survey goals and selection of reference areas (Section 2.2) • Discussions lined up with gillnet fisherman (see below) • Comment tracker prepared

[1] BOEM – Bureau of Ocean Energy Management; CFCRI – Commercial Fisheries Center of Rhode Island; CFRF – Commercial Fisheries Research Foundation; CT DEEP – Connecticut Department of Energy and Environmental Protection; MA DMF- Massachusetts Division of Marine Fisheries; MA CZM – Massachusetts Center of Coastal Zone Management; MA FWG – Massachusetts Offshore Wind Fisheries Working Group; NEFMC – New England Fisheries Management Council; NOAA/GARFO - National Oceanic and Atmospheric Administration's Greater Atlantic Regional Fisheries Office; NOAA/NMFS – National Oceanic and Atmospheric Administration's National Marine Fisheries Service; NYS DEC – New York State Department of Environmental Conservation; NYS DOS – New York Department of State; NYS DPS – New York State Department of Public Service; NYSERDA – New York State Energy and Research Development Authority; RI CRMC – Rhode Island Coastal Resources Management Council; RI DEM – Rhode Island Department of Environmental Management; RISAA – Rhode Island Saltwater Angler's Association; RODA – Responsible Offshore Development Alliance; ROSA – Responsible Offshore science Alliance; SFW – South Fork Wind, LLC; USACE – United States Army Corps of Engineers

[2] Please see documents attached in the exhibits to this Appendix A for all the written comments received and considered. The purpose of this table in Appendix A is to present a summary of key comments received (written and verbal).

Date	Organizations/Individuals Contacted[1]	Location/Form of Contact and Response	Purpose of Contact	Summary of Key Comments[2]	Response Summary
3/26/19	RI CRMC	RI CRMC Offices, Wakefield RI	Review of FMP and received comments	• Agreed gillnet and beam trawl surveys are appropriate and will complement each other • Look at Anna Malek's thesis results • Consider highly migratory species (HMS), coordinate with hook and line and headboats	• Additional gears under consideration; later added to FMP (Sections 4.0, 5.0, 6.0, 7.0) • Thesis results utilized to assess beam trawl design • Support for HMS project later added to FMP (Section 6.0)
3/27/19	BOEM, CT DEEP, MA CZM, MA DMF, NMFS, NYS DEC, NYS DOS, RI DEM	Webinar; See Exhibit 2 to Appendix A	Review of FMP and received comments	• Need to consider regional approach to sampling • Good to include two reference areas • May be worthwhile to narrow scope of gillnet survey and target what is in the area and what data can be captured • Restrict gillnets to tie down and one mesh size • Opportunity to deploy acoustic receivers to gather more information on tagged species in area • Request to consider how to replace NMFS stock assessments	• Regional research plan under development but permitting requirements dictate project-level plans • Sampling may be restricted to spring/fall based on input from industry, may narrow focus to monkfish and skates; later updated to spring and fall sampling season and changed gear to one mesh size using tie downs in FMP (Sections 2.2, 2.3) • Acoustic telemetry is under consideration for additional monitoring; later incorporated into FMP (Section 6.0)
4/26/19	Capt. Greg Mataronas	ALWTRT meeting, Providence, RI	FMP; gillnet survey design	• Fleet does not fish in summer due to presence of sharks and sea turtles • No fishing in winter due to no catch and weather • Provided specifics on gear dimensions	• Modified sampling to spring/fall when commercial fleet fishes and to avoid interactions with protected species (Section 2.2) • Winter season eliminated; many other surveys do not fish when resources are not in area (BIWF lobster survey) (Section 2.2)

Date	Organizations/Individuals Contacted[1]	Location/Form of Contact and Response	Purpose of Contact	Summary of Key Comments[2]	Response Summary
				• Comparable reference areas will be difficult to locate	• Incorporated gear specifics into plan (Section 2.3) • Will reach out to additional industry and state agencies for input on comparable ref areas (see below)
6/13/19	BOEM, CFRF, CT DEEP, MA CZM MA DMF, MA FWG, NMFS, NYS DEC, NYS DOS, NYS DPS, RI CRMC, RI DEM, RISAA, Individual fishermen	Emails from SFW and recipient responses are attached to Exhibit 3 to Appendix A	Distribution of updated version of FMP for comment	• Beam trawl is good compromise as additional gear due to otter trawling not being possible at site • Adaptive sampling approach is good strategy in absence of background data for gillnet power analysis • Gillnet and beam trawl alone still not enough to adequately sample area • Acoustic monitoring should occur before, during, and after construction • Concern about maintaining control areas located in the wind farm lease area • Concerns with data-sharing among stakeholders	• Additional gears still under consideration for site; later added to FMP (Sections 4.0, 5.0, 6.0, 7.0) • Power analysis for beam trawl ongoing; see Appendix B
8/20/19	RI CRMC Habitat Advisory Board (HAB)	URI Coastal Institute, Narragansett, RI	Project update including fisheries monitoring	• Concerns with gillnet and protected species interactions in April/May • Consider acoustic receivers in use and placed on foundations in the future	• This is the time of year the gillnet fishery occurs in the area • Acoustic telemetry under consideration for additional monitoring; later added to FMP (Section 6.0)
9/9/19	RI CRMC Fishermen's Advisory Board (FAB)	URI Coastal Institute, Narragansett, RI	Project update including fisheries monitoring	• Surveys already too late as Geophysical and Geotechnical (G&G) vessels impacting area	• Important to continue to develop plan quickly to sample • Ensure reference areas outside of geophysical survey footprint

Date	Organizations/Individuals Contacted[1]	Location/Form of Contact and Response	Purpose of Contact	Summary of Key Comments[2]	Response Summary
				• Gillnet and beam trawl alone still not enough to adequately sample area • No consideration for recreational interests; particularly HMS; no rod and reel survey	• Additional gears still under consideration for site; later added to FMP (Sections 4.0, 5.0, 6.0, 7.0) • Rod and reel survey for cod did not result in many samples; difficult to standardize; Highly Migratory Species (HMS) are being considered, , candidate for acoustic telemetry; later added to FMP (Section 6.0)
9/19/19	Capt. Mike Marchetti	F/V Mister G, Point Judith, RI	Beam trawl gear overview and discussion	• Provided specifics on areas to tow and showed beam trawl used in previous work	• Details of gear incorporated into plan and tow areas considered in development of new reference areas (Sections 3.2, 3.3)
9/27/19	Capt. Mike Monteforte	F/V Second Wind, Point Judith, RI	Discuss otter trawling in SFW	• Provided tow tracks of area towed within SFW • Discussed time of year his target species occur in area	• Determined that based on his tow tracks, towable area is too narrow and short for conducting full survey • He only fishes at SFW for a short time period so not conducive to full year survey
9/30/19	RI CRMC FAB	URI Coastal Institute, Narragansett, RI; Subsequent communications with the RI CRMC FAB included in Exhibit 4 to Appendix A	Marine Affairs and FMP updates	• Sampling gillnet once per month is not enough, may miss things • Reference areas need to be relocated far from development areas • Lobster survey should be extended to Nov. as lobsters still around in numbers	• Sampling increased to twice per month; up to five strings per set (from two initially) (Sections 2.2, 2.3) • Work will be done to consult with industry members, agencies, and review other studies to identify suitable reference areas; conducted later and outlined in Exhibit 4 to Appendix A • Lobster survey protocol updated to include Nov. sampling
10/8/19	Capt. Mike Marchetti	F/V Mister G, Point Judith, RI	Overview of previous beam trawl work and reference site discussion	• Provided tow tracks and information on previous work • Identified areas appropriate for beam trawling to use as reference areas	• Information provided used in part to identify new reference areas for both gillnet and beam trawl outlined in Exhibit 4 to Appendix A

Date	Organizations/Individuals Contacted[1]	Location/Form of Contact and Response	Purpose of Contact	Summary of Key Comments[2]	Response Summary
10/29/19	RI DEM	RI DEM Offices, Jamestown, RI	Discussion on reference areas for fisheries monitoring	• Understands difficulties in designing gillnet survey and is happy with Ørsted's approach; beam trawl also a welcomed addition • Proposed Reference Area East should be moved north to accommodate rocky area • Expand on data sharing approach	• Reference Area East moved north to accommodate this recommendation (Sections 2.2, 3.2) • Data sharing language added to next version of FMP (Section 8.0)
11/7/19	RI CRMC	RI CRMC Offices, Wakefield RI	FMP update	• Suggest consulting with MA DMF on plan and reference site locations • Supportive of approach to identifying reference sites • Suggest another follow-up with RI DEM on power analysis approach	• Meeting scheduled with MA DMF to review plan and discuss control site locations; see below • Follow-up with RI DEM scheduled to discuss power analysis; see below
11/21/19	RI DEM	RI DEM Offices, Jamestown, RI	FMP power analysis	• Suggest sampling more in year 1 for gillnet then conduct power analysis on those data to determine subsequent sampling levels	• Adaptive sampling approach adopted for gillnet and beam trawl going forward
11/22/19	MA DMF	SMAST/MA DMF offices, New Bedford, MA	FMP overview	• Welcome opportunity to meet and be kept up to date • Important ventless survey methodologies line up across groups, data very important • Stomach content analysis important, glad to see it incorporated	• Ventless survey design still in development and will look to align with other regional surveys as much as possible; protocol later added to FMP (Section 4.0) • Monkfish and skate stomach analysis added to gillnet plan per MA DMF request (Section 2.4)
11/22/19	MA FWG	SMAST/MA DMF offices, New Bedford, MA	Project updates and FMP overview	• Will exempted fishing permits be needed for surveys?	• Letter of Acknowledgement (LOA) needed (confirmed by D. Christel from GARFO)

Date	Organizations/Individuals Contacted[1]	Location/Form of Contact and Response	Purpose of Contact	Summary of Key Comments[2]	Response Summary
				• There is a need for acoustic tagging • More gear types needed to monitor site	• Acoustic telemetry being considered and may support BOEM funded cod project currently underway; later added to FMP (Section 6.0) • Additional gears under consideration and in development; later added to FMP (Sections 4.0, 5.0, 6.0, 7.0)
11/26/19	CFRF, CFCRI	CFRF offices, Kingston, RI	FMP	• Gillnet and beam trawl not sufficient to sample area • Trawl survey should be conducted, talk with Capt. Monteforte • Fish pots also good gear to consider for structure associated species	• Additional gear types still under consideration, including fish pot; later added to FMP (Sections 4.0, 5.0, 6.0, 7.0) • Based on meeting with Capt. Monteforte trawl survey not possible as towable area is too narrow and short
2/6/20	RI DEM	RI DEM Offices, Jamestown, RI	Power analysis	• Current approach is good but worries level of sampling in year 1 is still too low; acknowledges determining what is enough is difficult • Would like species specific approach conducted in future analyses	• Will proceed as planned and adjust as actual survey sampling dictates if needed • Will conduct species specific analysis after year 1 when sufficient data are available
2/6/20	Capt. Ken Murgo	INSPIRE office, Newport, RI	Fish pot overview	• Provided fish pot gear overview and characteristics	• Information to be incorporated into potential fish pot protocol; later added to FMP (Section 5.0)
2/10/20	RI CRMC FAB	URI Coastal Institute, Narragansett, RI	Project updates and FMP	• Is distance of new reference sites adequate? • Suggest having workshop to formulate whole research plan that is amenable to all	• 24km from impact site considered sufficient. Acoustic studies suggest this distance is more than adequate • CFRF agreed to host workshop in March, SFW team will participate (see below)
3/11/20	CFRF, CRMC, RI CRMC FAB, NOAA/NMFS, RIDEM, RISAA, Vineyard Wind, Industry members	URI Coastal Institute, Narragansett, RI	Fisheries monitoring workshop	• Need to consider more gear types: rod & reel, acoustic telemetry, ventless trap, fish pot	• Protocols for ventless trap, fish pot, benthic monitoring (SPI/PV) and support for two regional telemetry studies all to be developed; later

Date	Organizations/Individuals Contacted[1]	Location/Form of Contact and Response	Purpose of Contact	Summary of Key Comments[2]	Response Summary
				• Sampling along cable routes must be considered • Largest effects may happen near turbines (European studies) so may consider Before-After-Gradient (BAG) study design for some surveys • G&G surveys having impacts, need to know effects of these surveys on fish	added to FMP (Sections 4.0, 5.0, 6.0, 7.0) • SPI/PV being considered for scallops on cable route, benthic habitat; later added to FMP (Section 7.3) • BAG design incorporated into fish pot and wind farm benthic survey designs (Section 5.0 and Section 7.0) • More information was gathered from site investigation team to incorporate into plan (Appendix C)
4/21/20	BOEM, NOAA/GARFO, NOAA/NMFS	Conference call	Protected species and permitting requirements	• Glad to see modifications to gillnet survey but may not be enough • Need more information on how takes will be handled • Ørsted must decide which surveys will apply for LOA or Exempted Fishing Permit (EFP) (longer process)	• In case of takes, will follow observer program sampling protocols, will add language to plan (Sections 2.3, 3.3, 4.3, 5.3) • Will work with contractor conducting the work to determine which permit is needed and they will apply • Gear modifications to reduce protected species interactions added to the plan (Sections 2.1. 4.1. 5.1)
5/11/20	BOEM, CT DEEP, MA DMF, NEFMC, NOAA/GARFO, NOAA/NMFS, NYS DEC, NYS DOS, NYSERDA, RI CRMC, RI DEM, RODA, ROSA, USACE	Emails from SFW and recipient comment responses are found in Exhibit 5 to Appendix A	Distribution of Final Fisheries Management Plan	• Comments and feedback solicited through agency webinar (see below)	• Includes gillnet and beam trawl surveys and updated with ventless lobster trap, fish pot BAG, benthic monitoring (cable and wind farm BAG), support for two acoustic telemetry projects
5/22/20	BOEM, CT DEEP, MA CZM, MA DMF, NOAA/NMFS, NYS DEC, NYS DOS, RIDEM	Webinar; See Exhibit 6 to Appendix A	Updated Final Fisheries Monitoring Plan	• Agencies requested to provide written comments on plan provided 5/11/20 (See Exhibit 5 for comments submitted; comments received from agencies	• Data Sharing Plan added to the Monitoring Plan (Section 8.0) • Substantial revisions made throughout plan following written comments • Addition of a summary table of research questions and statistical

Date	Organizations/Individuals Contacted[1]	Location/Form of Contact and Response	Purpose of Contact	Summary of Key Comments[2]	Response Summary
				between 6/9/20 and 7/13/20) • More details needed on adaptive sampling strategy • Power analysis needed for the ventless trap survey. • Data sharing needs to be clarified • Conductivity-temperature-depth profilers (CTDs) should be used to sample water column profile.	analyses (Sections 3.0, 4.0, 5.0, 7.0). Clarification of objectives • Power analyses performed for ventless trap survey (See Appendix D); further details provided on adaptive sampling design (Sections 2.6, 3.7, 5.7) • CTDs will be used to collect a vertical profile of the water column (Sections 2.5, 3.4, 4.4, 5.5)

APPENDIX B

Power Analysis for Beam Trawl Survey of Fish and Invertebrates

September 2020

South Fork Wind | Powered by Ørsted & Eversource

1.0 Introduction

For the beam trawl survey, a Before-After-Control-Impact (BACI) survey design is planned for the South Fork Wind Farm (SFWF), largely to capture benthic species and smaller fishes in this area where physical constraints make it difficult to survey using other gear types. EXA conducted an assessment for South Fork Wind, LLC and two topics are included within this appendix:

1. A review of an existing beam trawl dataset in the vicinity of the SFWF (Malek 2015) to establish the proximate range of a meaningful effect size in measuring change over time.
2. A power analysis for a BACI fish trawl survey using elements of time series of fish/invertebrate abundance collected using otter trawls during Block Island Wind Farm (BIWF) fisheries impact assessment surveys.

2.0 Power Analysis Elements

A statistical power analysis requires specification of the following:

- Study design specifics (i.e., number of replicates, number of sites, number of sampling events, number of years before and after construction), and their structure (e.g., random trawls as independent replicates within each site and sampling event, or fixed trawls nested within sites and repeatedly sampled over time).
- The statistical model, which is determined by the study design (previous bullet) and characteristics of the data (e.g., catch data as counts would be modeled with a generalized linear (potentially mixed) model with Poisson errors, or with a negative binomial if the count data are over-dispersed; presence/absence data would be modeled with logistic regression and binomial errors).

A statistical power analysis relates the following four elements; given three of these elements, the fourth can be estimated:

- **Effect size (Δ)** is the difference that the design and model will be able to identify as statistically significant. Statistical analysis of a BACI dataset relies on the <u>interaction</u> between any Before-After period differences and Control-Impact location differences to indicate when a significant impact has occurred. The effect size herein is expressed as the change between Before and After at the impact site that exceeds the change at the control site, expressed as a proportion of the impact site mean during the Before period. For example, an effect size of –0.3 could represent a 30% decrease in abundance at the impact site and no change at the control site; or a 50% decrease at the impact site and a 20% decrease at the control site; or other similar combinations that net a 30% difference.
- **Power (1-β**, where β is the Type II error**)** is the probability of rejecting the null hypothesis when the difference in the data exceeds a specific effect size (Δ_M). In the BACI design setting, it is the probability of finding the interaction term between Before-After periods and Control-Impact locations to be statistically significantly different from zero when an effect of size Δ_M is operating on the data.
- **Alpha (α)** is the Type I error, or the probability of rejecting the null hypothesis in error because the true difference is small (i.e., < Δ_M). The value α is typically fixed, at 0.05 or 0.10 (95% or 90% confidence). For power estimated through simulations, α is estimated as the percent of significant outcomes when the effect size imposed on the data was 0.

- **Sample size** encompasses the number of sites, replicates, and time periods sampled and determines the degrees of freedom for the statistical tests. All else being equal, as sample size increases, the precision estimates for the model parameters increase. This will result in higher power for a specific effect size, or a smaller detectable effect size for a specific level of power.

3.0 Review Existing Data

The Malek (2015) beam trawl dataset was used to establish a proximate range of a meaningful effect size in measuring change over time. The dataset was screened to only include:

- useable tows based on depth (Figure 1).
- relevant species (Table 1).

This dataset provides only a single survey per station in each sampling year: in November of 2010, and in August of 2011 and 2012. Catch from November surveys are expected to be in decline leading into the winter season, while August surveys are expected to be representative of the higher catch summer season. As such, this dataset provides a very limited view of the inter-annual temporal variance. The spatial variance among tows during each survey event is also contrasted with the spatial variance from the BIWF surveys that are used as a surrogate time series in the power analysis (Section 4.0).

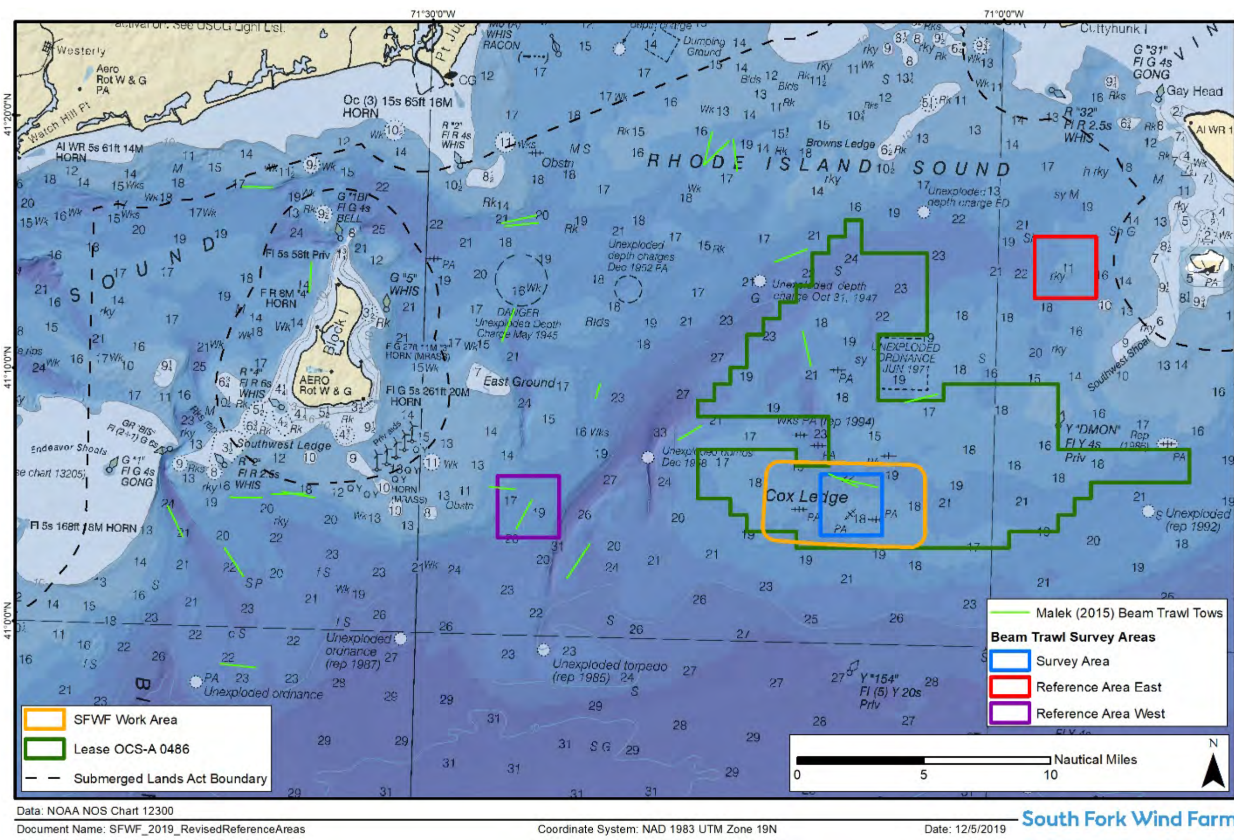


Figure 1. Map of Rhode Island Sound showing Malek (2015) tows from depths similar to the SFWF Work area, with proposed survey and reference sites.

Table 1. Individual Fish and Invertebrate species abundance from Malek (2015) that were used in this analysis

Fish	Total Abundance (all tows)		Invertebrate	Total Abundance (all tows)
Little skate	3251		Sea scallop	6496
Winter skate	1640		Sand dollar	4240
Skates (immature)	1187		Cancer crab	2638
Fourspot flounder	188		Starfish (mixed)	2545
Silver hake	153		Margined sea star	1488
Windowpane	122		Forbes sea star	1261
Red hake	88		Starfish	1256
Snailfish (Inquiline)	85		Boral sea star	935
Northern searobin	57		Pandalid shrimp	388
Gulf Stream flounder	55		Hermit crab	383
Winter flounder	51		Boreal sea star	359
Spotted hake	28		Longfin squid	270
Scup	26		Moon snail	189
Monkfish	20		Sea cucumber	61
Summer flounder	19		American lobster	39
Yellowtail flounder	15		Ocean quahog	34
Sea raven	12		Blue mussel	31
Longhorn sculpin	9		Blood star	24
Barndoor skate	8		Surf clam	20
Striped searobin	6		Conch (channeled whelk)	10
Black seabass	5		Sea mouse	9
Ocean pout	5		Waved whelk	7
Butterfish	2		Cockle	6
Cunner	2		Spider crab	6
Pipefish	2		White sea cucumber	6
Smallmouth flounder	2		Sea urchin	5
Spiny dogfish	2		Rat tailed sea cucumber	3
Atlantic torpedo	1		Horse mussel	2
Haddock	1		Orange footed sea cucumber	2
			Conrad's thracia	1

A summary of the total abundance for the species shown in Table 1 at the tows shown in Figure 1 is presented by year in Table 2 and Figure 2. There were two tows from 2010 that had catch that was 3.5 to 6.5 times higher than the next highest tow from that year. These outliers have a large effect on the outcome of the expected differences over time; but only four stations would remain if they were excluded. Consequently, they were retained in the analysis but their influence is noted.

Table 2. Summary of abundance data by year in beam trawl dataset (Malek 2015), with and without outliers from 2010.

Month - Year	Station	Total Abundance			
		Range	Mean	Std. Dev.	CV
Nov - 2010	OFF1[a]	5356	-	-	-
	PG1 [a]	2941	-	-	-
	Remaining Stations (n=4)	231 - 817	539	306	0.6
	All Stations (n=6)	231 – 5356	1742	2028	1.2
Aug - 2011	All Stations (n=9	597 – 2771	1399	762	0.5
Aug - 2012	All Stations (n=13)	52 - 1280	516	347	0.7

CV = Std. Dev. / Mean
[a] Observations represent extreme values

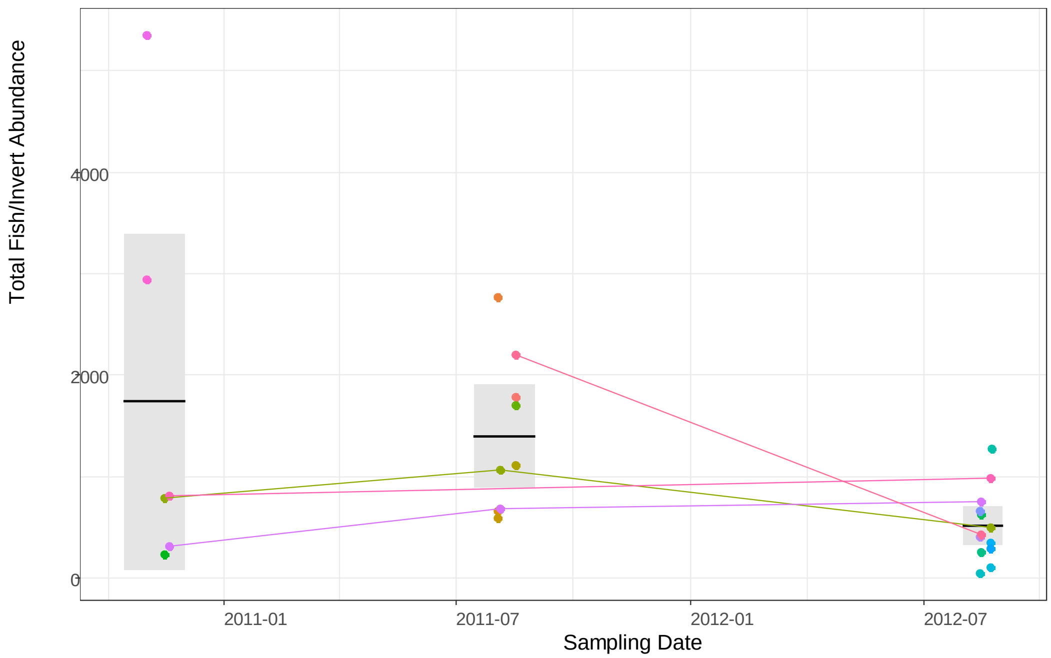


Figure 2. Total abundance for each station by date (from a single tow per date). Lines connect stations that were revisited over time. Gray bars cover the annual mean ± 2* SE, and the black line intersecting each bar is the mean of all stations for that year.

3.1 Methods

A meaningful *Effect Size* is one that is greater than differences commonly seen among control sites. The inter-annual differences in catch based on the single month beam trawl surveys provide very rough estimates of the magnitude of changes seen from natural variability. Meaningful *Effect Sizes* for the study design could not be expected to be smaller than natural variability. The range of natural variability was estimated using a bootstrap approach that assumes that all trawls in the Malek (2015) dataset are independent observations from the same population. Bootstrap estimates of differences in survey means (i.e., average of multiple tows from different areas on a single date) were calculated. Bootstrapping from the control area dataset of Malek (2015) used the following approach:

1. Randomly select k (k = 2, 3, or 4) trawls from each year t (t =2010, 2011, 2012). Note: The trawls are drawn independently from each year, with replacement.
2. Compute the annual average of the k trawls from each year, $\bar{X}_t$ for t =2010, 2011, 2012
3. Calculate and save the temporal differences, and calculate the change in means from year to year, as a proportion of the baseline year, i.e.,

$$Natural\ Temporal\ Change = (\bar{X}_{Yr2} - \bar{X}_{Yr1})/\bar{X}_{Yr1}$$

4. Repeat Steps 1-3 3000 times for each k. This will result in 3000 representations of the temporal differences in means of k trawls from a Control area.

3.2 Results

Results for the bootstrap estimates of the natural temporal change for k = 2, 3, or 4 replicates are shown in Figure 3 and summarized in Table 3. The median values of these nine bootstrapped distributions ranged from -0.7 to +0.6. The median values represent the central tendency without being overly influenced by individual high values. The 2010 survey had two extreme values which strongly influenced the annual means from this year; in addition, the 2010 survey was conducted in November, whereas the other two surveys were conducted in August, so the 2010 data introduce additional uncertainty due to the seasonal differences. The results between the August 2011 and August 2012 surveys are not confounded by seasonal differences, so these results may be most informative, albeit on a limited temporal scale. Temporal change estimates representing inter-annual August differences (and including spatial variability with k=2, 3, or 4) ranged from -0.8 to -0.5 (Table 3).

Table 3. Minimum, median and maximum temporal change estimates from bootstrap replicates shown in Figure 3.

Proportional Change[a] calculated between years	2 replicate tows			3 replicate tows			4 replicate tows		
	Min	Median	Max	Min	Median	Max	Min	Median	Max
2011 – 2010	-0.3	0.4	4.1	-0.3	0.4	4.1	-0.3	0.6	4.1
2012 – 2010	-0.8	-0.6	0.5	-0.8	-0.6	0.5	-0.8	-0.5	0.5
2012 – 2011	-0.8	-0.7	-0.5	-0.8	-0.7	-0.5	-0.8	-0.7	-0.5

[a] Proportional temporal change calculated as $(\bar{X}_{Yr2} - \bar{X}_{Yr1})/\bar{X}_{Yr1}$

The observed August differences between adjacent years for the BIWF data ranged from -0.8 to +3.6 (Table 4). The observed year-to-year differences within the same area support using multi-year surveys to measure abundance within each “Before” or “After” period. The differences using 2-year averages with 12 surveys per year are much less variable and range from -0.6 to +0.5 across the two reference areas (Table 4). While these values provide a very limited context for what level of temporal change may be natural for control sites away from a specific impact, the indication is that values much smaller than -0.6 or -0.5 may be untenable as a target effect size.

Table 4. Summary of annual BIWF fish survey results for total abundance, with estimates of natural temporal change

		August Value				12 Month Mean			
		Total Abundance		Temporal Change (single year)[a]		Total Abundance		Temporal Change (2 yr means)	
Year	Calendar Year	REF-E	REF-S	REF-E	REF-S	REF-E	REF-S	REF-E	REF-S
1	Oct 2012 – Sep 2013	3169	1048			6142	743		
2	Oct 2013 – Sep 2014	1185	239	-0.63	-0.8	4487	485		
3	Oct 2014 - Sep 2015	1129	1089	-0.05	3.6	1911	782		
4	Oct 2015 – Sep 2016	2392	2362	1.12	1.2	2043	1028	-0.63	0.5
5	Oct 2016 – Sep 2017	1285	3299	-0.46	0.4	1348	886	-0.47	0.5
6	Oct 2017 – Sep 2018	4204	915	2.27	-0.7	1975	703	-0.16	-0.1
	Minimum			-0.8				-0.6	
	Median			0.2				-0.1	
	Maximum			3.6				0.5	

[a] Single year temporal change calculated as $(\bar{X}_t - \bar{X}_{t-1})/\bar{X}_t$. Temporal change based on two year means calculated as $(\bar{X}_{t:t+1} - \bar{X}_{t-2:t-1})/\bar{X}_{t-2:t-1}$

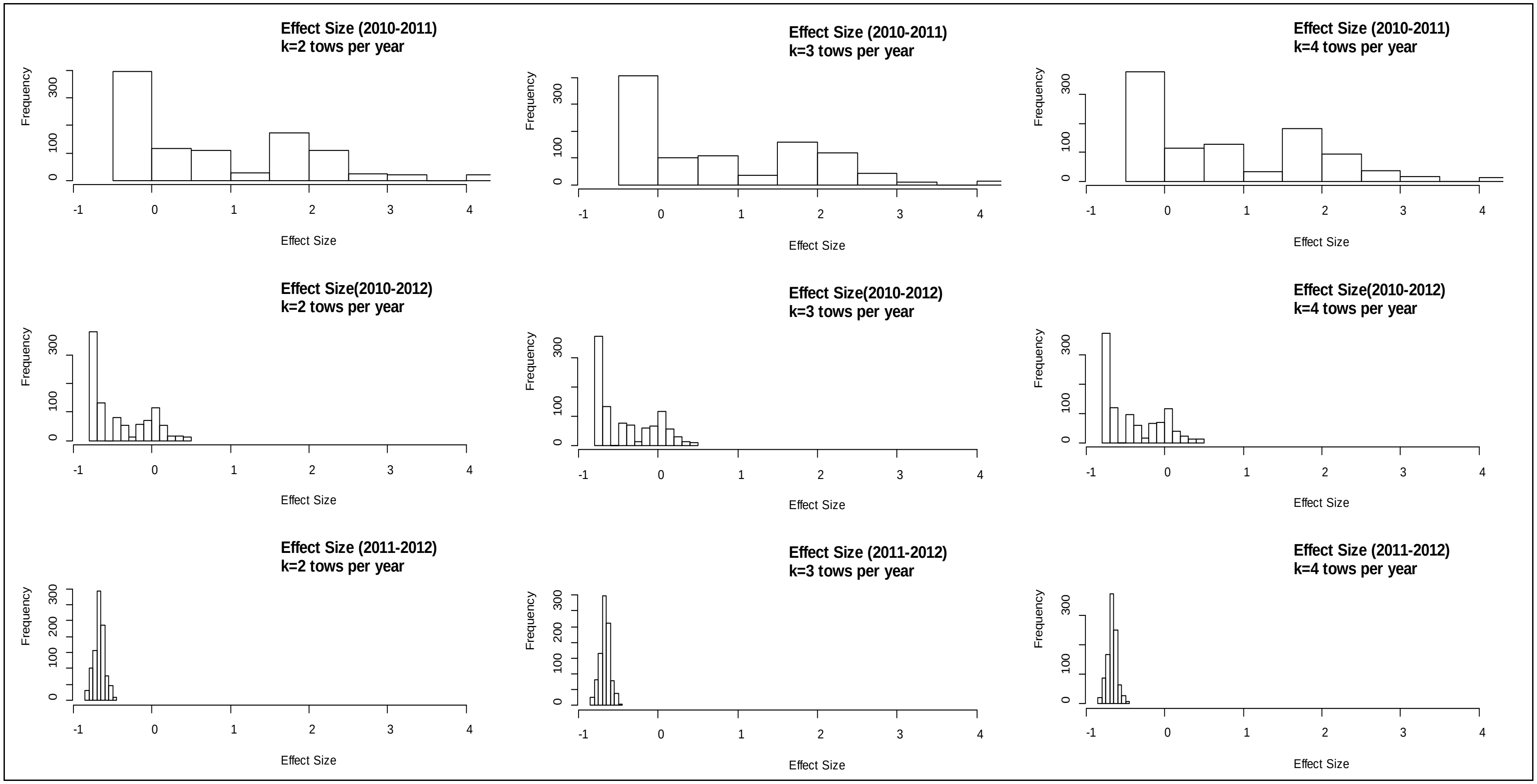


Figure 3. Bootstrap distributions (m=3000) of "effect sizes" for the differences in annual means as a percent of the "before" year. The three rows show three pairwise combinations of annual means, and three columns show different number of tows (for k=2, 3, and 4). Each annual mean is derived from k tows on a single survey date in the screened Malek (2015) dataset.

4.0 Power Analysis Methods

Statistical power was estimated using the program *epower* (Fisher et al. 2019), which requires pilot "Before Impact" data to estimate the posterior probability of model parameters in a Bayesian framework; the "After Impact" data are then simulated from these posterior probabilities under the effect size specified by the user. "Before" datasets that captured realistic spatial and temporal variability were needed for this analysis. The Malek (2015) beam trawl dataset provided estimates of total abundance and synoptic spatial variability among independent tows; these data were used to estimate natural temporal change as frame of reference for reasonable effect sizes to target in the SFWF beam trawl survey. However, in the Malek dataset the level of replication over time was insufficient to estimate temporal variability at the scale needed for the power analysis (i.e., intra-annual variance at a monthly scale, and inter-annual variance over multiple years). Consequently, the BIWF fish trawl datasets were mined for estimates of temporal variability. The BIWF dataset provides a 6-year time series of monthly observations at two reference areas (REF-E and REF-S), and one area of potential impact (APE) (Figure 4).

Year-to-year differences are present within each of the areas sampled from the BIWF dataset, particularly in the period 2013 to 2015 (Figure 4). The Malek survey did not overlap temporally with the BIWF survey so catch data from the two datasets represent different years as well as very different sampling frequencies and gear types. The magnitude of total catch values from the two datasets are not dramatically different for surveys from the same months (i.e., November or August) in most years (Table 5). This comparability is important since the BIWF time series will be used as a surrogate for the beam trawl surveys. The spatial variability within survey events of the Malek beam trawl surveys was moderate with CV values in the range 0.5 to 0.7 (or up to 1.2 if the 2010 outliers were included; Table 2). These values are within the range of CV values observed among spatial areas within the BIWF dataset, which ranged from 0.01 to 1.12 for August and November surveys (Table 5).

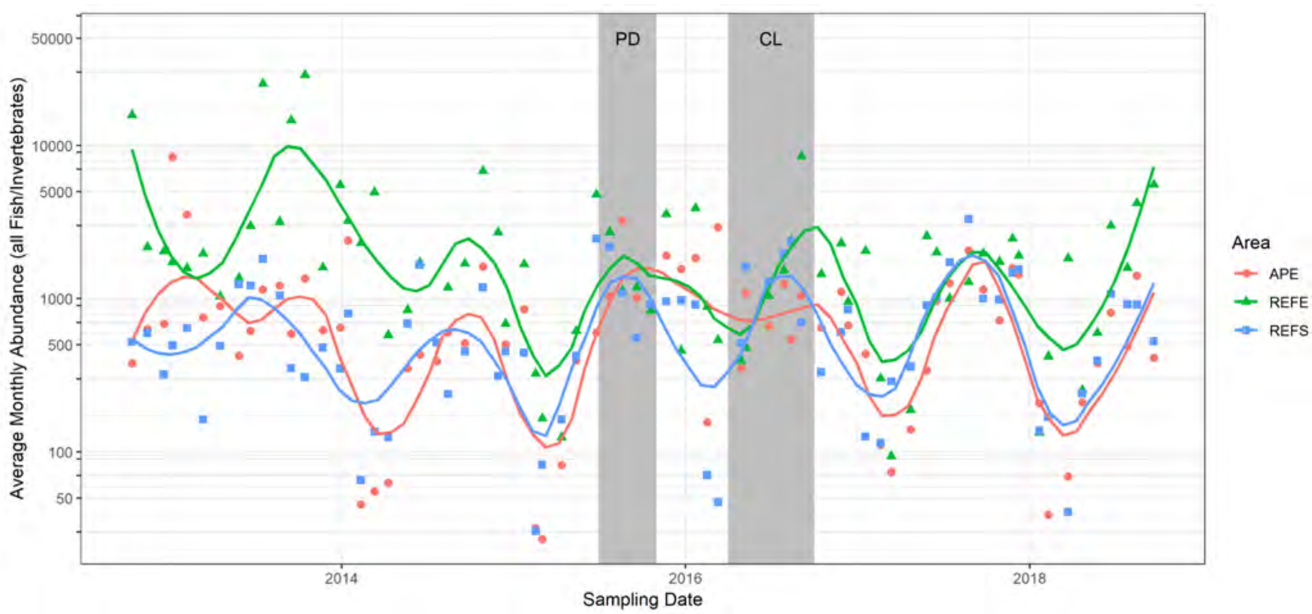
Table 5. Summary of annual mean (October – September) and November and August total abundance for BIWF otter trawl datasets at reference areas and the Malek (2015) beam trawl dataset

		12 Months		November			August		
Year	**Calendar Year**	**REF-E**	**REF-S**	**REF-E**	**REF-S**	**CV[a]**	**REF-E**	**REF-S**	**CV**
1	Oct 2012 – Sep 2013	6142[b]	743	2171	598	0.79	3169	1048	0.65
2	Oct 2013 – Sep 2014	4487	485	1597	480	0.67	1185	239	0.71
3	Oct 2014 - Sep 2015	1911	782	2716	313	1.12	1129	1089	0.03
4	Oct 2015 – Sep 2016	2043	1028	3566	961	0.81	2392	2362	0.01
5	Oct 2016 – Sep 2017	1348	886	2302	603	0.83	1285	3299	0.62
6	Oct 2017 – Sep 2018	1975	703	2463	1477	0.35	4204	915	0.91
6-Year BIWF Average		**2984**	**771**	**2469**	**739**	**0.76**	**2227**	**1492**	**0.49**
Minimum		1348	485	1597	313	0.35	1129	239	0.01
Median		2009	763	2383	601	0.80	1839	1069	0.64
Maximum		6142	1028	3566	1477	1.12	4204	3299	0.91
Beam Trawl Mean (2010 – 2012) [c]				**1219** (1 year)			**958** (2 years)		
Excluding outliers				**818** (1 year)					

[a] CV = coefficient of variation (standard deviation / mean) between areas within each year. The CV for years 1 and 2 include values for the APE (not shown).

[b] The data series in year 1 for REF-E had several extreme values (see Figure 4); the time series components for REF-E data excluding this year were also estimated.

[c] Data extracted from Malek (2015), as summarized in Table 2, shown here for some context in how total catch differed spatially and temporally for the two datasets.



Note: PD = pile driving and CL = cable laying

Figure 4. Time series for fish trawl data sets from the BIWF area of potential impact (APE) and two reference areas. Temporal patterns in the data are highlighted with a smoothing function (i.e., loess, span=0.20).

4.1 Estimate time series components

The time series attributes (i.e., stationarity, autocorrelation, seasonality) were estimated for the BIWF otter trawl data set from the REF-S reference area to simulate data for one of the variance scenarios used in the power simulations (Sections 4.2 and 4.3). Area REF-S was selected for modeling because it had the most consistent patterns from year-to-year (blue line, Figure 4), and therefore would provide the best-fitting model without the need to de-trend the series or remove extreme values. An auto-regressive integrated moving average (ARIMA) time series model with log-normal errors was estimated in R (R Core Team, 2019) using *forecast::auto.arima* (Hyndman et al. 2019 and Hyndman and Khandakar 2008), and simulations from the model were made using *sarima::sim_sarima* (Boshnakov and Halliday 2019*).* A description of the best-fitting time series model is presented in Table 6. Two-year time series simulations from this model were added to two different reference area mean abundance values to simulate references for scenario #2 in Section 4.2.

Table 6. Summary of best fit time series model for BIWF REF-S otter trawl dataset

Area Modeled	Time Series Length	Best model from auto.arima()	General Description
REF-S	6 years	ARIMA(0,0,1)(1,0,0)[12] with non-zero mean	Stationary series with a moving average (lag 1) smoothing function; seasonal pattern (1,0,0) is auto-regressive (lag 1) for 12 seasons per year. Mean = 761 and sigma = 518.

4.2 Construct alternative time series scenarios

Four alternative time series scenarios were developed to represent pilot data for the "Before" time period. The time series scenarios are intended to model the potential range of spatial-temporal variability in future beam trawl data, with the purpose of estimating how this variability affects the power to detect a meaningful effect. The higher the spatial-temporal variability in catch data, the harder it is to confidently detect a difference that is meaningful. These four time series scenarios were based on the BIWF dataset, because this dataset is the closest analogue available for the South Fork area.

The time series for the impact site was unchanged in the four variance scenarios; only the mean and variance for the two reference areas were altered. Because the effect size is expressed as a proportion of the mean abundance at the impact site during the Before years, keeping the impact time series unchanged in these four different scenarios means that the relationship between the proportional effect size and the magnitude of total abundance stays constant across all scenarios. **In all four scenarios, the impact site was represented by the observed time series from years 5 and 6 (October 2016 to September 2018) for the APE block**, while two reference area time series were extracted or simulated from the BIWF time series as described below. The data for each area in these four alternative scenarios are graphically presented in Figure 5; summary statistics are presented in Table 7.

1. **Variance Scenario #1** used the observed time series from years 5 and 6 (October 2016 – September 2018) from BIWF reference areas (REF-S and REF-E). During this 2-year period, the time series from the impact and two reference areas were very similar, with minimal spatial variance and similar temporal variance among areas. Temporal-spatial interactions were also minimal.

2. **Variance Scenario #2** used the BIWF reference area surveys from years 5 and 6 with intra-annual and spatial variance increased through multiplying REFE abundances by a factor of 1.5, and REFS abundances by 0.5. Spatial variance is increased from the variance scenario #1, but temporal-spatial interactions remain minimal.

3. **Variance Scenario #3** used a simulated 2-year time series modeled from the temporal patterns observed in BIWF REF-S survey (Section 4.1), applied to two different reference means. Spatial variance is increased relative to variance scenario #1; intra-annual temporal variability is reduced and temporal-spatial interaction is increased relative to variance scenario #2.

4. **Variance Scenario #4** used the observed time series from years 1 and 2 (October 2012 – September 2014) from the BIWF reference areas (REF-S and REF-E). During this two year period there was substantial spatial and temporal variance, as well as temporal-spatial interaction.

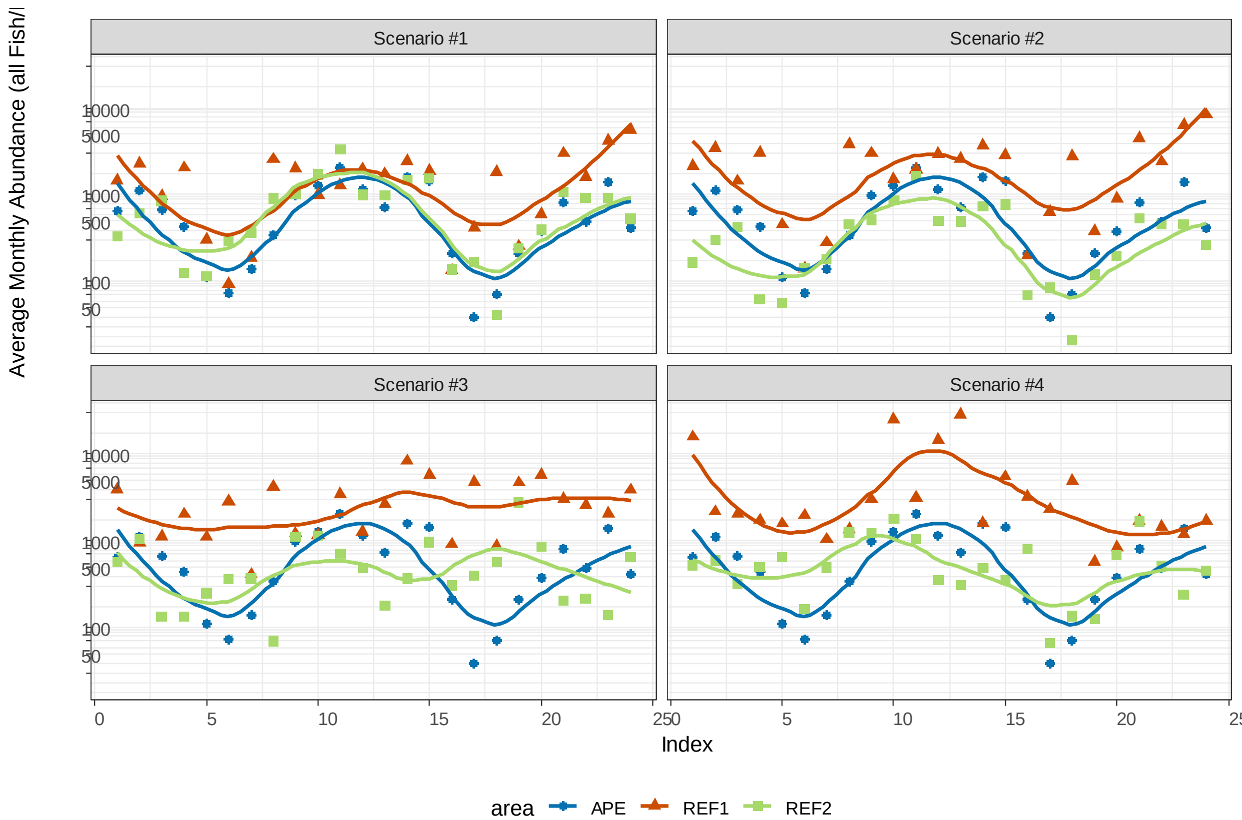


Figure 5. Time series for the four scenarios used in power simulations.

Table 7. Summary statistics[a] of total catch by area under the four alternative variance scenarios

	Scenario #1			Scenario #2			Scenario #3			Scenario #4		
	Mean	**SD**	**CV**	**Mean**	**SD**	**CV**	**Mean**	**SD**	**CV**	**Mean**	**SD**	**CV**
Impact	698	562	81%	698	562	81%	698	562	81%	698	562	81%
REF 1	1661	1324	80%	2492	1986	80%	2877	1982	69%	5314	7735	146%
REF 2	794	721	91%	397	361	91%	585	574	98%	614	469	76%
Standard Error of Means (n=3)	530			1133			1292			2690		

[a] Mean = average over 2 years; SD = standard deviation over 2 years (ignoring autocorrelation and assuming independence); CV = coefficient of variation = SD/mean x 100.

4.3 Estimate power using *epower* program

The *epower* program (Fisher et al, 2019) was initially run using 100 Monte Carlo simulations for each of the four scenarios used to describe the "Before Impact" period. Using 100 simulations provides preliminary results to highlight the patterns observed in the estimated power for various design and data scenarios. Three hundred simulations were run for effect sizes of -0.5 to refine the power estimates in this effect size range.

The model fit to the data is defined below, using model notation consistent with the notation used in Fisher et al (2019). Total abundance (Y) is modeled as a function of fixed and random effects using a generalized linear mixed model (GLMM). Y is distributed as a negative binomial variable, and the logarithm of its expected value (E[Y]) can be modeled as a linear function of the fixed and random effects.

$$log(E[Y(iltj)]) = \mu + u(l) + v(t) + k(lt) + z([t]j) + p(lj)$$

$$\mu = \beta_0 + \tau + \kappa + (\tau\kappa)$$

Where

$Y(iltj)$	=	total abundance in replicate (tow) *i* from location (or block) *l*, time (or year) *t*, subtime (or month) *j*
β_0	=	grand mean as intercept
τ	=	Before-After fixed effect
κ	=	Control-Impact fixed effect
$(\tau\kappa)$	=	fixed effect for BACI interaction term
$u(l)$	=	random effect for location *l* (*l*=1, 2, 3 for APE, REF1, and REF2)
$v(t)$	=	random effect for time (year) *t*
$k(lt)$	=	random effect for interaction between location *l* and time *t*
$z[t]j$	=	random effect for subtime (month) *j* nested within time (year) *t*
$p(lj)$	=	random effect for interaction between location and subtime

The basic study design for the SFWF beam trawl survey is described in Table 8 by the set design variables. The number of replicate tows per station per sampling event was varied in this analysis to explore how statistical power was affected by sampling effort. This analysis focused on total abundance as the response variable to be tested.

Table 8. Study design for SFWF beam trawl survey

Set design variables
• Impact Areas = 1 impact block
• Control Areas = 2 control/reference blocks
• Habitat Strata = 1 (a single stratum for habitat type was dominant within the areas that are fishable with the beam trawl)
• Frequency = once per month at each station (12 sampling events per year)
• Number of years Before impact = 2 • Number of years After impact = 2
Variables altered in the power analysis:
• Number of replicate tows (or stations) = 2, 3, or 4 tows per area per sampling event. Each tow represents a newly selected random station.

The variables altered in the power analysis (Table 8: three levels of replication) resulted in three different alternative designs. Power simulation results for the four alternative variance scenarios under these three alternative designs are shown in Table 9. The following conclusions can be made:

- Effect Size of 0 was used to estimate the Type I error (α) for each model and data scenario. For all scenarios, the type I error rate was a maximum of 1%, less than the nominal 5% Type I error rate that is typically used. A low Type I error indicates that spurious interaction effects are unlikely to be detected. The testing approach appears to be robust[1].

- Effect Size of -0.3 was found to have low power (< 50%) for all scenarios tested. This is not unexpected given the range of temporal differences observed in the bootstrapped results for the beam trawl survey and the BIWF dataset (Tables 3 and 4).

- Effect Size of -0.5 was found to have relatively high power (≥ 80%) for 3 and 4 replicate tows for Variance Scenarios #1 and #3, but only for the highest level of replication in the other two scenarios. The power results that are close to 80% could be tested with a larger number of simulations (m ≥ 500) in order to have greater confidence in these outcomes. Once power estimates are above 90% the marginal increase in power is less important.

- Effect Size of -0.7 resulted in high power (≥ 90%) for all of the designs for all four of the alternative variance scenarios tested. This provides assurance that the method and designs are capable of detecting fairly large effects (consistent with natural temporal variability) with consistently high power.

Table 9. Output from *epower* program estimating the power for three different model designs under four effect sizes for four alternative variance scenarios

		Type I error (α)			
Alternative Model Design[a]	Number of replicate tows	Variance Scenario #1	Variance Scenario #2	Variance Scenario #3	Variance Scenario #4
Effect Size = 0 (100 sims)					
1	2	0	0	0	0
2	3	0	0	0	0
3	4	0	0.01	0	0

		Power			
Alternative Model Design[a]	Number of replicate tows	Variance Scenario #1	Variance Scenario #2	Variance Scenario #3	Variance Scenario #4
Effect Size = -0.3 (100 sims)					
1	2	0.09	0.09	0.09	0.08
2	3	0.24	0.11	0.12	0.12
3	4	0.41	0.16	0.19	0.19
Effect Size = -0.5 (300 sims)					
1	2	0.79	0.51	0.65	0.46
2	3	0.93	0.72	0.83	0.66
3	4	1	0.82	0.95	0.87
Effect Size = -0.7 (100 sims)					
1	2	NT	0.99	0.98	0.97
2	3	NT	1	1	1
3	4	NT	1	1	1

[1] The same result was found by Fisher et al (2019) in their case studies. So, this robustness may be a function of the method rather than specific to the data.

[a] All model designs used the following: one impact block; two control blocks; one habitat stratum; monthly tows at each station (12 tows per year); two years of sampling Before and After the impact event.

5.0 Summary and Conclusions

As expected, increasing survey effort (i.e., more replicate tows) will increase the power to detect a given effect size. Variance Scenario #1 explored here was the last two years of the observed BIWF time series for the otter trawl surveys, representing realistic variance scenarios for fish trawl surveys in Rhode Island Sound. Three replicates resulted in high power (≥ 90%) to detect effect sizes of 0.5 or greater for this realistic variance scenario.

The power for the SFWF beam trawl surveys will depend on how the variance in those surveys compares to the surrogate variance scenarios explored in this analysis. Surveying SFWF using a survey design that samples monthly for 2 years before construction at 1 impact and 2 control locations, with three replicate stations per location will provide information similar to what was used in this power analysis, but specific to the SFWF impact assessment with a focus on the particular species of interest. After the first two years of the beam trawl surveys, this type of power analysis should be revisited to determine whether additional sampling effort during the After period is needed to achieve sufficient power given the actual spatial-temporal variability in the beam trawl catch.

Acknowledgements

Analyses were carried out using the software ‘epower’ V1.3 (BMT 2019) as described in Fisher et al (2019) and (BMT 2019) and based on the statistical programming platform R (R-Core Team, 2019). ‘epower’ has been developed jointly by BMT, the Australian Institute of marine Science and Queensland University of Technology. BMT, the Australian Institute of Marine Science and Queensland University of Technology accept no liability or responsibility for in respect of any use of or reliance upon this software.

6.0 References

Boshnakov, G. N. and J. Halliday. 2019. *sarima*: Simulation and Prediction with Seasonal ARIMA Models. R package version 0.8.1. https://CRAN.R-project.org/package=sarima

Fisher, R., G.R. Shiell, R.J. Sadler, K. Inostroza, G. Shedrawi, T.H. Holmes, and J.M. McGree. 2019. *epower*: An R package for power analysis of Before-After-Control-Impact (BACI) designs. *Methods Ecol. Evol.* 2019;00:1-11.

Hyndman R, Athanasopoulos G, Bergmeir C, Caceres G, Chhay L, O'Hara-Wild M, Petropoulos F, Razbash S, Wang E, and F. Yasmeen. 2019. *forecast*: Forecasting functions for time series and linear models. R package version 8.9 URL: http://pkg.robjhyndman.com/forecast .

Hyndman RJ, and Y. Khandakar. 2008. “Automatic time series forecasting: the *forecast* package for R.” Journal of Statistical Software, *26*(3), 1-22. URL: http://www.jstatsoft.org/article/view/v027i03

Malek, Anna. 2015. "An Investigation of the Fisheries Ecosystem Dynamics in Rhode Island's Nearshore Waters" (2015). *Open Access Dissertations.* Paper 352. http://digitalcommons.uri.edu/oa_diss/352

R Core Team. 2019. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/

APPENDIX C
High-Resolution Geophysical Surveys and Fisheries Monitoring Surveys

September 2020

South Fork Wind | Powered by Ørsted & Eversource

High-Resolution Geophysical (HRG) surveys are conducted by wind energy developers for site investigation to inform engineering and design. These surveys are also required by the Bureau of Ocean Energy Management (BOEM) for offshore wind development activities. Some stakeholders have raised the question about any spatial and temporal overlap of HRG surveys with fisheries monitoring surveys and whether HRG survey equipment potentially affects the behavior and distribution of marine taxa. Several points address this matter.

First, seismic air guns, which studies have shown can influence the distribution and catch rates of commercially important marine fish (e.g., Lokkeborg and Soldal, 1993; Engas et al., 1996), are not used during HRG surveys for offshore wind development. HRG surveys may employ a variety of different equipment, other than seismic air guns, that operate at a wide range of frequencies (Table 1). The acoustic characteristics of representative HRG survey equipment is well known, as shown in Table 1, which incorporates data from a recent study funded by BOEM to independently measure and verify the noise levels and frequencies of HRG equipment (Crocker and Fratantonio, 2016). Additional field studies have been conducted and are in review.

Second, well established audiograms have been used to understand the hearing sensitivities for a number of species of fish (Table 2). Fish have been classified into four groupings based on their physiology and their presumed hearing sensitivity (Hawkins et al., 2020). Of the HRG equipment that is commonly employed, ‘sparkers’ and ‘boomers’ operate at the lowest range of frequencies. As noted by Nedwell and Howell, (2004) there have been no animal reaction studies to determine how marine taxa respond to the boomers and sparkers that are used during HRG surveys, although Kikuchi (2010) suggested that sparkers and boomers may affect the behavior of cod due to the overlap between the hearing sensitivities of cod and the operational frequency of the equipment. Ørsted will not use ‘sparkers’ and/or ‘boomers’ in the South Fork lease area in the fall or winter of 2020 when fisheries monitoring surveys are expected to commence.

Third, for the remainder of 2020, the only HRG equipment that Ørsted plans to use in the SFWF lease area are non-intrusive parametric sub-bottom profilers and USBL acoustic positioning systems. The parametric sub-bottom profilers all operate at a frequency of $\geq$ 60 kHz, while the USBL’s operate at a frequency of $\geq$ 17 kHz (Table 1; Ørsted, 2019). Given that the operating frequencies of these HRG equipment are well outside the auditory range of nearly all species in the region, these HRG surveys are expected to have a negligible impact on the fisheries monitoring surveys. While the HRG equipment is likely to change over time, as stated above, Ørsted commits that seismic air guns will never be used for site investigations surveys. The Ørsted site investigations team records the time, date, and location that each piece of HRG equipment is deployed during site investigations surveys.

Finally, Ørsted anticipates that there will be periods of time with no spatial overlap between HRG surveys and fisheries monitoring surveys.

Table 1. Summary of the operating frequencies and source levels of HRG equipment authorized for use under the approved 2019 Ørsted IHA application.

Representative HRG Survey Equipment	Range of Operating Frequencies (kHz)	Baseline Source Level a/	Representative RMS_{90} Pulse Duration (millisec)	Pulse Repetition Rate (Hz)	Primary Operating Frequency (kHz)
USBL & Global Acoustic Positioning System (GAPS) Transceiver					
Sonardyne Ranger 2 transponder b/	19-34	200 dB_{RMS}	300	1	26
Sonardyne Ranger 2 USBL HPT 5/7000 transceiver b/	19 to 34	200 dB_{RMS}	300	1	26
Sonardyne Ranger 2 USBL HPT 3000 transceiver b/	19 to 34	194 dB_{RMS}	300	3	26.5
Sonardyne Scout Pro transponder b/	35 to 50	188 dB_{RMS}	300	1	42.5
Easytrak Nexus 2 USBL transceiver b/	18 to 32	192 dB_{RMS}	300	1	26
IxSea GAPS transponder b/	20 to 32	188 dB_{RMS}	20	10	26
Kongsberg HiPAP 501/502 USBL transceiver b/	21 to 31	190 dB_{RMS}	300	1	26
Edgetech BATS II transponder b/	17 to30	204 dB_{RMS}	300	3	23.5
Shallow Sub-Bottom Profiler (Chirp)					
Edgetech 3200 c/	2 to 16	212 dB_{RMS}	150	5	9
EdgeTech 216 b/	2 to 16	174 dB_{RMS}	22	2	6
EdgeTech 424 b/	4 to 24	176 dB_{RMS}	3.4	2	12
EdgeTech 512 b/	0.5 to 12	177 dB_{RMS}	2.2	2	3
Teledyne Benthos Chirp III - TTV 170 b/	2 to 7	197 dB_{RMS}	5 to 60	4	3.5
GeoPulse 5430 A Sub-bottom Profiler b/, e/	1.5 to 18	214 dB_{RMS}	25	10	4.5
PanGeo LF Chirp b/	2 to 6.5	195 dB_{RMS}	481.5	0.06	3
PanGeo HF Chirp b/	4.5 to 12.5	190 dB_{RMS}	481.5	0.06	5
Parametric Sub-Bottom Profiler					
Innomar SES-2000 Medium 100 c/	85 to 115	247 dB_{RMS}	0.07 to 2	40	85
Innomar SES-2000 Standard & Plus b/	85 to 115	236 dB_{RMS}	0.07 to 2	60	85
Innomar SES-2000 Medium 70 b/	60 to 80	241 dB_{RMS}	0.1 to 2.5	40	70
Innomar SES-2000 Quattro b/	85 to 115	245 dB_{RMS}	0.07 to 1	60	85
PanGeo 2i Parametric b/	90-115	239 dB_{RMS}	0.33	40	102
Medium Penetration Sub-Bottom Profiler (Sparker)					
GeoMarine Geo-Source 400J d/	0.2 to 5	212 dB_{Peak} 201 dB_{RMS}	55	2	2
GeoMarine Geo-Source 600J d/	0.2 to 5	215 dB_{Peak} 205 dB_{RMS}	55	2	2
GeoMarine Geo-Source 800J d/	0.2 to 5	215 dB_{Peak} 206 dB_{RMS}	55	2	2
Applied Acoustics Dura-Spark 400 System d/	0.3 to 1.2	225 dB_{Peak} 214 dB_{RMS}	1.1	0.4	1
GeoResources Sparker 800 System d/	0.05 to 5	215 dB_{Peak} 206 dB_{RMS}	55	2.5	1.9

Table 1 continued.

Representative HRG Survey Equipment	Range of Operating Frequencies (kHz)	Baseline Source Level a/	Representative RMS_{90} Pulse Duration (millisec)	Pulse Repetition Rate (Hz)	Primary Operating Frequency (kHz)
Medium Penetration Sub-Bottom Profiler (Boomer)					
Applied Acoustics S-Boom 1000J b/	0.250 to 8	228 dB_{Peak} 208 dB_{RMS}	0.6	3	0.6
Applied Acoustics S-Boom 700J b/	0.1 to 5	211 dB_{Peak} 205 dB_{RMS}	5	3	0.6

Notes:

a/ Baseline source levels were derived from manufacturer-reported source levels (SL) when available either in the manufacturer specification sheet or from the SSV report. When manufacturer specifications were unavailable or unclear, Crocker and Fratantonio (2016) SLs were utilized as the baseline:

b/ source level obtained from manufacturer specifications

c/ source level obtained from SSV-reported manufacturer SL

d/ source level obtained from Crocker and Fratantonio (2016)

e/ unclear from manufacturer specifications and SSV whether SL is reported in peak or rms; however, based on SLpk source level reported in SSV, assumption is SLrms is reported in specifications.

The transmit frequencies of sidescan and multibeam sonars for the 2019 marine site characterization surveys operate outside of marine mammal functional hearing frequency range.

It is important to note that neither Crocker and Farantino (2016), nor HRG manufacturer technical specifications report source levels in terms of the RMS_{90}, which is the metric required in assessment to the distance of NOAA Fisheries Level B harassment thresholds. Therefore, careful consideration should be made when attempting to make such direct comparisons. As shown in Crocker and Farantino, the pulse duration may also be a function of HRG operator settings.

Table 2. Summary of available information regarding the hearing sensitivities for fish species that are commonly encountered in the northwest Atlantic.

Species/Species Group	Family	Order	Sound Detection	Sensitivity
American eel	Anguillidae	Anguilliformes	Swim bladder close but not connecting to ear; Hearing by particle motion and pressure	Hawkins et al. 2020 Group 3 Up to 1-2 kHz
Alewife/herring/menhaden	Clupeidae	Clupeiformes (includes anchovies)	Weberian ossicles connecting swim bladder to ear; Hearing by particle motion and pressure	Hawkins et al. 2020 Group 4 Up to 3-4 kHz Alosinae detect to over 100 kHz
Cod/Pollock/Haddock/Hake	Gadidae	Gadiformes	Swim bladder close but not connecting to ear; Hearing by particle motion and pressure	Hawkins et al. 2020 Group 3 Up to 1-2 kHz
Mako sharks/mackerel sharks	Lamnidae	Lamniformes	No air bubble; Particle motion only	Hawkins et al. 2020 Group 1 Well below 1 kHz
Monkfish/goosefish	Lophiidae	Lophiiformes		unknown
Bluefish	Pomatomidae	Perciformes		unknown
Sea bass/groupers	Serranidae			unknown
Striped bass	Moronidae			unknown
Sand lance	Ammodytidae			unknown
Tautog	Labridae			unknown
Tunas/mackerels/albacores	Scombrinae		Swim bladder far from ear; Particle motion only	Hawkins et al. 2020 Group 2 Up to 1 kHz
Billfish/swordfish	Xiphiidae			unknown
Flounders/flatfish/sole/halibut	Pleuronectidae	Pleuronectiformes	No air bubble; Particle motion only	Hawkins et al. 2020 Group 1 Well below 1 kHz
Skates/rays	Rajidae	Rajiformes	No air bubble; Particle motion only	Hawkins et al. 2020 Group 1 Well below 1 kHz
Spiny dogfish	Squalidae	Squaliformes	No air bubble; Particle motion only	Hawkins et al. 2020 Group 1 Well below 1 kHz

References

Crocker, S.E., and Fratantonio, F.D. 2016. Characteristics of sounds emitted during high-resolution marine geophysical surveys. Naval Undersea Warfare Center Division Technical Report.

Engas, A., Lokkeborg, S., Ona, E., and Soldal, A.V. 1996. Effects of seismic shooting on local abundance and catch rates of cod (*Gadus morhua*) and haddock (*Melogrammus aeglefinus*). Canadian Journal of Fisheries and Aquatic Sciences, 53(10): 2238-2249.

Hawkins, A.D., Johnson, C., and Popper, A.N. 2020. How to set sound exposure criteria for fishes. The Journal of the Acoustical Society of America, 147: 1762. doi: 10.1121/10.0000907.

Kikuchi, R. 2010. Risk formulation for the sonic effects of offshore wind farms on fish in the EU region. Marine Pollution Bulletin, 60: 172-177.

Lokkerborg, S., and Soldal, A.V. 1993. The influence of seismic exploration with airguns on cod (*Gadus morhua*) behavior and catch rates. ICES Marine Science Symposium, 196: 62-67.

Ørsted Wind Power North America (Ørsted). 2019. Request for the taking of marine mammals incidental to the site characterization of lease areas OCS-A 0486, OCS-A 0487, and OCS-A 0500. Submitted to National Oceanic and Atmospheric Administration. June 10, 2019.

Popper, A.N., Hawkins, A.D., Fay, R.R. and 12 others. 2014. ASA S3/SC1.4TR-2014 Sound Exposure Guidelines for Fishes and Sea Turtles: A technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. Spring Briefs in Oceanography. Springer Science + Business Media. 87 pp.

APPENDIX D
Power Analysis for Lobster and Crab Ventless Trap Survey

September 2020

South Fork Wind | Powered by Ørsted & Eversource

1.0 Introduction

For the ventless trap survey, a Before-After-Control-Impact (BACI) design is planned to sample lobsters, Jonah crabs and rock crabs within the SFWF Project Area and two selected reference areas. EXA conducted an assessment for South Fork Wind, LLC, including a power analysis for this survey.

For the ventless trap survey, the trap size/configuration and trawl layout will be identical to that used by the University of Rhode Island and the Commercial Fisheries Research Foundation in the Southern New England Cooperative Ventless Trap Survey (SNECVTS). The SNECVTS datasets from 2014 and 2015 (Collie and King 2016) were queried to assess the residual variance estimates of lobster, Jonah crab and rock crab catch for use in this power analysis. The relationship between effect size and statistical power for the specific BACI contrast of interest was estimated under several alternative hypotheses about declines in the impact area relative to the control areas, and two different design alternatives were considered (i.e., two or three years post-construction).

2.0 Data and Assumptions

The survey design employed in the SFWF area will utilize 10-trap trawls configured identical to the trawls used in the SNECVTS survey (Collie and King 2016). The SNECVTS survey sampled three times per month over 6 months (May – October) each year. The SFWF ventless trap survey will sample twice per month over 7 months (May – November). The SFWF survey design will have an equal number of trawls in each area (Project Area and two reference areas) each year, with trawl locations randomly set during the first sampling event of each year and held fixed throughout the year, so that the response variable is annual average catch per trawl.

Details about the SNECVTS design:

- Each SNECVTS trawl was comprised of 10 traps, with six ventless (V) and four vented (or standard, S) using the following pattern: V-S-V-S-V-V-S-V-S-V. The trawl layout for the SFWF survey will be identical.
- Aliquot = random station location where a 10-trap trawl was placed. Same location was fished throughout the year, and a new location was randomly selected the next year. Similar approach will be used in the SFWF survey.

Data summaries were derived from the SNECVTS database as follows:

- The Lobsters table was queried, and the total lobster catch per 10-trap trawl was tallied. The Lobsters table only recorded non-zero catch, so zero catch trawls were added to the analysis table for trawls that were present in the Trawls table and absent in the Lobsters table.
- The final catch is summarized as average catch (number of lobsters) per trap (averaged over both trap types). The SFWF survey will use the same trawl configuration as the SNECVTS survey. Results may easily be converted to average catch per 10-trap trawl by multiplying catch results by 10.
- Similar queries were done on the bycatch tables for each year to obtain estimates for the Jonah and rock crab catch.

In the SNECVTS study, there were 24 aliquots sampled per year across the entire RI/MA BOEM lease area; five of these aliquots were within the SFWF footprint. Variances were summarized for the entire BOEM lease area, and separately for the SFWF Project Area. Aliquot numbers associated with the SFWF Project Area by year were:

- 2014: 14, 15, 20, 21, 22
- 2015: 38, 39, 44, 45, 46

In the SNECVTS study, each aliquot was fished three times per month over 6 months. For this analysis, annual catch rates were divided by 18 to get an annualized average catch per trawl in each aliquot. The database did not have information on missing/compromised traps, so all trawls were assumed to have 10 traps and catch per trawl was divided by 10 to estimate the annual average catch per trap (CPUE). Mean and variability across aliquots were summarized for the entire lease area, and for the subset of aliquots present within the SFWF footprint (Table 1). The CPUE data followed a lognormal distribution both for the SNECVTS dataset and the BIWF ventless trap dataset (2013-2018), so the data are summarized both on original and natural log scale. The mean, standard deviation and coefficient of variation (CV = standard deviation / mean) are reported, as well as the residual standard error (RSE). The RSE is used in the power calculations.

Table 1. Summary of mean and standard deviation for average catch of lobster and crab per trap (averaged over both trap types) in the SNECVTS dataset.

			Lobster		Jonah Crab		Rock Crab	
Group	**Scale**	**Summary Statistic**	**2014**	**2015**	**2014**	**2015**	**2014**	**2015**
All (n=24)	Original Scale	Mean	2.49	2.10	7.29	4.91	3.57	4.34
		Std Dev	1.60	0.83	3.27	1.84	3.59	4.11
		CV	64%	40%	45%	37%	100%	95%
	Log-scale	Mean	0.75	0.67	1.90	1.51	0.94	1.28
		Std Dev	0.57	0.37	0.44	0.44	0.85	0.55
		CV	76%	56%	23%	29%	90%	43%
			RSE = 0.48		**RSE = 0.44**		**RSE = 0.72**	
SFWF (n=5)	Original Scale	Mean	1.45	1.75	9.53	4.83	2.10	3.53
		Std Dev	0.61	0.53	5.41	0.55	0.92	1.13
		CV	42%	30%	57%	11%	44%	32%
	Log-scale	Mean	0.3	0.51	2.12	1.57	0.66	1.23
		Std Dev	0.4	0.33	0.58	0.12	0.48	0.29
		CV	130%	66%	27%	8%	73%	23%
			RSE = 0.36		**RSE = 0.42**		**RSE = 0.39**	

The SFWF ventless trap survey is designed to sample twice per month for 7 months. Bootstrapping was used to estimate the RSE for a 2x per month survey design using the SNECVTS dataset. The temporal patterns of catch in both the SNECVTS and BIWF surveys indicated that peak abundance had not always passed as of October, so sampling through November should result in variance estimates that are less than the values estimated here. The bootstrap estimates from the SNECVTS database used the following approach:

- Sample two dates per month (without replacement) to reflect the design planned for SFWF and estimate an annual mean per trawl.
- Sample k=5 trawls (with replacement) for each year from the entire BOEM lease area (n=24) and from the SFWF area (n=5). Repeat for k=5, 6, 7, 8 trawls.
- Calculate the RSE from the bootstrapped dataset for the BOEM lease area and the SFWF Project Area.
- Repeat process 5000 times. Results are summarized in Table 2.

Table 2. Table of RSE from bootstrap resampling (R=5000) of results on entire BOEM lease area and SFWF Project Area, sampling 2 dates per month and drawing 5, 6, 7, or 8 trawls per year.

	BOEM lease area (n=24)			SFWF Project Area (n=5)		
	Percentile			Percentile		
Trawl Count	**50th**	**75th**	**90th**	**50th**	**75th**	**90th**
Lobsters						
5 Trawls	0.47	0.56	0.63	0.34	0.39	0.45
6 Trawls	0.48	0.55	0.61	0.34	0.39	0.44
7 Trawls	0.48	0.54	0.60	0.34	0.39	0.44
8 Trawls	0.48	0.54	0.59	0.34	0.39	0.43
Jonah crabs						
5 Trawls	0.43	0.51	0.57	0.38	0.44	0.49
6 Trawls	0.43	0.50	0.55	0.38	0.43	0.48
7 Trawls	0.43	0.49	0.54	0.38	0.42	0.47
8 Trawls	0.44	0.49	0.54	0.38	0.42	0.46
Rock crabs						
5 Trawls	0.68	0.84	0.98	0.36	0.41	0.45
6 Trawls	0.69	0.83	0.96	0.36	0.40	0.44
7 Trawls	0.70	0.83	0.95	0.36	0.40	0.43
8 Trawls	0.70	0.82	0.93	0.36	0.40	0.43

The results for the SFWF Project Area changed very little when the number of trawls increased from 5 to 8, likely due to the small sample size from which the estimates were bootstrapped (n=5). However, the results for the BOEM lease area suggest that more trawls should reduce the upper bound of the expected variance, with little effect on the median value. Conservative results for all three species in the SFWF Project Area indicate an RSE in the range of [0.34, 0.49].

3.0 Methods

A power analysis is specific not only to study design and statistical model, but the hypothesis within that model that we want to test. The interaction hypotheses of interest associated with the ventless trap survey are as follows:

- $H_Ø$: Changes in CPUE in both the control and impact sites will be identical over time
- H_1: Changes in CPUE will not be the same at the control and impact sites over time (two-tailed)

Consistent with the SNECVTS and BIWF ventless trap datasets, the SFWF CPUE data are expected to be lognormally distributed. Consequently, a standard ANOVA model with normal errors may be used which greatly simplifies the power calculations. The effect sizes and residual variability were expressed on the log-scale, and power was estimated using the function *pwr::pwr.f2.test* (Champely 2020) within R version 4.0.0 (R Core Team 2020).

The study design has 2 years nested within each time period (before/after), and 2 control sites and an impact site within treatment. The interaction contrast we wish to test is the difference between the temporal change at the windfarm and the temporal change at the control sites, or $\Delta = \delta_{SFWF} - \delta_C$ where:

> $\delta_{SFWF} = \mu_{SFWF,B} - \mu_{SFWF,A}$ is the temporal difference in means (two-year average from the "before" period minus two-year average from the operation period) at the SFWF site.
>
> $\delta_C = \mu_{C,B} - \mu_{C,A}$ is the temporal difference in means at the control sites (multiple control sites are averaged within each period)

As a linear contrast, this test of Δ has the following coefficients, c_{ij}: (0.5, 0.5, -0.5, -0.5, -0.25, -0.25, 0.25, 0.25, -0.25, -0.25, 0.25, 0.25) where *i* = 1 (SFWF), 2 (Control 1), or 3 (Control 3); and *j* = years 1 to 4. The effect size for this contrast is calculated as in Perugini et al (2018) using following formula:

$$f = \left|\sum c_{ij}\mu_{ij}\right| / \sqrt{k \sum c_{ij}^2 \sigma^2} \qquad \text{[Eq. 1]}$$

where μ_{ij} is the mean of log(CPUE) in the ith area and *j*th year, and σ is the residual standard error (RSE = standard deviation of annualized log(CPUE) among trawls within each area and year). The RSE for the trawls within the SFWF footprint (n=5 in each of 2 years) for lobsters and crabs had median and 90th percentiles within the range of 0.34 to 0.49 (Table 2). Therefore, the following four RSE values will be used to capture the range of expected variability in the annual mean CPUE for lobsters and crabs: 0.35, 0.40, 0.45, 0.50.

The interaction effect size was calculated for a pattern of response with the temporal shift at the SFWF being a proportion of the shift at the control sites. All else being equal, the effect size 'f' is the same whether SFWF decreases by 50% and control sites are unchanged, or SFWF doubles and control sites increase by factor of 4: the relative change at control to SFWF is still 2 to 1. The SNECVTS 2014-2015 average CPUEs were used as the baseline year averages in all 3 areas (SFWF and Control 1 and Control 2). Effect sizes were calculated for two different proportional changes:

- **Level 1** (a small to moderate delta): a multiplier of change of 3/2 at controls or 2/3 at wind farm (a relative delta of 0.67), e.g., for baseline wind farm catch of 2 lobsters/trap the catch would decrease by 1/3 to 1.33 lobsters/trap during operation, and controls would stay the same.
- **Level 2** (a large delta): a multiplier of change of 2/1 at controls or 1/2 at windfarm (a relative delta of 0.5), e.g., for baseline wind farm catch of 2 lobsters/trap the catch would decrease by 50% to 1 lobster/trap during operation, and catches at the control sites would stay the same.
- The same effect size could be achieved with both the RSE and % change at windfarm either increasing or decreasing. For example, an interaction effect size of 0.27 could be achieved with all of the following combinations: (RSE =0.45, 40% decrease at windfarm), (RSE=0.35, 33% decrease), and (RSE=0.25, 25% decrease).

A spatially asymmetrical design is assumed with a single impact site and two control sites. Two different temporal scales are tested: two years of monitoring before construction contrasted with either two or three years of monitoring after construction.

Table 3. Interaction effect sizes calculated for BACI contrast (using Equation 1) for two different levels of change and range of likely RSE values

RSE	Change Level 1 Relative Delta = 0.67	Change Level 2 Relative Delta = 0.5
Two years before; Two years after		
0.35	0.27	0.47
0.40	0.24	0.41
0.45	0.21	0.36
0.50	0.19	0.33
Two years before; Three years after		
0.35	0.26	0.46
0.40	0.23	0.40
0.45	0.21	0.36
0.50	0.18	0.32

4.0 Results

Power was calculated as a function of sample size, for the range of interaction effect sizes shown in Table 3 for a design with one impact area and two control areas for 2 years before construction, and either 2 years (Figure 1) or 3 years (Figure 2) after operation. The minimum sample sizes to achieve 80% power with 90% confidence for the specific interaction effect sizes are presented in Table 4.

Table 4. Minimum sample sizes (power= 80%, confidence = 90%) for select interaction effect sizes

Interaction Effect Size	No. of Years in Operation Period		Assumptions
	2 years	3 years	
0.19	16	13	Small-moderate delta; high RSE
0.24	10	9	Small-moderate delta; moderately high RSE
0.27	9	7	Small-moderate delta; median RSE
0.33	6	5	Large delta; high RSE
0.41	5	4	Large delta; moderately high RSE
0.47	4	3	Large delta; median RSE

Notes:
Small-moderate delta is a 33% decrease at the windfarm with no change at control sites; a large delta is a 50% decrease at windfarm with no change at controls. The same effect size could be achieved if both delta and RSE decreased or increased.
RSE = residual standard error

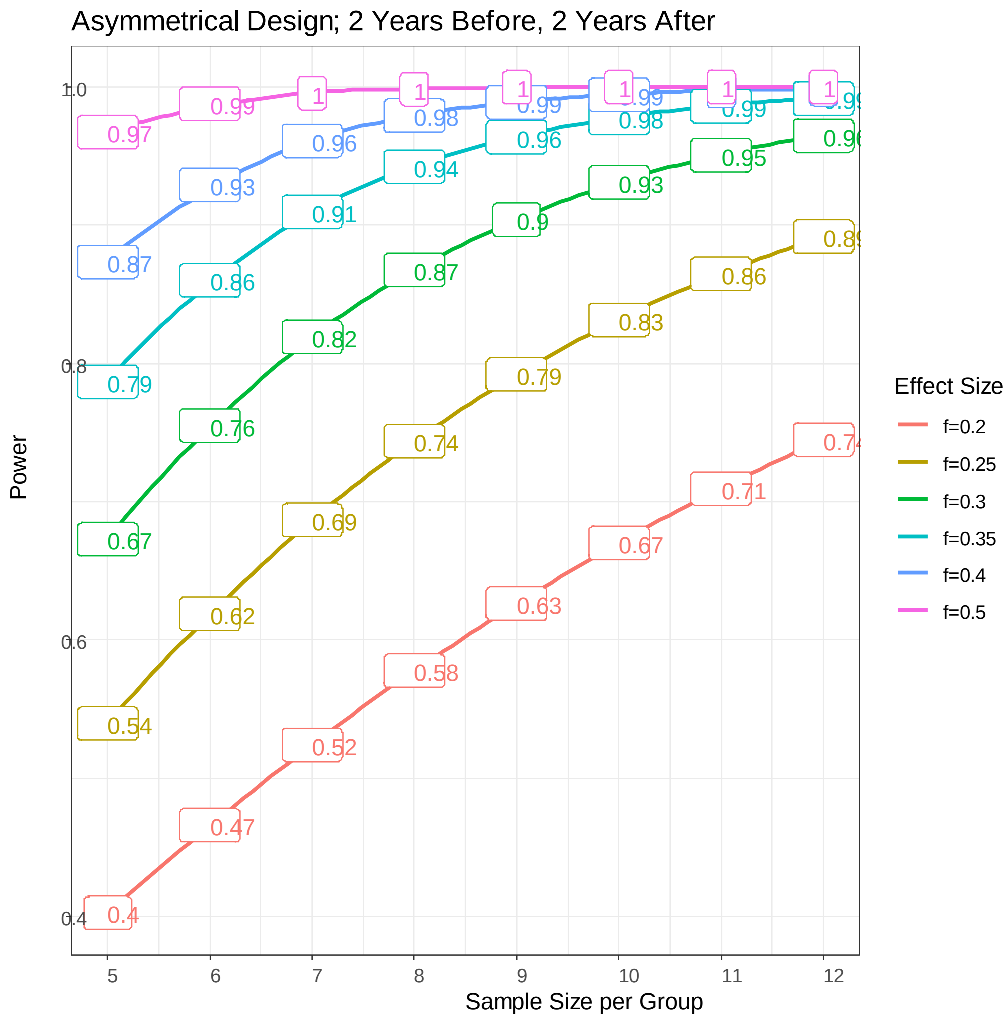


Figure 1. Power versus sample size (number of trawls) per area-year group for a range of interaction effect sizes (see Table 3), using a study design with single impact and two control areas for 2 years before and 2 years after construction, and α= 0.10.

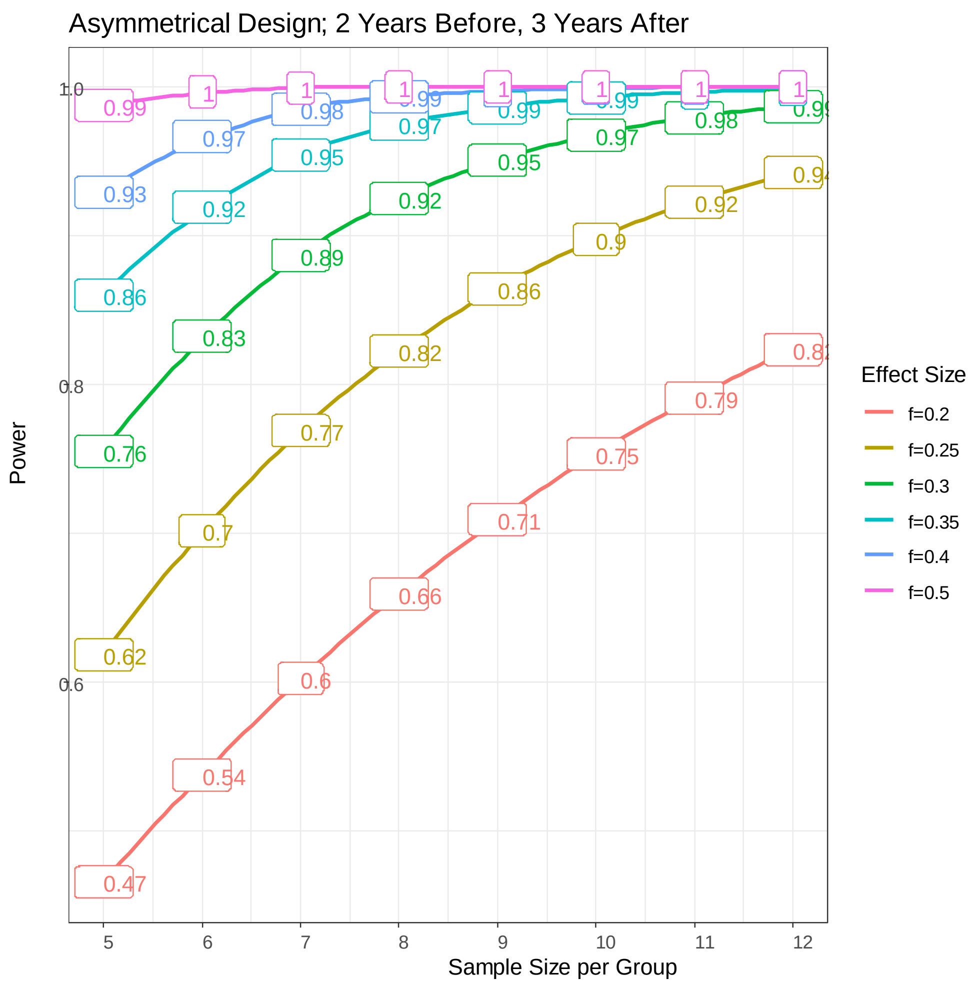


Figure 2. Power versus sample size (number of trawls) per area-year group for a range of interaction effect sizes (see Table 3), using study design with single impact and two control areas for 2 years before and 3 years after construction, and α= 0.10.

5.0 References

Champely, S. 2020. *pwr: Basic Functions for Power Analysis*. R package version 1.3-0. https://CRAN.R-project.org/package=pwr

Collie, J. and J. King. 2016. Spatial and Temporal Distributions of Lobsters and Crabs in the Rhode Island Massachusetts Wind Energy Area. Prepared for BOEM by University of Rhode Island Graduate School of Oceanography, Narragansett, RI. BOEM 2016-073

Perugini, M. M. Gallucci, G. Costantini. 2018. A Practical Primer To Power Analysis for Simple Experimental Designs, International Review of Social Psychology, 31(1): 20, 1–23, DOI: https://doi.org/10.5334/irsp.181

R Core Team. 2020. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

EXHIBIT 1

Date	Organizations/Individuals Contacted[1]	Location/Form of Contact and Response	Purpose of Contact
11/14/18	BOEM, CFRF, CT DEEP, MA DMF, MA CZM, NMFS, NYS DEC, NYS DOS, NYS DPS, RI CRMC, RI DEM, RISAA, Individual fishermen	Emails from SFW and recipient responses are attached to Exhibit 1 to Appendix A	Distribution of Gillnet monitoring plan for comment

[1] BOEM – Bureau of Ocean Energy Management; CFCRI – Commercial Fisheries Center of Rhode Island; CFRF – Commercial Fisheries Research Foundation; CT DEEP – Connecticut Department of Energy and Environmental Protection; MA DMF- Massachusetts Division of Marine Fisheries; MA CZM – Massachusetts Center of Coastal Zone Management; MA FWG – Massachusetts Offshore Wind Fisheries Working Group; NEFMC – New England Fisheries Management Council; NOAA/GARFO - National Oceanic and Atmospheric Administration's Greater Atlantic Regional Fisheries Office; NOAA/NMFS – National Oceanic and Atmospheric Administration's National Marine Fisheries Service; NYS DEC – New York State Department of Environmental Conservation; NYS DOS – New York Department of State; NYS DPS – New York State Department of Public Service; NYSERDA – New York State Energy and Research Development Authority; RI CRMC – Rhode Island Coastal Resources Management Council; RI DEM – Rhode Island Department of Environmental Management; RISAA – Rhode Island Saltwater Angler's Association; RODA – Responsible Offshore Development Alliance; ROSA – Responsible Offshore science Alliance; USACE – United States Army Corps of Engineers

Document Title: Demersal Fisheries Resources Survey Protocol - ***DRAFT***
Issued for Comment: November 14, 2018
Comments Due: December 14, 2018
Submit comments via email to: Melanie Gearon at mgearon@dwwind.com

1.0 Introduction

The South Fork Wind Farm (SFWF) is proposed in the Bureau of Ocean Energy Management (BOEM) Lease Area OCS A-0486 (Figure 1). Permit review for the SFWF is underway with offshore construction scheduled to begin in Spring 2021. Over the last three years, the SFWF team has spoken extensively with regional fishing organizations, working groups, and individual fisherman about their work in the project area as development of the wind farm has evolved. In addition, the SFWF team has consulted with several states (e.g., NY, CT, RI, and MA) and federal fisheries resource management agencies.

Based on feedback and data received to date, an approach to assess commercially and recreationally targeted demersal fish at the SFWF is needed. DWSF contracted INSPIRE Environmental, LLC. to draft this protocol for a Demersal Fisheries Resource Survey (Survey), which will provide data on:

1) Demersal species (susceptible to gillnets) that occur in and around the SFWF;
2) The seasonal timing of the occurrence of these species; and
3) Whether the taxonomic compositions of demersal fish assemblages change between the baseline and post-construction time periods, i.e., do some species have reduced abundance and/or new species appear?

This draft Survey protocol has been prepared for review by fishermen and state and federal resource management agencies. Comments on this draft Survey protocol must be submitted via email by December 14, 2018 to:

Melanie Gearon
South Fork Wind Farm
Manager, Permitting and Environmental Affairs
mgearon@dwwind.com

All comments will be considered. A final protocol will be published in a Request for Proposals (RFP) in the Winter of 2019 with the goal of starting the Survey in the Spring of 2019. Similar to the principles and practices for the Block Island Wind Farm, SFWF is committed to conducting scientific surveys and assessments that are collaborative with the fishing industry. SFWF will select for-hire gillnet fishing vessels from which the Survey will be conducted.

The SFWF “Project Area” is defined as the maximum work area required to install the SFWF (yellow outline in Figure 1 below). This includes the maximum extent where vessels or lift barges may anchor during construction around the wind turbines and foundations.

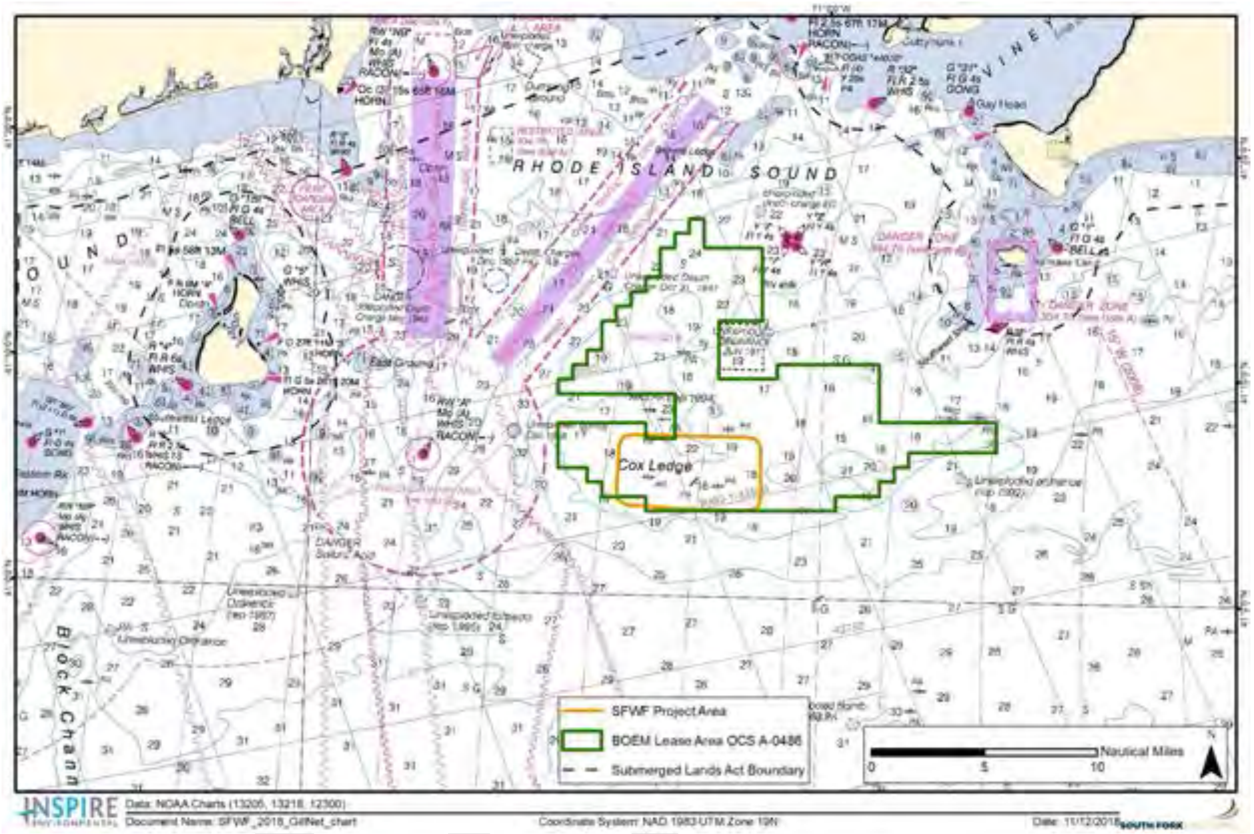


Figure 1. South Fork Wind Farm Project Area

2.0 Demersal Fisheries Resources Survey

The Survey will help establish pre-construction baseline community composition and may be used to assess whether detectable shifts occur in fish presence, absence, or abundance during and after construction.

2.1 Rationale

Federal Vessel Trip Report (VTR) data indicate bottom trawling and sink gillnets have the highest revenue and landings over all gear types fished within the Rhode Island-Massachusetts Wind Energy Area (RI-MA WEA). However, as indicated by fishermen, and further supported by Vessel Monitoring System (VMS) data, the SFWF Project Area within the larger RI-MA WEA, has minimal trawl effort. Gillnet high fliers have been observed in and around the proposed SFWF Project Area and participants in fisheries outreach meetings have indicated they actively gillnet in the Project Area. Details of the SFWF fisheries data assessment and stakeholder feedback can be found in the SFWF COP Appendix Y - *Commercial and Recreational Fisheries Technical Report*[1].

Southern New England waters are host to a large monkfish fishery, much of it permitted under gillnet licenses. Commercial fishermen who hold federal monkfish permits may also hold northeast multispecies, small mesh multi-species, spiny dogfish, and/or skate permits to optimize potential revenue and reduce bycatch return. As a result, a wide variety of demersal species are commercially fished using gillnets in the SFWF Project Area. Therefore, gillnets are proposed as the method of sampling for the Survey.

Gillnet selectivity depends mainly on fish size and shape and mesh size, but is also affected by the thickness, material, and color of net twine, hanging of net, and method of fishing (Hamley 1975). Using specific gear placements and prescribed mesh sizes, gillnets may be designed to target specific species, or subgroupings of species, and life stages.

Sampling demersal species with bottom otter trawls, similar to those used by NEAMAP[2] and at the Block Island Wind Farm, is less feasible within the SFWF Project Area due to the presence of boulders and mobile gear "hangs". Additionally, gillnets are static, or a fixed gear type, and exhibit low impact to benthic habitats (Thomsen et al., 2010).

2.2 Survey Design/Procedures

The Survey will be conducted from commercial fishing vessel(s) with scientists on board to process the catch. As summarized in Section 1.0, SFWF will run a procurement process for the selection of for-hire fishing vessels. Vessels will be selected based on criteria such as experience, safety record, knowledge of the area, and cost. Vessels will be required to have one or more federal gillnet permits for the monkfish, northeast multispecies, small mesh multi-species, spiny dogfish, and/or skate fishery management plans (FMP). The vessel's federal fishing permits will include incidental take under the Marine Mammal Protection Act (MMPA). Efforts will be taken to reduce marine mammal injuries and mortality caused by incidental interactions with fishing gear. Specific guidelines and plans (e.g., Harbor Porpoise Take Reduction Plan) will be implemented to reduce the potential for interaction or injury.

2.2.1 Proposed Sampling Stations

Three Survey blocks will be designated for sampling, two Survey blocks within the SFWF Project Area and one block within a reference area. Each Survey block contains three-predetermined gillnet areas delineated by bottom type: rocks and boulder, gravel, and sand/fines. One gillnet line per habitat type per block is randomly selected from the Survey areas for each Survey, resulting in nine independent gillnets conducted per Survey. Designation of Survey areas will be based on detailed geophysical seafloor Survey data as well as input from commercial gillnet fishermen regarding areas important to their work. Location of gillnets may be subject to change due to seasonal location of other fixed fishing

[1] The SFWF Construction and Operations Plan (COP) and Appendices can be accessed online at: https://www.boem.gov/South-Fork/

[2] NorthEast Area Monitoring and Assessment Program (NEAMAP)

gear (e.g., lobster pots). If a Survey line is found to have poor conditions for setting gillnets it may be moved based on the captain's professional judgement.

Data will be collected in the Project Area (near field) and a farfield reference area with similar habitat characteristics as the SFWF. The reference area will serve as a general index of demersal fish abundance in Rhode Island Sound in an area well outside of the direct influence of the SFWF. Sampling in a reference area is necessary because differences in demersal fish abundance data from this Survey before and after construction might be due to regional trends rather than impacts due to construction. The study will be a before-after control-impact (BACI) experimental design for direct effects, with quantitative comparisons made before and after construction and between control and impact areas (Underwood, 1994). A BACI design will allow for assessment of detectable shifts in fish presence, absence, or abundance associated with construction and proposed operations.

The systematic sample design consists of sampling each of the treatment blocks (Survey block x habitat type) with a gillnet. SFWF is requesting feedback on this draft Survey plan, including the identification of suitable locations in the Project Area and the farfield reference area. The proposed sampling locations will be selected to ensure both a robust statistical sampling approach, e.g., matching habitat and depth conditions among the sampling blocks, and to enhance operational execution of the Survey and minimize space conflicts with other active uses.

2.2.2 Gillnet Methods

A gillnet is a wall of netting that hangs in the water column, it is typically made of monofilament or multifilament nylon. Mesh sizes are designed to allow fish to get only their head through the netting, but not their body. The fish's gills then get caught in the mesh as the fish tries to back out of the net. Factors that can influence the catch rate of gillnets for target species include: fish density in the vicinity of gears, the behavior of the target species, the ability of fish to detect and locate the gillnet, and environmental factors such as water temperature, visibility, current direction, and velocity. It is often challenging to calculate catch per unit effort (CPUE) from gillnets due to potential changes in efficiency (e.g., fluctuating soak time and catch rate). This Survey is designed to account for as many variables as possible to standardize CPUE. Comparison of this gillnet Survey data to other baseline sampling efforts (e.g., nearby federal NEAMAP trawl stations) will be limited due to gear and effort differences.

The gillnet Survey may be conducted using two types of gillnets including experimental gillnets with multiple mesh sizes (e.g., four panels of 5", 6", 6.5" and 7" mesh) and typical, single mesh size gillnets commonly used in Rhode Island and Massachusetts fisheries (including the Southern New England Monkfish and Dogfish Gillnet Exemption Area) as determined through consultation with contracted fishermen.

Sampling will take place a minimum of once per season, year-round for a minimum of one year prior to the start of construction and for up to two years post construction. During the year of construction, sampling will track with the period of actual construction activities. The standard soak time of approximately 16 hours, is proposed to be consistent with recent scientific surveys (Kelly 2006, Grizzle et al., 2009), coupled with input from gillnet fisherman, to maximize catch and standardize catch rates. Soak time will remain consistent throughout the duration of the Survey. Each Survey event will be managed by a team of qualified scientists including a lead scientist with experience performing fisheries research. The catch will be removed from the gillnets by the boat crew for processing. The lead scientist will be responsible for collection of data and data recording.

Fish collected in each gillnet will be identified, weighed, and enumerated consistent with the sampling approach of Northeast Area Monitoring and Assessment Program (NEAMAP). Scientists will sort and identify fish, and weigh each species by the following protocol:

All organisms will be identified to species. Taxonomic guides include: NOAA Guide to Some Trawl Caught Marine Fishes (Flescher, 1980), Kells and Carpenter (2011) Field Guide to Coastal Fishes from Maine to Texas and Peterson's Field Guide to the Atlantic Seashore (Gosner, 1999).

The catch will be sorted by species. All specimens are sorted by species and size (if appropriate) into buckets or fish totes as needed. This process continues until all specimens are sorted, and the lead scientist verifies that the sorting areas are clear of all specimens.

Notwithstanding sub-sampling procedures, up to 50 individuals of each species/size are measured and the rest counted. Individual lengths are recorded on the field data sheet. Fork length is recorded for all fishes with a forked tail. Total length is measured for all other fishes. Exceptions to these rules are the measurement of skates and rays (disc width), and sharks (pre-caudal length). Total weight of all individuals of each respective species will be recorded.

2.2.3 Atlantic Cod Reproductive Stage

Atlantic cod is historically an important cultural and commercial species in New England and is believed to be dependent on geographically-specific spawning areas. Atlantic cod length, weight, location caught, and spawning condition will be recorded for all individuals caught. All Atlantic cod caught will be examined externally for signs indicating they are in the ripe and running maturity stage (Table 1). When caught individuals are not in the ripe and running maturation stage they will be dissected to determine maturation stage (Hutchings et al., 1999, Siceloff and Howell 2013, Dean et al., 2014). The maturity stage of each individual dissected will be assigned based on guidelines determined by Burnett et al. (1989) and updated by O'Brien et al. (1993): immature, developing, ripe, ripe and running, spent, resting, unknown (*Table* 1). Weight (g) of dissected gonads will be recorded. Photographs of gonads will be recorded for all individuals dissected for QA/QC analysis.

Table 1. Maturity staging criteria used during the Northeast Fisheries Science Center trawl surveys and to be utilized in determining Atlantic cod maturity (from O'Brien et al., 1993)

Stage	**Description and Criteria**
Female	
Immature	Ovary paired, tube-like, small relative to body cavity; colorless to pink jell-like tissue, no visible eggs; thin transparent outer membrane.
Developing	Ovaries large, occupying up to 2/3 of the body cavity; blood vessels prominent when present; ovary appears granular as yellow to orange yolked eggs develop. A mix of yolked and hydrated eggs.
Ripe	Ovaries large, may fill entire body cavity; hydrated eggs present. Transparent ovary wall.
Ripe and Running	Eggs flow from vent with little or no pressure to abdomen.
Spent	Ovaries flaccid, sac-like similar in size to ripe ovaries; color red to purple; ovary wall thickened, cloudy and translucent; some hydrated eggs may adhere to ovary wall.
Resting	Ovaries smaller than ripe ovaries, but larger than immature. Interior jell-like, no visible eggs.
Male	
Immature	Testes small relative to body cavity, colorless to gray and translucent. Testes narrow, lobed and elongated, resembles crimped ribbon.
Developing	Testes large, grey to off-white, firm consistency with very little or no milt present.
Ripe	Testes larger than 'Developing', chalk white, consistency mostly liquid. Milt flows easily when testes dissected.
Ripe and Running	Chalk white milt flows easily from the vent with little or no pressure on abdomen. Once dissected, milt flows easily.
Spent	Testes flaccid, may contain residual milt, less robust than 'Ripe'. Edges or other parts of testes starting to turn reddish to brown or grey as milt recedes.
Resting	Testes shrunken in size relative to 'Ripe'. Color is yellow, brown or grey with little or no milt.

2.2.4 Hydrographic and Atmospheric Data

Hydrographic data will be collected using a YSI 6820 V2 multi parameter sonde coupled with a YSI 650 MDS display system (or similar). The sonde is lowered overboard and held in surface waters until the instrument equilibrates. Water temperature (degrees C), dissolved oxygen concentration (mg/l), and salinity (ppt) data are recorded for the near-surface waters. The sonde is then lowered to near-bottom and water temperature, dissolved oxygen, and salinity data are recorded. Measurements are recorded for each station at the end of each tow.

Sea state and weather conditions are recorded from visual observations. Air temperature may be downloaded from a local weather station if not available onboard.

2.2.5 Gillnet Station Data

The following data will be collected during each sampling effort:

- Station number
- Latitude and longitude
- Soak start and end time and date
- Water depth
- Wind speed
- Wind direction
- Wave height
- Air temperature
- Surface and bottom water temperature, salinity, and dissolved oxygen

2.2.6 Data Entry and Reporting

Data will be transcribed from hard copy datasheets into electronic worksheets. The data sheets will be reviewed for data entry errors prior to importing into a relational database. Quality control checks will be performed on database tables by running standardized, systematic queries to identify anomalous data values and input errors. Species names (common and scientific) are verified and tabulated for consistency. All data used in analysis will be exported from the relational database.

Annual reports containing catch data will be prepared after the conclusion of each year of sampling and shared with State and Federal resource agencies. One final report will also be produced synthesizing the findings of the pre- and post-construction evaluations.

2.3 Potential Demersal Species Catch

It is anticipated that species primarily targeted in the monkfish, northeast multispecies, small mesh multi-species, spiny dogfish, and skate FMPs will account for a majority of the catch (Table 2). Table 2 is not all inclusive, additional fish and invertebrates will be caught in Survey gillnets.

Table 2. Example species likely to be collected in gillnet Survey.

Resource	FMP/Permit
Monkfish	Monkfish
Atlantic cod	Northeast Multispecies
Haddock	Northeast Multispecies
Atlantic pollock	Northeast Multispecies
Witch Flounder	Northeast Multispecies
Yellowtail Flounder	Northeast Multispecies
American Plaice	Northeast Multispecies
Winter flounder	Northeast Multispecies
Atlantic halibut	Northeast Multispecies
Redfish	Northeast Multispecies
White hake	Northeast Multispecies
Silver hake	Small-Mesh Multispecies
Red hake	Small-Mesh Multispecies
Offshore hake	Small-Mesh Multispecies
Spiny dogfish	Spiny Dogfish
Winter skate	Skate
Barndoor skate	Skate
Thorny skate	Skate
Smooth skate	Skate
Little skate	Skate
Clearnose skate	Skate
Rosette skate	Skate
Conger eel	NA
Black sea bass	NA
Tautog	NA
Cunner	NA
American lobster	NA

3.0 References

BOEM (Bureau of Ocean Energy Management). 2013. Guidelines for providing information on fisheries for renewable energy development on the Atlantic outer continental shelf pursuant to 30 CFR Part 585. Office of Renewable Energy Programs. August 13, 2013.

Dean, M. J., W. S. Hoffman, and M. P. Armstrong. 2012. Disruption of an Atlantic Cod spawning aggregation resulting from the opening of a directed gill-net fishery. North American Journal of Fisheries Management 32: 124–134.

Flescher, D. D. 1980. Guide to Some Trawl Caught Marine Fishes from Maine to Cape Hatteras, North Carolina. NOAA Technical Report NMFS Circular 431. March 1980.

Gosner, K.L. 1999. A Field Guide to the Atlantic Seashore: From the Bay of Fundy to Cape Hatteras. Houghton Mifflin Harcourt, 329 p.

Grizzle, R., L.G. Ward, L.A. Mayer, M.A. Malik, A.B. Cooper, H.A. Abeels, J.K. Greene, M.A. Brodeur, and A.A. Rosenberg. 2009. Effects of a large fishing closure on benthic communities in the western Gulf of Maine: recovery from the effects of gillnets and otter trawls. Fish Bull. 107: 308-317

Hamley, J. M. 1975. Review of gillnet selectivity. Journal of the Fisheries Board of Canada. 32(11): 1943-1969.

Hutchings, J. A., T. D. Bishop, and C. R. McGregor-Shaw. 1999. Spawning behaviour of Atlantic Cod, G*adus morhua*: evidence of mate competition and mate choice in a broadcast spawner. Canadian Journal of Fisheries and Aquatic Sciences 56:97–104.

ICES. 2006. Report of the ICES-FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB), 3–7 April 2006, Izmir, Turkey. ICES CM 2006/FTC:06, Ref. ACFM. 180 pp.

Kells, V. and K. Carpenter. 2011. A Field Guide to Coastal Fishes from Maine to Texas. Johns Hopkins University Press, 448 p.

Kelly, K. 2006. A pilot gillnet survey of the Cashes Ledge closed area. Northeast Consortium Technical Report and evaluation.

O’Brien, L., J. Burnett, and R. Mayo. 1993. Maturation of nineteen species of finfish off the northeast coast of the United States, 1985-1990. NOAA Technical Report NMFS-113. June 1993.

Petruny-Parker, M., A. Malek, M. Long, D. Spencer, F. Mattera, E. Hasbrouck, J. Scotti, K. Gerbino, and J. Wilson. 2015. Identifying Information Needs and Approaches for Assessing Potential Impacts of Offshore Wind Farm Development on Fisheries Resources in the Northeast Region. US Dept. of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2015-037. 79 pp.

Siceloff, L., and H. Howell. 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.

Underwood, A.J. 1994. On beyond BACI: sampling designs that might reliably detect environmental disturbances. Ecol Appl 4: 3–15.

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Monday, November 19, 2018 6:19 PM
To: fredmattera@cfcri.org
Cc: John O'Keeffe <jokeeffe@dwwind.com>; Rodney Avila <ravila@dwwind.com>; Caitlin O'Mara <comara@dwwind.com>
Subject: SFWF - Demersal Fisheries Resources Survey Protocol

Hi Fred,

Please find attached the South Fork Wind Farm (SFWF) *Draft Demersal Fisheries Resources Survey Protocol* for CFCRI review. Our team is seeking initial comments on this draft by **December 14, 2018**. This plan is part of the overall science agenda currently under development for the SFWF. This has been submitted to the following agencies for technical review: BOEM, NMFS, MA DMF, MA CZM, RI DEM, RI CRMC, CT DEEP, NYS DEC, NYS DPS, and NYS DOS. In addition, it has been circulated for comment to various regional fisheries organizations and fishermen that the SFWF fisheries outreach team regularly meet with.

I know that Rodney already sent this draft to several folks (including you) last week, but I want to make sure that CFCRI has received the document and is circulating within the Center.

Please let me know if you have any questions.

Thanks!
Melanie

DEEPWATERWIND
Clean energy is just over the horizon.®

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

From: Rodney Avila <ravila@dwwind.com>
Date: Friday, November 16, 2018 at 2:40 PM
To: Lanny <lad0626@aol.com>, Julia Prince <jprince@dwwind.com>, John O'Keeffe <jokeeffe@dwwind.com>, Julie Evans <jevansmtk@gmail.com>, Dave Beutel <dbeutel@crmc.ri.gov>, "edward.anthes-washburn@newbedford-ma.gov" <edward.anthes-washburn@newbedford-ma.gov>, Pamela Lafreniere <Pamela.Lafreniere@newbedford-ma.gov>, Fred Mattera <fredmattera@cfcri.org>, Richard Fuka <captlobster@yahoo.com>, Greg Duckworth <truetwistreap@yahoo.com>, Elizabeth Marchetti <rifisheryliaison@gmail.com>, Rodman Sykes <crfisheries@gmail.com>, Beth Casoni <beth.casoni@gmail.com>, Greg Materoins <saklob@aol.com>, Greg Dubrule <blackhawkfishing@gmail.com>, Capt Mike Barnett <mbarnett@optonline.net>, Michael Pierdinock <cpfcharters@yahoo.com>, Chris Brown <gvdwood@cox.net>, Jeff Kaelin <jkaelin@lundsfish.com>, Peter Hughes <phughes@atlanticcapes.com>, Gary Cobb <12thgenbonacker@gmail.com>, Score Alert <gary@davisplumbingmaterials1.net>, Tom Mikoleski <grandslamcharter@aol.com>, Tom Jordan <ebbtidemtk@optonline.net>, Jerry Borriello <jerryborrillo@gmail.com>, Orla Reville <orlareville@gmail.com>, Skip Rudolph <captskip2@optonline.net>, Andy Corrigan <hattandtails@gmail.com>, Burton Prince <Suziecharters@gmail.com>, Barry Kohlus <antj2@aol.com>, Scott Albrecht <scott@albrechtlaw.com>, Peter Anthony <peter@easternfisheries.com>, Ronnie Enoksen <ronnie@easternfisheries.com>, Steve Arnold <steve_sherry4@verizon.net>, Gary Yerman <swim@snet.net>, William Wells <WellsScals@aol.com>, Jim Auteri <jimauteri@gmail.com>, Jessica Coakley <jcoakley@mafmc.org>, Bill Grim <fvperception@gmail.com>, Dave Aripotch <captainhappy@optonline.net>, Danny Giunta <DoubleDMTK@yahoo.com>, Dan Farnham SR <offshorefishery@aol.com>, Dewey Wilson <andrew@amoryseafood.com>, Gary Stephens <GaryToad@aol.com>, Greg DiDomenico <gregdidomenico@gmail.com>, Harold Seybert <hseybert@hotmail.com>, James Jolly <rustyboat@gmail.com>, Annie Hawkins <annie@rodafisheries.org>, Richard Canastra <richie@baseseafood.com>, Bonnie Brady <greenfluke@optonline.net>, Scott Schafer <CaptScott@Runawayfishingcharters.com>, Capt Charlie <vecchmi@optpnline.net>, William McCann <william.mcCann@comcaast.net>, Tommy Williams <twilliams194@cox.net>, Arron Williams <Arronfisheries@hotmail.com>, Charles Weinon <star2017@aol.com>, Charlie Borden <choggiefish@hotmail.com>, Dave Lofstead <daveylof@msn.com>, David Pierce <david.pierce@state.ma.us>, Erling Berg <erlingberg99@yahoo.com>, Joy Weber <jweber@dwwind.com>, Chad Brayton <cbrayton@atlanticcapes.com>, Marc Palombo <calicolob@comcast.net>, Dan Farnham JR <siverdollarseafood@gmail.com>, Mike Theiler <lobster.mike@yahoo.com>, Skip Rudolph <captskip2@optonline.net>, Stu Foley <airandspeedsurf@gmail.com>, Matthew Trombly <matt.trombly@gmail.com>, Crista Banks <cbank@vineyardwind.com>, Donald Fox <dfox@towndock.com>, Rodney Avila <ravila@dwwind.com>, Katie Almeida <kalmeida@towndock.com>,

Eric Reid <ericreidri@gmail.com>, Richie Rosenkranz <wfs447@optonline.net>, Wayne Reichle <wreichle@lundsfish.com>, Richard Canastra <richie@baseseafood.com>, Dan Farnham <siverdollarseafood@gmail.com>, Megan Lapp <Meghan@seafreezeltd.com>, Saving Seafoods <taz@savingseafoods.org>, Ryan Fallon <covereaper@gmail.com>, Scott Berglin <bergman353@gmail.com>, Scott Leonard <topgunfishing27@gmail.com>, Al Schafer <alfred.schfer@icloud.com>, Art Cortes <captainart@earthlink.net>, Ben Philbrick <bphilbrick43@gmail.com>, Beth Casoni <beth.casoni@lobstermen.com>, Bill Reed <providencefisheries@gmail.com>, Ryan Fallon <covereaper@gmail.com>, Bob Markis <fishbones21@verizon.net>, Bob Smith <r.smith@tvcconnect.net>, Brent Lofres <blofres@hotmil.com>, Joe Mcbride <captmcbride@optonline.net>, Capt Ron <captron1@optonline.net>, Captain John <lotsoffish@aol.com>, Carl Forsberg <vikingfleet@gmail.com>, Mike Vegess <mabones@optonline.net>, Charles Donilon <snappacharters@cox.net>, Chris Healy <christopher.healy@cga.ct.gov>, Chris Westcott <chris_westcott200@yahoo.com>, Christine Blount <francesflt@aol.com>, Dan Buckley <capdanbuckley@gmail.com>, Danny Eilertsen <deilertsen@comcast.net>, Donald Frel <don.frel@noaa.gov>, Ed Renner <joxer821@aol.com>, Gary Rutty <tamgary399@gmail.com>, Gene Bergson <gene@harborblueseafood.com>, George Pharo <evets2409@outlook.com>, Jay Elsner <jaymassfab@verizon.net>, Jeff Grant <jeffgrant19@cox.net>, Joe Mcbride <captmcbride@optonline.net>, Joe Wagner <lobsterboy17@icloud.com>, John Deluca <john@johnnymarlin.com>, John Verissimo <JVerissimo@mfmga.org>, John Gillin <Gillinjohn@yahoo.com>, Julie Lofstad <jlofstad@southamptontownny.gov>
Subject: Demersal Fisheries Resources Survey Protocol

Demersal Fisheries Resources Survey Protocol

DEEPWATERWIND
Clean energy is just over the horizon.®

Rodney Avila
Fisheries Liaison – www.dwwind.com
Mobile: 508-889-0401
55 Pleasant Street, 5C, New Bedford, MA 02740

Subject: FW: Demersal Fisheries Resources Survey Protocol - DRAFT
Date: Monday, December 17, 2018 at 10:28:43 PM Eastern Standard Time
From: Melanie Gearon
To: Caitlin O'Mara
Attachments: 2018-11-13_SFWF-DraftDemersal_GillNetsurvey_for comment_JW .docx, image001.png

Comments from John Williamson below and attached. Please save his tracked version with comments, pdf email on BOX and extract his comments from the email and put into the comment tracker.
Thanks

From: John Williamson <john@seakeeper.org>
Date: Sunday, December 16, 2018 at 12:35 PM
To: Melanie Gearon <mgearon@dwwind.com>, John O'Keeffe <jokeeffe@dwwind.com>
Cc: Kris Ohleth <KRIOH@orsted.com>
Subject: Demersal Fisheries Resources Survey Protocol - DRAFT

Hi Melanie,

John O asked me to take a look at the Demersal Fisheries Resources Survey Protocol which you have circulated for comment. Attached is the document with my comments and small wording edits in Track Change.

I have several years' experience as a sink-gillnet fisherman in New England, and also worked in an Alaska drift gillnet fishery. A couple of concerns on this proposal:

First. It's admirable that you have reached out to local gillnet fishermen for input on this protocol. Unfortunately, I find the text confusing and, reading between the lines, I suspect that the author of the draft study (INSPIRE Environmental, LLC.) is confounding an understanding of the way gillnets are used on the Pacific coast and the way they are used here, which are significantly different. If your fisherman-reviewers also express confusion, that could be a reason.

Second. The stated objectives of the study:
1) Demersal species (susceptible to gillnets) that occur in and around the SFWF;
2) The seasonal timing of the occurrence of these species; and
3) Whether the taxonomic compositions of demersal fish assemblages change between the baseline and post-construction time periods, i.e., do some species have reduced abundance and/or new species appear?

The protocol design is "open ended" with no effective standardization and therefore may not achieve the intended ends, especially the much needed information in point 3

The survey protocol does not take into account the wide variation in gillnet use and design. In my experience:

- A New England gillnet is 300 feet long; fishermen tie gillnets together in multiple-net strings of 10 to 30, meaning that a string of gillnets may range from 0.5 miles to 1.5 miles long depending on the species being targeted and the terrain.
- Soak time may vary from a few hours (dogfish) to several days (monkfish/skates), depending on the species being targeted.
- Gillnets are highly selective due to mesh size – from 6" mesh (dogfish seasonal area exemption), to

6.5” mesh (groundfish minimum), to 11” mesh (typical monkfish).
- Another variation is the tied-down gillnet.

Because of this extensive variation in fishing practice, coupled with the limited amount of monthly sampling described, data generated in the described protocol will probably have low statistical power. Without rigid standardization of the length of gillnet strings, mesh size or soak times, the survey time-series will be unlikely to generate useful comparison of catch rates of any given species among the three treatment areas.

It might be better and more useful science therefore, to add specificity to this list and focus on one or two primary objectives (an example: changes in behavior and abundance of cod), in each case adopting a more structured sampling protocol tailored to each more limited objective.

Sorry to seem critical – it’s not intended. I think there are very useful data to be obtained in this overall approach – it just needs more thought. You might also seek input from the newly-hired NJ-based Orsted Fishery Liaison – Kevin Wark. Kevin is also an experienced gillnet fisherman who has participated in a lot of collaborative research. Kevinwark@comcast.net

Finally, NOAA has done surveys using gillnets in the past. Paul Rago was head of NOAA Populations Dynamics Branch in Woods Hole until his recent retirement. You might do a quick consult with Paul.
paulrago22@gmail.com

Best regards,
John Williamson

Fishery Liaison Ørsted US
Mobile: (207) 939-7055
john@seakeeper.net

Ørsted
Formerly DONG Energy

From: Melanie Gearon
To: Brian Gervelis
Subject: FW: SFWF - Draft Demersal Fisheries Resources Survey
Date: Wednesday, July 1, 2020 1:41:27 PM
Attachments: image002.jpg
2018-11-14_SFWF-DraftDemersal_GillNetsurvey_for comment.pdf
2018-11-16_SFWF Demersal Fisheries Survey-transmittal-NMFS.pdf

---

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Friday, November 16, 2018 7:39 PM
To: Susan Tuxbury - NOAA Federal <susan.tuxbury@noaa.gov>
Cc: Caitlin O'Mara <comara@dwwind.com>; Stephanie Wilson <swilson@dwwind.com>; Mary Colbert <mcolbert@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>; Aileen Kenney <akenney@dwwind.com>
Subject: SFWF - Draft Demersal Fisheries Resources Survey

Hi Sue,
Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for NMFS review. Please provide comments by December 14, 2018.
Thanks,
Melanie

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

Subject: Re: SFWF - Draft Demersal Fisheries Resources Survey
Date: Thursday, December 13, 2018 at 4:24:01 PM Eastern Standard Time
From: Susan Tuxbury - NOAA Federal
To: Melanie Gearon
CC: Caitlin O'Mara, Stephanie Wilson, Mary Colbert, John O'Keeffe, Aileen Kenney, Sharon Benjamin - NOAA Affiliate, Andrew Lipsky - NOAA Federal
Attachments: image001.png, 2018-12-13_NMFS Comments on Draft Demersal Fisheries Resources Survey Protocol.docx

Hi Melanie,

Thank you for the opportunity to review the SFWF Draft Demersal Fisheries Research Survey Protocol. In addition to our review in the regional office, we distributed the survey protocol for review by experts in our Science Center. We received some good feedback that we think will be helpful to you as develop the survey. Please let me know if you have any questions or want to discuss any of these comments further.

Thank you.

Sue

On Fri, Nov 16, 2018 at 7:39 PM Melanie Gearon <mgearon@dwwind.com> wrote:

> Hi Sue,
>
> Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for NMFS review. Please provide comments by December 14, 2018.
>
> Thanks,
>
> Melanie
>
> Melanie Gearon
>
> *Manager, Permitting & Environmental* ***Affairs*** – www.dwwind.com
>
> **Direct:** 401-648-2628 **Mobile:** 401-486-7797
>
> 56 Exchange Terrace, Suite 300, Providence, RI 02903

NMFS Comments on Draft Demersal Fisheries Resources Survey Protocol
December 14, 2018

General Comments

We appreciate the opportunity to review and provide comments on the Draft Demersal Fisheries Resources Survey protocol for the South Fork Wind Farm. The proposed study was reviewed by our Northeast Fisheries Science Center and our regional office. While we are providing specific comments by section, we would like to highlight some of the more significant comments and questions related to the proposed study. First, we have questions on the gear type proposed and the target species identified for the survey. While gillnets may be optimized for capturing monkfish, they may not be effective for other important demersal species. The target species identified for the project focus on the New England fish complex and is not representative of all the species that are likely to occur in and around the project area.

The duration of the survey (1 year pre- and 2 years post construction) is limited and may not provide enough data to quantify impacts of construction. The duration of the survey may depend on what the survey is attempting to quantify. For example, is it abundance in the specific area or overall impacts to demersal fish abundance from the wind farm? These are two different questions and the latter would require long-term monitoring surveys to answer the question. Furthermore, detecting spatial shifts or impacts on migratory pattern in species, and seasonal availability to local ports, will be difficult to answer at a small scale. It is important to design a study that can be calibrated with existing federal trawl surveys to allow for comparison with existing long-term data sets. We would encourage you to continue working with our agency as you finalize the designs for this survey.

1.1 Introduction

This section should include a statement of the reason for conducting this study, its goals, and the questions addressed.

It is not clear to which organizations and agencies the first paragraph refers - the agencies should be listed.

2.1 Demersal Fisheries Resources Survey

This section is quite vague and does not clarify the intent of this study. Everything proposed should flow from what the purpose, objectives, and questions this monitoring is focused on. In addition, this statement should include aspects beyond just presence, absence, and abundance, including fish condition and reproduction.

2.2. Rationale

We concur that minimal trawl effort exists within this area, but what has been done should not be ignored as it provides background coverage in space and time that the proposed monitoring program cannot cover. The NEFSC has completed trawl surveys in this area, as illustrated by the figure below.

4.2.5.2 NEFSC Seasonal Trawl Survey

The locations of seasonal trawls in the NEFSC seasonal trawl survey between 2003 and 2016 are illustrated in Figure 4-17.

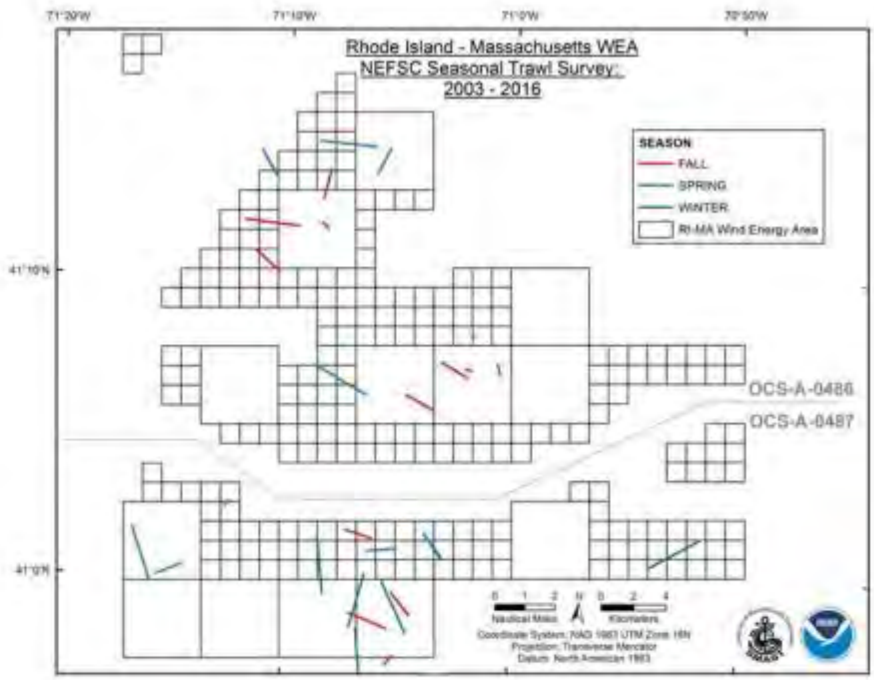


Figure 4-17. Locations of NEFSC seasonal trawls from 2003 to 2016 in the RIMA WEA.

It is not clear why only one gear type is being considered. While gill net fishing makes sense for the SFWF area in providing intensive data in an area where bottom trawling is difficult, it does have some downsides. Gillnets optimized for catching monkfish may not be effective on other demersal species. Gillnetting may or may not capture squid, crab and lobster resources or small juvenile cod and black sea bass that are specialized for utilizing certain rough-bottom habitats. It is not useful for assessing effects on bivalves, including sea scallops, which are known to be in the vicinity. Additional gear types for sampling should also be considered.

Since existing databases are largely populated with bottom trawl data, we recommend at a limited number of stations where gill net and trawl gear data are collected simultaneously, you make a comparison or calibrate gill net results. This will also make the results amenable to comparison with existing trawl data and across wind energy areas. Without any possibility of associating results in this study with the larger database, this becomes an isolated "black box" study where you can see the input (initial fishery abundance and wind farm installations) and output (resulting fishery abundance). It provides little extra data to begin to look for causes or connect it with a larger regional picture. We recommend these studies be designed to allow for comparison with existing survey data.

2.3.1 Proposed Sampling Stations

It will be difficult, if not impossible to examine the choices for sampling areas without review of the high-resolution geophysical data collected for the project. We request that you provided us with the geophysical data so we can provide input into the proposed sampling stations.

Biological sampling should be consistent with 'regional' surveys so comparisons to regional trends are valid. Priority species should be sampled in the same manner (e.g. length, weight, sex, maturity, age sample) and protocol (i.e. numbers per cm size bins) to compare fish condition and spawning, or potential different habitat use by size/age.

2.3.2 Gillnet Methods

While the SFWF is well outside the NEAMAP coverage, this area is within the NEFSC trawl survey coverage. While comparison may be limited, it certainly needs to be done and, therefore, simultaneous sampling via gill net and trawl is recommended. This will also be effective in sampling multiple species at different life stages.

Gillnet sampling should include an analysis of gillnet observations and characteristics of the soak duration, targets, and catches in order to be compared with the gill net catch data collected by fisheries observers. The design should provide sufficient observations to answer the pertinent questions. Part of this should include the description of the gillnet (as in, sink nets or floating nets, anchored or drift nets) and more detailed explanation of survey methods. For example, for the soak procedure, is the 16 hour standard soak time described starting regardless of time of day, or is it an overnight set? If the 16-hour soak time was determined in order to maximize catch and based on commercial catch, is fish condition a priority? Will the catch be retained by cooperating fishermen?

The mesh size protocol as described may not adequately capture effects on species that are affected, but are not caught (as in smaller than the 5” mesh will catch).

The number of samples proposed (for three fixed habitat stations, within two areas within the lease site and one outside control, a total of nine stations, once per season (assuming four seasons) would total 36 observations. In comparison many gear studies use paired trawls or paired gillnets, and we suggest the survey designers conduct an appropriate power analysis to determine the number of samples and soak times necessary to observe an affect. Spatial scale is simply not appropriate given the size of the lease sites and cumulative impacts. An immediate evaluation of soak times might help inform soak duration decisions. Similar analyses were conducted relative to the design of the ventless trap survey for scup and seabass that was an earlier cooperative research activity under Mid-Atlantic Research Set Asides (RSA) and Northeast Cooperative Research Program (NCRP) funding.

Justification for the timeline and schedule should be included, and clarification if “seasonal” means four times each year, three months apart. In addition, with only one year of data prior to construction, there is no way to control for inter-annual variability unrelated to the construction activity. This is an additional reason to plan protocol to make surveys comparable to existing datasets.

The last paragraph in this section refers to sub-sampling procedures - these should be described or referenced.

Recommend the sampling approach follow the NOAA trawl surveys since this project area overlaps with NOAA survey strata. Match the sampling protocols to those used for NEAMAP and NEFSC Bottom Trawl Survey, so that relevant comparisons are possible. Specifically, recording individual lengths, weights, sex, maturity, and potentially ages. Individual weights will be necessary to evaluate relative condition, which may be sex and maturity stage dependent (thus the need to determine those as well). Aim for individual weights at the 0.5-1 g resolution, as done on surveys with motion compensated balances.

Regarding measurements of sharks and rays, the NEFSC measures total length (TL) for skates, and disc width for rays. VIMS (and now NEAMAP) have a history of measuring pre-caudal lengths. The NEFSC shark longline survey measures over the body fork length as well as straightline for comparison to other studies. The longline survey also measures TL in natural position, the same two ways. In a dogfish reproduction study, NEFSC measured FL, natural and stretched TL. For skates and rays, suggest measuring both disc width and total length. If you must pick a single measurement pre-caudal is not appropriate. Thus to correspond to most studies and enforcement you should take straightline FL. For dogfish take stretched straightline TL for comparison to the NEFSC trawl survey. In general, we recommend working with the Apex Predators group at Narragansett Lab for guidance on protocols from their surveys.

This section should also provide protocols for lobsters, crabs, squid and scallops if there is anticipation of catching these species.

2.3.3 Atlantic Cod Reproductive Stage

More details should be provided on cod maturity portion of the proposed study plan. The purpose and objective of this section is not clear (e.g. Is this an attempt to document cod spawning in the area or determine if the wind farm impacts cod maturity?). More information should be provided so we can provide better feedback on this aspect of the study.

Measurements should include length (+/- 0.5 cm) and weight (+/- 0.5 g); the weight of dissected gonads should be record to 0.5 g precision as well.

A major problem with macroscopic maturity classification is the lack of a physical sample to revisit later (unlike age samples). Photos can help somewhat, but it is very easy to take a lot of terrible and useless photos at sea. If samples are taken from gonads, preserved, and processed for histology, these can serve as definitive diagnosis of reproductive condition, and also serve as an archive-able sample to be revisited as needed, shared with experts for agreement/confirmation, etc. Histology adds costs, but given expected low occurrence of cod in the area, this wouldn't be too large of a burden, and would provide the most accurate diagnosis.

2.4 Potential Demersal Species Catch

The list in Table 2 seems to "target" species that are commercially and recreationally caught in the SFWF area and certain important permitted fisheries. Based on NEFSC trawl survey data, the most abundant catch species within the RI WEA between 2003 and 2006 were longfin squid, scup, butterfish, and round herring (#1-4 in Fall), and Atlantic herring (#1 in Spring). None of these appear in this list. Only Northeast and Small-Mesh Multispecies, Monkfish, and Spiny Dogfish, and skate FMPs are mentioned. It is not clear why some species on the list have “NA” under the FMP/Permit column. Black sea bass is actually under the MAFMC Summer Flounder, Scup & Black Seabass FMP, tautog and American lobster are managed by the ASMFC via the states. It is not clear how these target species were selected, but this list appears very slanted toward certain New England fisheries and ignores others that could be important, particularly outside or adjacent to the project boundary. If this study only focuses on species fished within the SFWF project boundary, it could mask the true impact of this wind farm on the larger ecosystem by regarding only those species of commercial value within the project boundary.

From: [Melanie Gearon](#)
To: [Brian Gervelis](#)
Subject: FW: SFWF - Draft Demersal Fisheries Resources Survey
Date: Wednesday, July 1, 2020 2:11:48 PM
Attachments: image002.jpg
2018-11-15_SFWF Demersal Fisheries Survey-transmittal-BOEM.pdf
2018-11-14_SFWF-DraftDemersal_GillNetsurvey_for comment.pdf

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Thursday, November 15, 2018 11:51 AM
To: Stromberg, Jessica <jessica.stromberg@boem.gov>
Cc: Hooker, Brian (Brian.Hooker@boem.gov) <Brian.Hooker@boem.gov>; Stephanie Wilson <swilson@dwwind.com>; Caitlin O'Mara <comara@dwwind.com>; Mary Colbert <mcolbert@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>; Aileen Kenney <akenney@dwwind.com>
Subject: SFWF - Draft Demersal Fisheries Resources Survey

Hi Jessica,
Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for BOEM review. Please provide comments by December 14, 2018.
Thanks,
Melanie

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

Subject: FW: BOEM Comments: Deepwater Wind New England, LLC Draft Demersal Fisheries Resources Survey Protocol - OCS-A 0486

Date: Thursday, December 6, 2018 at 10:29:24 AM Eastern Standard Time

From: Melanie Gearon

To: Mary Colbert, Caitlin O'Mara

Attachments: BOEM Comments_Draft Demersal Fisheries Resources Survey Protocol_OCS-A 0486_120618.pdf, BOEM Comments_Draft Demersal Fisheries Resources Survey Protocol_OCS-A 0486_120618.docx

Caitlin,
Please file these comments on gill net plan from BOEM, integrate into comment tracker.

Mary
Please pdf email and put up in BOEM incoming correspondence

Thanks
Mel

From: "Stromberg, Jessica" <jessica.stromberg@boem.gov>
Date: Thursday, December 6, 2018 at 10:26 AM
To: Aileen Kenney <akenney@dwwind.com>, Stephanie Wilson <swilson@dwwind.com>, Melanie Gearon <mgearon@dwwind.com>
Cc: David Macduffee <david.macduffee@boem.gov>, Mary Cody <mary.cody@boem.gov>, Motunrayo Kemiki <motunrayo.kemiki@boem.gov>, "Hildreth, Emily" <emily.hildreth@bsee.gov>, "Boatman, Mary" <mary.boatman@boem.gov>
Subject: BOEM Comments: Deepwater Wind New England, LLC Draft Demersal Fisheries Resources Survey Protocol - OCS-A 0486

Aileen, Stephanie, Melanie,

On November 15, 2018, Deepwater Wind New England, LLC submitted a Draft Demersal Fisheries Resources Survey Protocol for the South Fork Wind Farm to BOEM for commercial lease OCS-A 0486. BOEM has reviewed the draft survey protocol and included comments in the attached comment/response matrix. A .PDF and Microsoft Word version of the comment/response matrix are available, with a column on the right-hand side for the Lessee to indicate how the comment has been addressed with the submission of the revised survey plan.

Staff are available to discuss the attached comments and how they can be resolved. Please let us know if you have any questions.

Thanks,

Jessica Stromberg
Project Coordinator
Office of Renewable Energy Programs
Bureau of Ocean Energy Management
Office: (703) 787-1730
Mobile: (571) 393-4371

BOEM Comment Matrix Deepwater Wind New England, LLC - Commercial Lease OCS-A 0486 Draft Demersal Fisheries Resources Survey Protocol Review (November – December 2018)							
#	**Location**		**BOEM Comment (December 6, 2018)**	**Type***		**Reviewer**	**Lessee Response (to be completed with revised submission): Explanation of how comment has been addressed**
	Section	**Page**		**C**	**Q**		
1.	2.2	3	Section 2.2 includes discussion regarding the authorized take of marine mammals that may occur. However, sea turtles may also be taken by these fisheries surveys, but such documentation of authorized take is absent from the plan. The plan must include a discussion of authorized turtle takes to ensure compliance with Section 7 or Section 9 of the Endangered Species Act. It is likely that NMFS has information regarding authorized take under a biological opinion associated with approval of a fishery management plan(s), but I am not aware of what that may cover or of the date it was issued. Please discuss and reference how take of sea turtles is authorized under the fishing activities proposed in the plan.	X		Baker	
2.	2.2	3	Please document and report to BOEM any take of seabirds or other avian species, if this should occur during demersal fisheries surveys, with photos if possible.		X	Bigger	

* Comment Type:
C = Completeness comment. Is something missing that should be included to meet the provisions of 30 CFR 585?
Q = Quality comment. A comment related to the quality of the methodology employed or the quality of the data, if said results were to be submitted in support of the Lessee's COP.

From: Melanie Gearon
To: Brian Gervelis
Subject: FW: SFWF - Draft Demersal Fisheries Resources Survey
Date: Wednesday, July 1, 2020 1:58:57 PM
Attachments: image002.jpg
2018-11-14_SFWF-DraftDemersal_GillNetsurvey_for comment.pdf
2018-11-16_SFWF Demersal Fisheries Survey-transmittal-CTDEEP.pdf

---

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Saturday, November 17, 2018 10:04 AM
To: Aarrestad, Peter <Peter.Aarrestad@ct.gov>
Cc: Alexander, Mark <Mark.Alexander@ct.gov>; Matthew Morrissey <mmorrissey@dwwind.com>; Aileen Kenney <akenney@dwwind.com>; Stephanie Wilson <swilson@dwwind.com>; Caitlin O'Mara <comara@dwwind.com>
Subject: SFWF - Draft Demersal Fisheries Resources Survey

Hi Peter,
Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for CT DEEP review. Please provide comments by December 14, 2018.
Thanks,
Melanie

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

From: Melanie Gearon
To: Brian Gervelis
Subject: FW: SFWF - Draft Demersal Fisheries Resources Survey
Date: Wednesday, July 1, 2020 1:57:09 PM
Attachments: image002.jpg
2018-11-14_SFWF-DraftDemersal_GillNetsurvey_for comment.pdf
2018-11-15_SFWF Demersal Fisheries Survey-transmittal-MA CZM.pdf

---

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Thursday, November 15, 2018 12:11 PM
To: Carlisle, Bruce (ENV) <bruce.carlisle@state.ma.us>; Engler, Lisa (ENV) <lisa.engler@state.ma.us>
Cc: Stephanie Wilson <swilson@dwwind.com>; Caitlin O'Mara <comara@dwwind.com>; Mary Colbert <mcolbert@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>; Aileen Kenney <akenney@dwwind.com>
Subject: SFWF - Draft Demersal Fisheries Resources Survey

Hi Bruce and Lisa,
Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for MA CZM review. Please provide comments by December 14, 2018. We respectfully request that MA CZM circulate this plan to the Massachusetts Fisheries Working Group (MA FWG) on offshore wind energy for review and comment.
Thanks,
Melanie

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

Subject: FW: Deepwater Wind SFWF Survey Plan
Date: Monday, December 17, 2018 at 9:54:12 PM Eastern Standard Time
From: Melanie Gearon
To: Caitlin O'Mara, Mary Colbert
Attachments: CZM to DWW SFWF re fishery survey plan 12 14 18 - signed.pdf

Comments from MA CZM

From: "Boeri, Robert (ENV)" <robert.boeri@state.ma.us>
Date: Friday, December 14, 2018 at 4:10 PM
To: Melanie Gearon <mgearon@dwwind.com>
Cc: "Pierce, David (FWE)" <david.pierce@state.ma.us>, "Ford, Kathryn (FWE)" <kathryn.ford@state.ma.us>, Aileen Kenney <akenney@dwwind.com>, Stephanie Wilson <swilson@dwwind.com>, Mary Colbert <mcolbert@dwwind.com>, "'Brian.Krevor@boem.gov'" <Brian.Krevor@boem.gov>, "mary.boatman@boem.gov" <mary.boatman@boem.gov>, "jessica.stromberg@boem.gov" <jessica.stromberg@boem.gov>, "susan.tuxbury@noaa.gov" <susan.tuxbury@noaa.gov>, "Engler, Lisa (ENV)" <lisa.engler@state.ma.us>, "Bordonaro, Patrice (ENV)" <patrice.bordonaro@state.ma.us>, "Callaghan, Todd (ENV)" <todd.callaghan@state.ma.us>
Subject: Deepwater Wind SFWF Survey Plan

Good afternoon Melanie,

I have attached CZM's comments on the above-referenced survey plan. Please feel free to contact Todd Callaghan at CZM should you have any questions.

Regards,

Bob Boeri

Robert L. Boeri
Massachusetts Office of Coastal Zone Management | Project Review Coordinator/Dredging Coordinator | 251 Causeway Street, Suite 800| Boston, MA 02114 | 617.626.1050 | robert.boeri@mass.gov

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 Causeway Street, Suite 800, Boston, MA 02114-2136
(617) 626-1200 FAX: (617) 626-1240

December 14, 2018

Ms. Melanie Gearon
Manager, Permitting and Environmental Affairs
Deepwater Wind South Fork, LLC
56 Exchange Terrace
Providence, RI 02903

Dear Ms. Gearon,

Thank you for providing the Massachusetts Office of Coastal Zone Management (CZM) the opportunity to review and comment on the document titled, "Demersal Fisheries Resources Survey Protocol-Draft" ("the survey") dated November 14, 2018. Below we offer comments and recommendations.

Survey Summary

Deepwater Wind (DWW) has proposed the South Fork Wind Farm (SFWF) in the Bureau of Ocean Energy Management's (BOEM) Lease Area OCS A-0486, roughly 15 nautical miles south west of Martha's Vineyard and adjacent to Cox Ledge, a well-known commercial and recreational fishing area. The intention of the survey is to provide data on:

1. Demersal species susceptible to gillnets that occur in and around the SFWF;
2. Seasonal timing of the occurrence of these species; and
3. Changes in taxonomic compositions of demersal fish assemblages between the baseline and post-construction time periods; i.e., do some species have reduced abundance and/or do new species appear after construction of SFWF?

DWW has proposed to define the fisheries community composition within the SFWF Project Area by deploying nine 4-panel gillnets with 5, 6, 6.5, and 7-inch mesh for 16 hours each. DWW proposes to use gillnet sampling rather than a traditional trawl survey since portions of the study area are too rocky to be trawled. DWW also states that based on Vessel Monitoring System data, field observations of gillnet "high fliers," and statements by fishermen at outreach meetings, that a wide variety of demersal species are commercially fished using gillnets in the SFWF Project Area. While the survey is designed to target monkfish, DWW expects that species included under the northeast multispecies, small mesh multispecies, spiny dogfish, and skate Fishery Management Plans will also be caught.

The statistical design includes three survey blocks: two within the SFWF Project Area and one block within a reference area. Each survey block would contain three-predetermined gillnet areas delineated by bottom type: rocks and boulder, gravel, and sand/fines. One gillnet setting site per habitat type per block would be randomly selected from the survey areas for each survey, resulting in nine independent gillnets conducted per survey. The surveys are proposed to be repeated four times prior to construction (seasonally for one year) and eight times post construction (seasonally for two years). After the 16-hour soak time, all organisms captured would be identified, counted, and measured for length. Any Atlantic cod captured would also be assessed for maturity stage. The surveys are proposed to be completed using for-hire commercial vessels whose owners hold the appropriate permits.

CZM Comments

The design of successful surveys and experiments often requires a power analysis to determine the minimum number of samples necessary to detect a measurable effect. It is not clear from the brief description of the proposed statistical design if a power analysis was performed. CZM suggests that DWW use existing fishery-dependent data from the gillnet fishery as the basis of a power analysis for determining how many samples (i.e., replications via gillnet sets) will be needed to achieve the twin goals of baseline characterization and detection of any changes in the community composition of the Project Area over time.

CZM agrees that a stratified approach to sampling is appropriate for the proposed survey. We recommend that the individual gillnet sites be randomly selected within each survey block in advance, and that a set of alternative sites be generated in case the initial list of sites cannot be occupied.

The draft protocol is not clear as to why the experimental design is set up asymmetrically (i.e., two survey blocks within the SFWF and only one reference survey block) and why more effort is proposed within the wind farm. Underwood (1992) highlighted the importance of replication, in general, and the importance of replication in reference sites. The proposed three gillnet sites in the reference block are likely inadequate replication to detect a change in the community. As stated above, a power analysis will help identify the necessary sampling effort for the proposed project's goals. CZM recommends that DWW consider a more balanced experimental design, or an asymmetrical design with more effort in the reference block(s), as DWW does for the Block Island Wind Farm trawl surveys.

CZM encourages DWW to consult with Massachusetts Division of Marine Fisheries and National Marine Fisheries Service to determine if other assessment means are warranted in the Project Area. In particular, ventless traps may be needed to assess potential changes to American lobster abundances and acoustic receivers may assist in assessing spatial use and any potential impacts to previously-tagged species of importance including Atlantic cod, haddock, striped bass, etc.

Thank you for the opportunity to provide comments on this draft survey. CZM appreciates DWW's commitment to balancing ocean renewable energy development with preserving existing resources and water dependent uses. CZM looks forward to working with DWW on the final survey.

Sincerely,

Lisa Berry Engler

Lisa Berry Engler
Acting CZM Director

Cc: David Pierce, Kathryn Ford DMF
Robert Boeri, Todd Callaghan, David Janik, CZM
Aileen Kenney, Stephanie Wilson, Mary Colbert, DWW
Mary Boatman, Jessica Stromberg, BOEM
Sue Tuxbury, NOAA-NMFS

Underwood, A.J. 1992. Beyond BACI: the detection of environmental impacts on populations in the real, but variable, world. Journal of Experimental Marine Biology and Ecology 161: 145-178.

From: Melanie Gearon
To: Brian Gervelis
Subject: FW: SFWF - Draft Demersal Fisheries Resources Survey
Date: Wednesday, July 1, 2020 1:55:47 PM
Attachments: image002.jpg
2018-11-15_SFWF Demersal Fisheries Survey-transmittal-MA DMF.pdf
2018-11-14_SFWF-DraftDemersal_GillNetsurvey_for comment.pdf

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Thursday, November 15, 2018 12:22 PM
To: Ford, Kathryn (FWE) <kathryn.ford@state.ma.us>
Cc: david.pierce@mass.gov; Stephanie Wilson <swilson@dwwind.com>; Caitlin O'Mara <comara@dwwind.com>; Mary Colbert <mcolbert@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>; Aileen Kenney <akenney@dwwind.com>
Subject: SFWF - Draft Demersal Fisheries Resources Survey

Hi Kathryn,
Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for MA DMF review. Please provide comments by December 14, 2018.
Thanks,
Melanie

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

Subject: FW: SFWF - Draft Demersal Fisheries Resources Survey
Date: Monday, December 17, 2018 at 10:37:57 PM Eastern Standard Time
From: Melanie Gearon
To: Caitlin O'Mara, Mary Colbert
Attachments: DMF to SFWF fisheries survey 12-13-2018.doc, image001.jpg

Comments from MA DMF

From: "Ford, Kathryn (FWE)" <kathryn.ford@state.ma.us>
Date: Thursday, December 13, 2018 at 7:35 PM
To: Melanie Gearon <mgearon@dwwind.com>
Cc: "Pierce, David (FWE)" <david.pierce@state.ma.us>, "Pol, Mike (FWE)" <mike.pol@state.ma.us>, "Logan, John (FWE)" <john.logan@state.ma.us>, "Burke, Erin (FWE)" <erin.burke@state.ma.us>, "Whitmore, Kelly (FWE)" <kelly.whitmore@state.ma.us>, "OKeefe, Catherine (FWE)" <catherine.okeefe@state.ma.us>, "DeCelles, Gregory (FWE)" <gregory.decelles@state.ma.us>, "Pugh, Tracy (FWE)" <tracy.pugh@state.ma.us>, "Callaghan, Todd (ENV)" <todd.callaghan@state.ma.us>, "Carlisle, Bruce (ENV)" <bruce.carlisle@state.ma.us>, Susan Tuxbury - NOAA Federal <susan.tuxbury@noaa.gov>, Julia Livermore <julia.livermore@dem.ri.gov>, "dbeutel@crmc.ri.gov" <dbeutel@crmc.ri.gov>, "Brunbauer, Morgan A (DEC)" <morgan.brunbauer@dec.ny.gov>, Michelle Bachman <mbachman@nefmc.org>, Brian Hooker <brian.hooker@boem.gov>
Subject: RE: SFWF - Draft Demersal Fisheries Resources Survey

Melanie,
Please see attached comments from Mass DMF. Regards, Kathryn

From: Melanie Gearon [mailto:mgearon@dwwind.com]
Sent: Thursday, November 15, 2018 12:22 PM
To: Ford, Kathryn (FWE)
Cc: Pierce, David (FWE); Stephanie Wilson; Caitlin O'Mara; Mary Colbert; John O'Keeffe; Aileen Kenney
Subject: SFWF - Draft Demersal Fisheries Resources Survey

Hi Kathryn,
Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for MA DMF review. Please provide comments by December 14, 2018.
Thanks,
Melanie

DEEPWATERWIND
Clean energy is just over the horizon.

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwin
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

Commonwealth of Massachusetts
Division of Marine Fisheries
251 Causeway Street, Suite 400
Boston, Massachusetts 02114
(617)626-1520
fax (617)626-1509

David E. Pierce, Ph.D.
Director

Charles D. Baker
Governor
Karyn E. Polito
Lieutenant Governor
Matthew A. Beaton
Secretary
Ronald Amidon
Commissioner
Mary-Lee King
Deputy Commissioner

Ms. Melanie Gearon
Manager, Permitting and Environmental Affairs
South Fork Wind Farm
56 Exchange Terrace
Providence, RI 02903

December 13, 2018

Dear Ms. Gearon,
Thank you for providing the Massachusetts Division of Marine Fisheries (MA DMF) the opportunity to provide comment on the document, "Demersal Fisheries Resources Survey Protocol-Draft" dated November 14, 2018 for the South Fork Wind Farm (SFWF).

SFWF has proposed define the study area's baseline community composition by deploying nine 4-panel gillnets with 5, 6, 6.5, and 7 inch mesh for 16 hours[1]. This survey will be repeated four times prior to construction (seasonally for one year) and eight times post construction (seasonally for two years). The survey uses a random stratified design stratified by bottom type into three strata: rocks and boulder, gravel, and sand/fines. Within each stratum 3 samples will be taken: 2 in the impact area and 1 in a reference area. The survey uses a gillnet since some areas of the study area are too rocky to be trawled and "a wide variety of demersal species are commercially fished using gillnets in the SFWF Project Area" (page 3). Whatever is captured will be identified, counted, and measured for length. Any Atlantic cod captured will also be assessed for maturity stage. Surveys will be done using for hire vessels (e.g., commercial vessels hired for the purpose of conducting the survey).

Our comments are organized by topic area below.

Survey purpose

- The plan states that "baseline community composition" is the primary goal. The survey plan focuses on in-water data collection and does not describe baseline work using available data, the identification of gaps in that data, and how this survey addresses those gaps. We believe this survey is an effort to increase the spatial resolution of existing datasets. The selection of the gillnet method we assume is to enable standard sampling across a broad range of substrate types.
- The purpose statement on page 2 also says the survey "may be used to assess whether detectable shifts occur in fish presence, absence, or abundance during and after construction." This objective should be clearly identified and the survey plan should describe how the proposed method will address this objective.
- A section describing reproductive sampling of cod is included but the purpose for that sampling is not described.
    - If the objective is to define the timing of spawning, then samples should be obtained on a monthly basis (at a minimum).

---

[1] The survey plan recognizes the wide variability in gillnet gear and the need for standardization but other specifications have yet to be determined.

  - If the objective is to determine whether or not cod spawn in the construction area, there are much more direct and effective ways to answer that question (e.g., high resolution rod and reel survey, passive acoustics, or a dedicated acoustic telemetry experiment).
  - What is the plan if few or no cod are caught during sampling in that quarter? Will additional gillnet sets be made to obtain samples?
  - Prior training with fresh or preserved samples to assess reproductive condition is recommended to ensure accuracy.
- Spatial distribution and relative abundance are typically sampled using different survey designs. Please be clear regarding the survey objectives and how the data will be used to address specific questions.
- MA DMF recommends that data collection should provide information on at least species composition, pelagic-demersal ratio, biomass, and relative abundance.

Survey design

- The main weakness to the proposed design is inadequate proposed sampling on all levels (in terms of proposed number of sites, stations per site, sampling years, and sampling frequency). For a given habitat type, there is only a single gillnet sample site for a reference and only two within the wind farm site. Replication should occur at the site-bottom type level (e.g., multiple sites within the reference area sampled over rock/boulder, several in ref site over sand/fines, etc and same for wind site). As proposed, comparisons of species composition between wind farm and reference for, say, a sand/fines bottom would be based on a single sampling location in the reference and only 2 sites in the farm. One reference site and one year of pre-construction baseline is inadequate for the stated objectives. The number of control sites should at least be equal to, if not exceed, the number of impact sites.
- Given the inherent interannual variability of fish distributions, especially on the scale proposed, it will be difficult to assess whether the baseline data are representative of a "typical" year. The proposed soak time is 16 hours/net. In total, if four samples were taken per year, the temporal intensity of sampling (64 hours/year) at the control and impact sites is very poor.
- It is likely that the samples sizes as proposed will be too small to detect changes in abundance, assemblage, or spatial distribution. A power analysis is needed to estimate the statistical power that would result from this (and alternative) sampling designs, before any decisions are made as to the intensity of sampling. Existing fishery dependent data from the gillnet fishery could be used as the basis of this power analysis.
- The alternative survey lines for when poor setting conditions are found should be pre-selected to avoid loss of randomization in the survey design.
- The uncertainty of the sampling frequency ("a minimum of once per season") is not appropriate. Please establish a sampling rate.

Survey method

- Gillnets can be a very effective monitoring tool and are legitimate to assess part of the baseline community composition. Furthermore, they are a sensible gear type for looking at pre and post-construction questions given concerns regarding access to trawlers among turbine fields both due to turbine spacing and the potential additional of hard bottom for scour protection. However, additional gear types should be used to appropriately assess baseline community composition, especially for the benthos. Gillnets will not adequately sample shellfish, Jonah crabs, or lobsters and the limited sampling will likely miss important migratory species. The Jonah crab and lobster resources around this location support the bulk of the remaining nearshore lobster fishers in the region, and as such require consideration in survey efforts. We recommend this study be combined with a ventless lobster trap study and the deployment of acoustic receivers at a minimum. We recommend the ventless lobster trap study utilize a fishery-independent BACI design with stratified random placement of stations using substrate type to define the strata (complex and not complex).
- A frequent concern in gillnet studies is how to handle fish caught in different ways within the net analytically (i.e. should they be included?). Suggested readings to better understand the advantages and limitations of gillnet sampling include Hubert, W. A., Pope, K. L., & Dettmers, J. M. (2012). Passive capture techniques. Pages 223-253 in A.V. Zale, D.L. Parrish, and T.M. Sutton. Fisheries

Techniques, 3rd Edition. American Fisheries Society, Bethesda, Maryland and He, P., and M. V. Pol. 2010. Fish Behavior near Gillnets: Capture Processes and Influencing Factors. Pages 183–198 in P. He, editor. Behavior of Marine Fishes: Capture Processes and Conservation Challenges. Wiley-Blackwell, Ames, Iowa. Numerous details affect catch in gillnets, including hanging ratios, mesh depth, twine diameter, and many others that must be vetted and standardized.
- The use of the meshes suggested will likely only capture fish recruited to the fishery. Of particular interest is the effect of construction and operation on abundance and presence of juvenile fish, which the survey gear will not capture.
- The plan should describe the order of meshes within gillnet strings, which should either be randomized, or designed so that each mesh occupies a position within the string an equal number of times. Gillnet strings are known to have end effects where the end panels capture fish at different rates than other panels.
- It is unclear why single mesh size gillnets will be deployed. The rationale for this sampling is not described, and is not recommended for abundance or assemblage changes.
- Commercial effort for monkfish and skates in the region uses larger mesh sizes (>10 inches) as well as tie-downs that restrict the floatline height. Intention to use this type of gear to sample these species should be explicit, as tie-downs and large meshes will yield very different results and samples differently than the other gillnets described.
- The soak time may not include a full diurnal cycle which is recommended for assessing species assemblages (Rotherham et al. 2006; Minns and Hurley 1988; Mattson and Mutales 1992; Šmejkal et al. 2015).
- Verification of fish species identification through freezing or photographing of samples is needed to assure accuracy. Of the guides suggested, Flescher is a dichotomous key but does not cover gillnet species and the others are not keys.
- The sampling plan is not appropriate for gillnet vessels. When gillnetting, fish will typically arrive singly and can be weighed and measured immediately; sorting is likely not necessary unless processing for scientific samples occurs later.
- What happens to live and dead catch? Are they landed or discarded?

Results
- A description of planned analyses is needed.
- Several of the species marked NA in Table 2 are included in Fisheries Management Plans.
- Please define how survey results will be made available and incorporated into data management systems.

General comments
- Other surveys have been conducted for SFWF, including a cod spawning survey and ventless lobster trap survey. It is our understanding that hydrodynamic studies are also required. How will these surveys be continued and used to inform both a baseline characterization of species and impact studies?
- There are specific impacts anticipated from offshore wind, in particular from sound during construction. Since a unique Atlantic cod spawning ground occurs at this potential wind farm site, it is important to fully characterize the timing, location, and sensitivity of the spawning activity to wind farm development. This should be a clear priority in any fisheries survey plan for the site.
- Other surveys are highly relevant to fisheries habitat, including surveys for benthic biota and oceanographic conditions. Are studies of these variables being conducted, and what fisheries concerns can they address? For example, we recommend that benthic grab studies be used to assess changes in prey composition. Benthic photo surveys should be used to assess changes in prey composition and shellfish abundance.
- A very important missing component is the assessment of fish condition. In addition to length, stomach contents and/or isotopes should be used to measure fish condition in several target species (e.g., monkfish, flounders, and skates).
- According to BOEM guidelines (BOEM 2013), the overall purpose of the fishery plan is to characterize the fishery resources within the survey area that may be affected by the proposed actions. The guidelines state:

The fish survey plan should describe how the following goals will be accomplished:

- Identify and confirm dominant benthic, demersal, and pelagic species within the project footprint and surrounding areas (see Section IV below);
- Establish a pre-construction baseline that may be used to assess whether detectable changes occurred in fish presence, absence, or abundance post-construction;
- Collect additional information aimed at reducing uncertainty associated with existing fish data and/or to help inform the interpretation of survey results; and
- Develop an approach to quantify any substantial changes in fish presence, absence, or abundance associated with proposed operations.

The survey specifications should state the issues to be investigated, hypotheses, assumptions, data collection techniques, standards, analytical and statistical techniques, and quality control.

The survey plan we reviewed only proposes a single study using a single gear type which will not identify and confirm dominant benthic, demersal, and pelagic species; it does not address the majority of the items to be covered in a fish survey plan as recommended by BOEM.

Questions pertaining to this review can be directed to John Logan (john.logan@mass.gov) or Kathryn Ford (kathryn.ford@mass.gov).

Sincerely,

Kathryn Ford, Ph.D.
Habitat Program Leader

Cc:
Pierce, Logan, Pol, Pugh, Burke, Whitmore, O'Keefe, DeCelles, MA DMF
Callaghan, MA CZM
Carlisle, MA CEC
Tuxbury, NOAA-NMFS
Livermore, RIDEM; Beutel, RI CRMC
Brunbauer, NYDEC
Bachman, NEFMC
Hooker, BOEM

References

BOEM 2013. Guidelines for Providing Information on Fisheries for Renewable Energy Development on the Atlantic Outer Continental Shelf. https://www.boem.gov/Fishery-Survey-Guidelines/

Minns, C.K. and D.A. Hurley. 1988. Effects of net length and set time on fish catches in gill nets. North American Journal of Fisheries Management 8: 216-223

Mattson, N. S., & Mutales, J. C. (1992). Multi-mesh gillnets to estimate species composition and catch per unit effort of fish in a small water body in Zambia. Journal of Fish Biology, 41(6), 897-908.

Šmejkal, M., Ricard, D., Prchalová, M., Říha, M., Muška, M., Blabolil, P., & Encina, L. (2015). Biomass and abundance biases in European standard gillnet sampling. PloS one, 10(3), e0122437.

Rotherham, D., Gray, C. A., Broadhurst, M. K., Johnson, D. D., Barnes, L. M., & Jones, M. V. (2006). Sampling estuarine fish using multi-mesh gill nets: effects of panel length and soak and setting times. Journal of Experimental Marine Biology and Ecology, 331(2), 226-239.

From: Melanie Gearon
To: Brian Gervelis
Subject: FW: SFWF - Draft Demersal Fisheries Resources Survey
Date: Wednesday, July 1, 2020 1:43:08 PM
Attachments: image002.jpg
2018-11-14_SFWF-DraftDemersal_GillNetsurvey_for comment.pdf
2018-11-16_SFWF Demersal Fisheries Survey-transmittal-NYDEC.pdf

---

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Friday, November 16, 2018 8:16 PM
To: Gaidasz, Karen M (DEC) <karen.gaidasz@dec.ny.gov>
Cc: Chytalo, Karen (DEC) <karen.chytalo@dec.ny.gov>; Brunbauer, Morgan A (DEC) <morgan.brunbauer@dec.ny.gov>; Caitlin O'Mara <comara@dwwind.com>; Stephanie Wilson <swilson@dwwind.com>; Aileen Kenney <akenney@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>
Subject: SFWF - Draft Demersal Fisheries Resources Survey

Hi Karen,
Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for NY DEC review. Please provide comments by December 14, 2018. We respectfully request that NY DEC circulate this plan to the New York Fisheries-Technical Working Group (F-TWG) for review and comment. I believe that Morgan and Karen (cc'd) participate in that working group.
Thanks,
Melanie

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

From: Melanie Gearon
To: Brian Gervelis
Subject: FW: SFWF - Draft Demersal Fisheries Resources Survey
Date: Wednesday, July 1, 2020 1:42:34 PM
Attachments: image002.jpg

From: Chytalo, Karen (DEC) <karen.chytalo@dec.ny.gov>
Sent: Monday, November 19, 2018 1:19 PM
To: Melanie Gearon <mgearon@dwwind.com>; Gaidasz, Karen M (DEC) <karen.gaidasz@dec.ny.gov>
Cc: Brunbauer, Morgan A (DEC) <morgan.brunbauer@dec.ny.gov>; Caitlin O'Mara <comara@dwwind.com>; Stephanie Wilson <swilson@dwwind.com>; Aileen Kenney <akenney@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>
Subject: RE: SFWF - Draft Demersal Fisheries Resources Survey

Thanks Melanie. Morgan will send to the TWG.

From: Melanie Gearon [mailto:mgearon@dwwind.com]
Sent: Friday, November 16, 2018 8:16 PM
To: Gaidasz, Karen M (DEC) <karen.gaidasz@dec.ny.gov>
Cc: Chytalo, Karen (DEC) <karen.chytalo@dec.ny.gov>; Brunbauer, Morgan A (DEC) <morgan.brunbauer@dec.ny.gov>; Caitlin O'Mara <comara@dwwind.com>; Stephanie Wilson <swilson@dwwind.com>; Aileen Kenney <akenney@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>
Subject: SFWF - Draft Demersal Fisheries Resources Survey

Hi Karen,
Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for NY DEC review. Please provide comments by December 14, 2018. We respectfully request that NY DEC circulate this plan to the New York Fisheries-Technical Working Group (F-TWG) for review and comment. I believe that Morgan and Karen (cc'd) participate in that working group.
Thanks,
Melanie

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

From:	Melanie Gearon
To:	Brian Gervelis
Subject:	FW: SFWF - Draft Demersal Fisheries Resources Survey
Date:	Wednesday, July 1, 2020 1:42:43 PM
Attachments:	image001.jpg

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Tuesday, November 27, 2018 4:19 PM
To: Brunbauer, Morgan A (DEC) <morgan.brunbauer@dec.ny.gov>
Subject: Re: SFWF - Draft Demersal Fisheries Resources Survey

Hi Morgan,
Thanks for distributing it to F-TWG. And, yes you have our permission to post to the website.
Best,
Melanie

From: "Brunbauer, Morgan A (DEC)" <morgan.brunbauer@dec.ny.gov>
Date: Tuesday, November 27, 2018 at 1:06 PM
To: Melanie Gearon <mgearon@dwwind.com>
Subject: RE: SFWF - Draft Demersal Fisheries Resources Survey

Hi Melanie,

We will share this with the F-TWG – should go out in the next day or so. Do you also want this posted on the F-TWG public website? We wanted to ask your permission before we posted it.

Thanks,

Morgan

From: Melanie Gearon [mailto:mgearon@dwwind.com]
Sent: Friday, November 16, 2018 8:16 PM
To: Gaidasz, Karen M (DEC) <karen.gaidasz@dec.ny.gov>
Cc: Chytalo, Karen (DEC) <karen.chytalo@dec.ny.gov>; Brunbauer, Morgan A (DEC) <morgan.brunbauer@dec.ny.gov>; Caitlin O'Mara <comara@dwwind.com>; Stephanie Wilson <swilson@dwwind.com>; Aileen Kenney <akenney@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>
Subject: SFWF - Draft Demersal Fisheries Resources Survey

Hi Karen,
Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for NY DEC review. Please provide comments by December 14, 2018. We respectfully request that NY DEC circulate this plan to the New York Fisheries-Technical Working Group (F-TWG) for review and comment. I believe that Morgan and Karen (cc'd) participate in that working group.
Thanks,
Melanie

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

NYSDEC Marine Resources Comments on SFWF Demersal Fisheries Resources Survey Protocol

page 4, 2nd to last paragraph: They need to select a gillnet mesh size and use it consistently at all stations during the whole survey. Otherwise they won't be able to compare catch

Page 4, Last paragraph: Please define the seasons sampling will occur. Is it just spring in fall? Four times a year? Being consistent from year to year will be important to compare catch data.

Page 4, Last paragraph: A minimum of two years of data should be collected prior to construction, three would be preferable. Three years post construction data collection is also suggested.

page 7, 1st paragraph: They should bring along a thermometer for air temperature. It's a small inexpensive piece of equipment - they shouldn't need to rely on the fisherman's equipment or download the data after the fact.

Page 7, 2,2,5, gillnet station data: They should record latitude and longitude at each end of the gillnet when they set them.

From:	Melanie Gearon
To:	Brian Gervelis
Subject:	FW: SFWF - Draft Demersal Fisheries Resources Survey
Date:	Wednesday, July 1, 2020 1:45:09 PM
Attachments:	image002.jpg 2018-11-14_SFWF-DraftDemersal_GillNetsurvey_for comment.pdf 2018-11-16_SFWF Demersal Fisheries Survey-transmittal-NYS DOS.pdf

---

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Friday, November 16, 2018 8:25 PM
To: McLean, Laura (DOS) <Laura.McLean@dos.ny.gov>
Cc: Maraglio, Matthew (DOS) <Matthew.Maraglio@dos.ny.gov>; Aileen Kenney <akenney@dwwind.com>; Stephanie Wilson <swilson@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>; Caitlin O'Mara <comara@dwwind.com>; Mary Colbert <mcolbert@dwwind.com>
Subject: SFWF - Draft Demersal Fisheries Resources Survey

Hi Laura,
Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for NY DOS review. Please provide comments by December 14, 2018.
Thanks,
Melanie

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

From:	Melanie Gearon
To:	Brian Gervelis
Subject:	FW: SFWF - Draft Demersal Fisheries Resources Survey
Date:	Wednesday, July 1, 2020 1:47:51 PM
Attachments:	image002.jpg 2018-11-14_SFWF-DraftDemersal_GillNetsurvey_for comment.pdf 2018-11-16_SFWF Demersal Fisheries Survey-transmittal-NYS PSC.pdf

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Saturday, November 17, 2018 9:37 AM
To: Davis, Andrew (DPS) <Andrew.Davis@dps.ny.gov>
Cc: Aileen Kenney <akenney@dwwind.com>; Mary Colbert <mcolbert@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>; Caitlin O'Mara <comara@dwwind.com>; Stephanie Wilson <swilson@dwwind.com>
Subject: SFWF - Draft Demersal Fisheries Resources Survey

Hi Andy,
Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for NYS PSC review. Please provide comments by December 14, 2018.
Thanks,
Melanie

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

From: Melanie Gearon
To: Brian Gervelis
Subject: FW: SFWF - Draft Demersal Fisheries Resources Survey
Date: Wednesday, July 1, 2020 1:52:17 PM
Attachments: image002.jpg
2018-11-16_SFWF Demersal Fisheries Survey-transmittal-RIDEM.pdf
2018-11-14_SFWF-DraftDemersal_GillNetsurvey_for comment.pdf

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Friday, November 16, 2018 7:50 PM
To: McNamee, Jason (DEM) <jason.mcnamee@dem.ri.gov>
Cc: Julia Livermore <julia.livermore@dem.ri.gov>; Aileen Kenney <akenney@dwwind.com>; Stephanie Wilson <swilson@dwwind.com>; Caitlin O'Mara <comara@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>; Mary Colbert <mcolbert@dwwind.com>
Subject: SFWF - Draft Demersal Fisheries Resources Survey

Hi Jason,
Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for RIDEM review. Please provide comments by December 14, 2018.
Thanks,
Melanie

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

Subject: FW: RIDEM DMF Comments on SFWF Gillnet Survey
Date: Monday, December 17, 2018 at 9:55:55 PM Eastern Standard Time
From: Melanie Gearon
To: Caitlin O'Mara, Mary Colbert
Attachments: RIDEM_Comments_on_Demersal_Fish_Survey.docx, image001.png

Comments from RI DEM

From: "Livermore, Julia (DEM)" <Julia.Livermore@dem.ri.gov>
Date: Friday, December 14, 2018 at 3:49 PM
To: Melanie Gearon <mgearon@dwwind.com>
Cc: "McNamee, Jason (DEM)" <jason.mcnamee@dem.ri.gov>, "Mcmanus, Conor (DEM)" <Conor.McManus@dem.ri.gov>, Susan Tuxbury - NOAA Federal <susan.tuxbury@noaa.gov>, "Ford, Kathryn (FWE)" <kathryn.ford@state.ma.us>, "Brunbauer, Morgan A (DEC)" <morgan.brunbauer@dec.ny.gov>
Subject: RIDEM DMF Comments on SFWF Gillnet Survey

Hello Melanie,

Thank you for the opportunity to provide feedback on the proposed South Fork Wind Farm gillnet survey. Attached you will find our comments. Please contact me with any questions.

Happy holidays,
Julia

Julia Livermore, Supervising Marine Biologist
Rhode Island Department of Environmental Management
Division of Marine Fisheries
3 Ft. Wetherill Rd.
Jamestown, RI 02835
Office: 401.423.1937
Fax: 401.423.1925

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
DIVISION OF MARINE FISHERIES
Three Fort Wetherill Road
Jamestown, Rhode Island 02835

To: Melanie Gearon, Manager of Permitting and Environmental Affairs

From: Jason McNamee, Chief of Marine Resources

Date: December 14, 2018

Re: Comments on Gillnet Survey

Staff at the Rhode Island Department of Environmental Management (RIDEM) Division of Marine Fisheries have reviewed the document titled "Demersal Fisheries Resources Survey Protocol – DRAFT". We commend your effort to collect data on demersal fish communities given the challenges associated with conducting an otter trawl survey in this area. We offer the following comments regarding the survey protocol:

Sampling Design

- No description of potential analysis is provided. This is necessary to determine how data will be used, and if the survey design meets the needs of the questions to be answered.
- The term "detectable shift" is not defined. What is meant by detectible and has a power analysis been done to determine whether shifts could be detectible from a statistical standpoint?
- The use of specific gear placements may target specific species and/or life history stages.
    - This is problematic if you are trying to detect changes in species assemblages, as the assemblages caught may be reflective of the areas and mesh sizes selected, rather than the actual community within the survey blocks. Current sampling protocol may not provide enough samples to make these determinations. However, if the focus is to identify changes in abundance and condition of specific species, targeted sampling may be appropriate.
- The distances of survey Blocks from the construction area are not described for the project area or the farfield reference areas.
    - This information is essential to understand what types of environmental effects may be detectible within each Block (e.g., how far away is pile driving noise disruptive?).
    - More information is necessary to understand siting of impact and reference areas.
- The word "season" is not defined within this sampling protocol and therefore the sampling frequency is not clearly presented.
    - Sampling should occur at least once per month to effectively capture change, as the timing of seasonal changes in temperature fluctuate from year-to-year.

    - Increased sampling will also be necessary from a statistical standpoint to evaluate any temporal or spatial changes.
- 16 hours is a relatively short soak time for a gillnet. While this will lead to a fresher catch and reduce predation on fish caught in the net, the shorter time may result in lower catch or missed movements of fish through the area. To correct this issue, better describe the seasonality component and increase sampling frequency (i.e., monthly) to improve the statistical power of the dataset.
    - Further, if a large school of fish moves though the area, they may fill up the net quickly, which reduces the amount of time that the net is actually fishing.
        - One method to understand whether a net was not fishing actively for the whole soak time is to use depth sensors on lead and float lines. This will show when the net collapsed under the weight of the catch.
- The time frame of data collection is too short if only one year of baseline data is collected.
    - At minimum, 2 years of baseline data should be collected, as was done for the Block Island Wind Farm demersal trawl and ventless lobster pot survey.

Gillnet configuration

- We are supportive of your selection of an experimental gillnet with varying mesh sizes, as well as the use of a commercial net. However, we have the following suggestions regarding design:
    - We are confused about what mesh sizes will be used. Section 2.2.2 Gillnet Methods states "The gillnet survey may be conducted using two types of gillnets including experimental gillnets with multiple mesh sizes (e.g., four panels of 5', 6', 6.5', and 7' mesh) and typical, single mesh size gillnets commonly used in Rhode Island and Massachusetts fisheries (including Southern New England Monkfish and Dogfish Gillnet Exemption Area) as determined through consultation with contracted fishermen." Given that nine nets will be used per Survey, the use of two nets is not possible. The same net configuration must be used in all locations for the data to be useful in detecting effects. The only way multiple nets could be used is if both an experimental (four mesh sizes) and a typical commercial (single mesh size) net were set at each block to show side-by-side results.
    - Nets with multiple panels should be arranged in a random sequence to reduce some of the selectivity bias that can exist between different mesh panels across the nets.
    - FAO has some literature explaining proper gillnet study design. Another good resource is: Holst, René & Madsen, Niels & Fonseca, Paulo & Moth-Poulsen, Thomas & Campos, Aida. (2005). Manual for gillnet selectivity.
- No mention is made of the use of tie-downs in the survey protocol. While tie-downs are common in the commercial fishery, they decrease net selectivity, and are not suitable for sampling. We therefore recommend that tie-downs be avoided.

- Generally, in gillnet surveys the fish captured in the first and last panel (the two outermost panels) are not considered. These two panels move around more frequently than other panels due to the floats and can frequently lift off the bottom allowing demersal fish to swim beneath. Therefore, the catch in the outermost panels is not representative of the area, as they "fish" inconsistently. If catch from these panels is included, an analysis should be done to ensure the catch is not significantly different within these panels as compared to other panels (of identical mesh size) in the net.

General Comments

- If possible, the RIDEM DMF would like to gain access to the survey data for use in species stock and habitat assessments.
- Given the selectivity of gillnets, other surveys (ventless lobster pot and hook and line) may be necessary to fill data gaps and collect data on a broader intersection of the fish community in the area.
- We would also recommend that you measure skates by total length. Total length is a better measurement to assess growth and is used in RIDEM DMF surveys.
    - If the disk with measurement is a function of NEAMAP sampling protocol, we recommend measuring both disk width and total length to improve utility of the gillnet survey data in assessment work.

From: Melanie Gearon
To: Brian Gervelis
Subject: FW: FAB review of South Fork proposed fisheries survey
Date: Wednesday, July 1, 2020 1:48:38 PM
Attachments: South Fork Fisheries Survey 2018.pdf

From: Dave Beutel <dbeutel@crmc.ri.gov>
Sent: Thursday, November 15, 2018 2:57 PM
To: saklob@aol.com; LAD0626@aol.com; 'Brian' <Kwe5tbos90@yahoo.com>; 'Polark' <polark1@verizon.net>; gvdwood@cox.net; 'Mike Marchetti' <fvmisterg@gmail.com>; 'Rick Bellavance' <makosrule@verizon.net>; 'Erich Stephens' <estephens@vineyardwind.com>; 'Erik Peckar' <erik@vineyardpower.com>; 'Rachel Pachter' <rpachter@vineyardwind.com>; 'Matthew Robertson' <mrobertson@vineyardwind.com>; john@seakeeper.net; 'James Neveu' <JANEV@orsted.com>; 'Laura Morse' <LAURM@orsted.com>; 'Michael Evans' <MICEV@orsted.com>; 'Donald Fox' <dfox@towndock.com>; 'Lisa Turner' <lturner@crmc.ri.gov>; Rodney Avila <ravila@dwwind.com>; 'Cristiana Bank' <cbank@vineyardwind.com>; 'Katie Almeida' <kalmeida@towndock.com>; 'Rodman Sykes' <crfisheries@gmail.com>; 'Fred Mattera' <fredmattera@cfcri.org>; 'Meghan Lapp' <Meghan@seafreezeltd.com>; Aileen Kenney <akenney@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>; 'R. Daniel Prentiss' <Dan@prentisslaw.com>; Melanie Gearon <mgearon@dwwind.com>
Cc: 'Grover Fugate' <gfugate@crmc.ri.gov>; 'Janet Coit' <Janet.Coit@DEM.RI.GOV>; 'Kearns, Christopher (DOA)' <Christopher.Kearns@energy.ri.gov>; 'Powers, Rosemary (GOV)' <Rosemary.Powers@governor.ri.gov>; 'Grant, Carol (DOA)' <Carol.Grant@energy.ri.gov>; 'Porfilio, Jaclyn (GOV)' <Jaclyn.Porfilio@governor.ri.gov>; 'James Boyd' <jboyd@crmc.ri.gov>; 'Dave Reis' <dreis@crmc.ri.gov>; 'Dan Goulet' <dgoulet@crmc.ri.gov>; Julia Livermore <julia.livermore@dem.ri.gov>; 'Jeff Willis' <jwillis@crmc.ri.gov>
Subject: FAB review of South Fork proposed fisheries survey

Fishing industry members,

Deepwater Wind has provided a draft of the fisheries survey proposed for the South Fork Wind Farm. Please review and provide comments. Thank you.

Dave

David Beutel
Coastal Resources Management Council
Aquaculture Coordinator
Oliver Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879
401-783-3370

From: Melanie Gearon
To: Brian Gervelis
Subject: FW: SFWF - Consistency Certification and Monitoring Plan
Date: Wednesday, July 1, 2020 1:50:29 PM
Attachments: image002.jpg
App A_SFWF_CZM Rvw 2018-11-10_Clean.pdf
App A_SFWF_CZM Rvw 2018-11-10_Redline.pdf
2018-11-13_SFWF-RI CRMC_Additional Info Request-Transmittal-Final.pdf
2018-11-14_SFWF-DraftDemersal_GillNetsurvey_for comment.pdf

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Tuesday, November 13, 2018 5:26 PM
To: Grover Fugate <gfugate@crmc.ri.gov>
Cc: Stephanie Wilson <swilson@dwwind.com>; Aileen Kenney <akenney@dwwind.com>; Mary Colbert <mcolbert@dwwind.com>; Stromberg, Jessica <jessica.stromberg@boem.gov>; John O'Keeffe <jokeeffe@dwwind.com>; Caitlin O'Mara <comara@dwwind.com>; 'Dave Beutel' <dbeutel@crmc.ri.gov>; James Boyd <jboyd@crmc.ri.gov>; David Schwartz <dschwartz@dwwind.com>
Subject: SFWF - Consistency Certification and Monitoring Plan

Dear Grover,
In response to your email sent on October 24, 2018 requesting additional information to support the Rhode Island Coastal Resources Management Council (CRMC) federal consistency review for the South Fork Wind Farm (SFWF) and South Fork Export Cable (SFEC), I am submitting the attached package:

- Submission cover letter
- Revised COP Appendix A - Coastal Zone Management Consistency Statements (New York, Rhode Island, and Massachusetts) (clean and redline versions)
- Draft Demersal Fisheries Resources Survey Protocol

Please do not hesitate to contact me if you have any questions. We will FedEx a hard copy of these materials to the CRMC office tomorrow.
Thanks,
Melanie

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

Subject: FW: FAB review of South Fork proposed fisheries survey
Date: Monday, November 19, 2018 at 5:31:25 PM Eastern Standard Time
From: Melanie Gearon
To: Caitlin O'Mara
Attachments: South Fork Fisheries Survey 2018.pdf

Dave Beutel's original email to FAB, please pdf email and post to BOX and make sure these emails are added to the gill net survey distribution list spreadsheet

---

From: Dave Beutel <dbeutel@crmc.ri.gov>
Date: Thursday, November 15, 2018 at 2:53 PM
To: "saklob@aol.com" <saklob@aol.com>, "LAD0626@aol.com" <LAD0626@aol.com>, 'Brian' <Kwe5tbos90@yahoo.com>, 'Polark' <polark1@verizon.net>, "gvdwood@cox.net" <gvdwood@cox.net>, 'Mike Marchetti' <fvmisterg@gmail.com>, Rick Bellavance <makosrule@verizon.net>, 'Erich Stephens' <estephens@vineyardwind.com>, 'Erik Peckar' <erik@vineyardpower.com>, 'Rachel Pachter' <rpachter@vineyardwind.com>, 'Matthew Robertson' <mrobertson@vineyardwind.com>, "john@seakeeper.net" <john@seakeeper.net>, 'James Neveu' <JANEV@orsted.com>, 'Laura Morse' <LAURM@orsted.com>, 'Michael Evans' <MICEV@orsted.com>, 'Donald Fox' <dfox@towndock.com>, 'Lisa Turner' <lturner@crmc.ri.gov>, Rodney Avila <ravila@dwwind.com>, 'Cristiana Bank' <cbank@vineyardwind.com>, 'Katie Almeida' <kalmeida@towndock.com>, 'Rodman Sykes' <crfisheries@gmail.com>, 'Fred Mattera' <fredmattera@cfcri.org>, 'Meghan Lapp' <Meghan@seafreezeltd.com>, Aileen Kenney <akenney@dwwind.com>, John O'Keeffe <jokeeffe@dwwind.com>, "'R. Daniel Prentiss'" <Dan@prentisslaw.com>, Melanie Gearon <mgearon@dwwind.com>
Cc: 'Grover Fugate' <gfugate@crmc.ri.gov>, 'Janet Coit' <Janet.Coit@DEM.RI.GOV>, "'Kearns, Christopher (DOA)'" <Christopher.Kearns@energy.ri.gov>, "'Powers, Rosemary (GOV)'" <Rosemary.Powers@governor.ri.gov>, "'Grant, Carol (DOA)'" <Carol.Grant@energy.ri.gov>, "'Porfilio, Jaclyn (GOV)'" <Jaclyn.Porfilio@governor.ri.gov>, 'James Boyd' <jboyd@crmc.ri.gov>, 'Dave Reis' <dreis@crmc.ri.gov>, 'Dan Goulet' <dgoulet@crmc.ri.gov>, Julia Livermore <julia.livermore@dem.ri.gov>, 'Jeff Willis' <jwillis@crmc.ri.gov>
Subject: FAB review of South Fork proposed fisheries survey

Fishing industry members,

Deepwater Wind has provided a draft of the fisheries survey proposed for the South Fork Wind Farm. Please review and provide comments. Thank you.

Dave

David Beutel
Coastal Resources Management Council
Aquaculture Coordinator
Oliver Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879
401-783-3370

Subject: FW: Demersal Fisheries Resources Survey Protocol
Date: Monday, November 19, 2018 at 10:07:14 AM Eastern Standard Time
From: Rodney Avila
To: Melanie Gearon, Caitlin O'Mara
Attachments: image001.png

From: Rodney Avila <ravila@dwwind.com>
Date: Friday, November 16, 2018 at 4:17 PM
To: Gary Yerman <swim@snet.net>
Subject: Re: Demersal Fisheries Resources Survey Protocol

Thank you if you need more copies I will send you some
Rodney

Get Outlook for iOS

From: Gary yerman <swim@snet.net>
Sent: Friday, November 16, 2018 3:07 PM
To: Rodney Avila
Subject: Re: Demersal Fisheries Resources Survey Protocol

Hello Rodney,

I have downloaded the info. I'll make copies and give to our group of concerned individuals.

Regards,
Gary

On Friday, November 16, 2018, 2:41:18 PM EST, Rodney Avila <ravila@dwwind.com> wrote:

Demersal Fisheries Resources Survey Protocol

DEEPWATERWIND
Clean energy is just over the horizon.

Rodney Avila

Fisheries Liaison – www.dwwind.com

Mobile: 508-889-0401

From:	Melanie Gearon
To:	Brian Gervelis
Subject:	FW: FAB review of South Fork proposed fisheries survey
Date:	Wednesday, July 1, 2020 1:49:56 PM

From: Dave Beutel <dbeutel@crmc.ri.gov>
Sent: Monday, November 19, 2018 9:08 AM
To: lad0626@aol.com
Cc: saklob@aol.com; 'Brian' <Kwe5tbos90@yahoo.com>; 'Polark' <polark1@verizon.net>; gvdwood@cox.net; 'Mike Marchetti' <fvmisterg@gmail.com>; 'Rick Bellavance' <makosrule@verizon.net>; 'Erich Stephens' <estephens@vineyardwind.com>; 'Erik Peckar' <erik@vineyardpower.com>; 'Rachel Pachter' <rpachter@vineyardwind.com>; 'Matthew Robertson' <mrobertson@vineyardwind.com>; john@seakeeper.net; 'James Neveu' <JANEV@orsted.com>; 'Laura Morse' <LAURM@orsted.com>; 'Michael Evans' <MICEV@orsted.com>; 'Donald Fox' <dfox@towndock.com>; 'Lisa Turner' <lturner@crmc.ri.gov>; Rodney Avila <ravila@dwwind.com>; 'Cristiana Bank' <cbank@vineyardwind.com>; 'Katie Almeida' <kalmeida@towndock.com>; 'Rodman Sykes' <crfisheries@gmail.com>; 'Fred Mattera' <fredmattera@cfcri.org>; 'Meghan Lapp' <Meghan@seafreezeltd.com>; Aileen Kenney <akenney@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>; 'R. Daniel Prentiss' <Dan@prentisslaw.com>; Melanie Gearon <mgearon@dwwind.com>; 'Grover Fugate' <gfugate@crmc.ri.gov>; 'Janet Coit' <Janet.Coit@DEM.RI.GOV>; 'Kearns, Christopher (DOA)' <Christopher.Kearns@energy.ri.gov>; 'Powers, Rosemary (GOV)' <Rosemary.Powers@governor.ri.gov>; 'Grant, Carol (DOA)' <Carol.Grant@energy.ri.gov>; 'Porfilio, Jaclyn (GOV)' <Jaclyn.Porfilio@governor.ri.gov>; 'James Boyd' <jboyd@crmc.ri.gov>; 'Dave Reis' <dreis@crmc.ri.gov>; 'Dan Goulet' <dgoulet@crmc.ri.gov>; Julia Livermore <julia.livermore@dem.ri.gov>; 'Jeff Willis' <jwillis@crmc.ri.gov>
Subject: RE: FAB review of South Fork proposed fisheries survey

Lanny,

We will have copies of the DWW draft for distribution to the FAB. Unfortunately, because it is not on the agenda, we cannot discuss the draft proposal. We will not meet the Secretary of State requirements for public notice for the discussion of the proposal and it is too late to modify the agenda.

Dave

David Beutel
Coastal Resources Management Council
Aquaculture Coordinator
Oliver Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879
401-783-3370

From: lad0626@aol.com [mailto:lad0626@aol.com]

Sent: Saturday, November 17, 2018 7:00 AM
To: Dave Beutel
Cc: saklob@aol.com; Brian; Polark; gvdwood@cox.net; Mike Marchetti; Rick Bellavance; Erich Stephens; Erik Peckar; Rachel Pachter; Matthew Robertson; john@seakeeper.net; James Neveu; Laura Morse; Michael Evans; Donald Fox; Lisa Turner; Rodney Avila; Cristiana Bank; Katie Almeida; Rodman Sykes; Fred Mattera; Meghan Lapp; Aileen Kenney; John O'Keeffe; R. Daniel Prentiss; Melanie Gearon; Grover Fugate; Janet Coit; Kearns, Christopher (DOA); Powers, Rosemary (GOV); Grant, Carol (DOA); Porfilio, Jaclyn (GOV); James Boyd; Dave Reis; Dan Goulet; Livermore, Julia (DEM); Jeff Willis
Subject: Re: FAB review of South Fork proposed fisheries survey

Dave
I would like to request we have copies of this at Monday's FAB meeting. The FAB should take a few minutes at the end of the VW business at hand to weigh in on this being we only have until 12/18 to do so and an overly burdensome schedule of meetings for these projects already. I have heard from enough fishermen already to know there are many concerns with the proposal.
Lanny

Sent from my iPhone

On Nov 15, 2018, at 2:56 PM, Dave Beutel <dbeutel@crmc.ri.gov> wrote:

> Fishing industry members,
>
> Deepwater Wind has provided a draft of the fisheries survey proposed for the South Fork Wind Farm. Please review and provide comments. Thank you.
>
> Dave
>
> David Beutel
> Coastal Resources Management Council
> Aquaculture Coordinator
> Oliver Stedman Government Center
> 4808 Tower Hill Road
> Wakefield, RI 02879
> 401-783-3370
>
> <South Fork Fisheries Survey 2018.pdf>

Subject: FW: FAB review of South Fork proposed fisheries survey
Date: Monday, November 19, 2018 at 10:06:54 AM Eastern Standard Time
From: Rodney Avila
To: Melanie Gearon, Caitlin O'Mara

From: Rodney Avila <ravila@dwwind.com>
Date: Saturday, November 17, 2018 at 8:08 AM
To: Aileen Kenney <akenney@dwwind.com>, Melanie Gearon <mgearon@dwwind.com>
Subject: Fwd: FAB review of South Fork proposed fisheries survey

Get Outlook for iOS

From: lad0626@aol.com
Sent: Saturday, November 17, 2018 6:59 AM
To: Dave Beutel
Cc: saklob@aol.com; Brian; Polark; gvdwood@cox.net; Mike Marchetti; Rick Bellavance; Erich Stephens; Erik Peckar; Rachel Pachter; Matthew Robertson; john@seakeeper.net; James Neveu; Laura Morse; Michael Evans; Donald Fox; Lisa Turner; Rodney Avila; Cristiana Bank; Katie Almeida; Rodman Sykes; Fred Mattera; Meghan Lapp; Aileen Kenney; John O'Keeffe; R. Daniel Prentiss; Melanie Gearon; Grover Fugate; Janet Coit; Kearns, Christopher (DOA); Powers, Rosemary (GOV); Grant, Carol (DOA); Porfilio, Jaclyn (GOV); James Boyd; Dave Reis; Dan Goulet; Julia Livermore; Jeff Willis
Subject: Re: FAB review of South Fork proposed fisheries survey

Dave
I would like to request we have copies of this at Monday's FAB meeting. The FAB should take a few minutes at the end of the VW business at hand to weigh in on this being we only have until 12/18 to do so and an overly burdensome schedule of meetings for these projects already. I have heard from enough fishermen already to know there are many concerns with the proposal.
Lanny

Sent from my iPhone

On Nov 15, 2018, at 2:56 PM, Dave Beutel <dbeutel@crmc.ri.gov> wrote:

> Fishing industry members,
>
> Deepwater Wind has provided a draft of the fisheries survey proposed for the South Fork Wind Farm. Please review and provide comments. Thank you.
>
> Dave
>
> David Beutel
> Coastal Resources Management Council
> Aquaculture Coordinator
> Oliver Stedman Government Center
> 4808 Tower Hill Road
> Wakefield, RI 02879

401-783-3370

<South Fork Fisheries Survey 2018.pdf>

Subject: FW: FAB review of South Fork proposed fisheries survey
Date: Monday, November 19, 2018 at 1:30:26 PM Eastern Standard Time
From: Melanie Gearon
To: Caitlin O'Mara

From: Dave Beutel <dbeutel@crmc.ri.gov>
Date: Monday, November 19, 2018 at 9:05 AM
To: "lad0626@aol.com" <lad0626@aol.com>
Cc: "saklob@aol.com" <saklob@aol.com>, 'Brian' <Kwe5tbos90@yahoo.com>, 'Polark' <polark1@verizon.net>, "gvdwood@cox.net" <gvdwood@cox.net>, 'Mike Marchetti' <fvmisterg@gmail.com>, Rick Bellavance <makosrule@verizon.net>, 'Erich Stephens' <estephens@vineyardwind.com>, 'Erik Peckar' <erik@vineyardpower.com>, 'Rachel Pachter' <rpachter@vineyardwind.com>, 'Matthew Robertson' <mrobertson@vineyardwind.com>, "john@seakeeper.net" <john@seakeeper.net>, 'James Neveu' <JANEV@orsted.com>, 'Laura Morse' <LAURM@orsted.com>, 'Michael Evans' <MICEV@orsted.com>, 'Donald Fox' <dfox@towndock.com>, 'Lisa Turner' <lturner@crmc.ri.gov>, Rodney Avila <ravila@dwwind.com>, 'Cristiana Bank' <cbank@vineyardwind.com>, 'Katie Almeida' <kalmeida@towndock.com>, 'Rodman Sykes' <crfisheries@gmail.com>, 'Fred Mattera' <fredmattera@cfcri.org>, 'Meghan Lapp' <Meghan@seafreezeltd.com>, Aileen Kenney <akenney@dwwind.com>, John O'Keeffe <jokeeffe@dwwind.com>, "'R. Daniel Prentiss'" <Dan@prentisslaw.com>, Melanie Gearon <mgearon@dwwind.com>, 'Grover Fugate' <gfugate@crmc.ri.gov>, 'Janet Coit' <Janet.Coit@DEM.RI.GOV>, "'Kearns, Christopher (DOA)'" <Christopher.Kearns@energy.ri.gov>, "'Powers, Rosemary (GOV)'" <Rosemary.Powers@governor.ri.gov>, "'Grant, Carol (DOA)'" <Carol.Grant@energy.ri.gov>, "'Porfilio, Jaclyn (GOV)'" <Jaclyn.Porfilio@governor.ri.gov>, 'James Boyd' <jboyd@crmc.ri.gov>, 'Dave Reis' <dreis@crmc.ri.gov>, 'Dan Goulet' <dgoulet@crmc.ri.gov>, Julia Livermore <julia.livermore@dem.ri.gov>, 'Jeff Willis' <jwillis@crmc.ri.gov>
Subject: RE: FAB review of South Fork proposed fisheries survey

Lanny,

We will have copies of the DWW draft for distribution to the FAB. Unfortunately, because it is not on the agenda, we cannot discuss the draft proposal. We will not meet the Secretary of State requirements for public notice for the discussion of the proposal and it is too late to modify the agenda.

Dave

David Beutel
Coastal Resources Management Council
Aquaculture Coordinator
Oliver Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879
401-783-3370

From: lad0626@aol.com [mailto:lad0626@aol.com]
Sent: Saturday, November 17, 2018 7:00 AM
To: Dave Beutel
Cc: saklob@aol.com; Brian; Polark; gvdwood@cox.net; Mike Marchetti; Rick Bellavance; Erich Stephens; Erik Peckar; Rachel Pachter; Matthew Robertson; john@seakeeper.net; James Neveu; Laura Morse; Michael Evans;

Donald Fox; Lisa Turner; Rodney Avila; Cristiana Bank; Katie Almeida; Rodman Sykes; Fred Mattera; Meghan Lapp; Aileen Kenney; John O'Keeffe; R. Daniel Prentiss; Melanie Gearon; Grover Fugate; Janet Coit; Kearns, Christopher (DOA); Powers, Rosemary (GOV); Grant, Carol (DOA); Porfilio, Jaclyn (GOV); James Boyd; Dave Reis; Dan Goulet; Livermore, Julia (DEM); Jeff Willis
Subject: Re: FAB review of South Fork proposed fisheries survey

Dave
I would like to request we have copies of this at Monday's FAB meeting. The FAB should take a few minutes at the end of the VW business at hand to weigh in on this being we only have until 12/18 to do so and an overly burdensome schedule of meetings for these projects already. I have heard from enough fishermen already to know there are many concerns with the proposal.
Lanny

Sent from my iPhone

On Nov 15, 2018, at 2:56 PM, Dave Beutel <dbeutel@crmc.ri.gov> wrote:

> Fishing industry members,
>
> Deepwater Wind has provided a draft of the fisheries survey proposed for the South Fork Wind Farm. Please review and provide comments. Thank you.
>
> Dave
>
> David Beutel
> Coastal Resources Management Council
> Aquaculture Coordinator
> Oliver Stedman Government Center
> 4808 Tower Hill Road
> Wakefield, RI 02879
> 401-783-3370
>
> <South Fork Fisheries Survey 2018.pdf>

Subject: Re: SFWF - Demersal Fisheries Resources Survey Protocol
Date: Tuesday, November 27, 2018 at 10:44:09 AM Eastern Standard Time
From: Melanie Gearon
To: Fred Mattera
CC: Rodney Avila, John O'Keeffe, Caitlin O'Mara, Aileen Kenney
Attachments: image001.jpg

Fred,
Thank you for your call yesterday and the below questions and feedback. We will address these after the comment period has ended and will integrate details into the protocol document. I look forward to continued discussions with you regarding this plan.
Best,
Melanie

From: Fred Mattera <fredmattera@cfcri.org>
Date: Tuesday, November 27, 2018 at 10:01 AM
To: Melanie Gearon <mgearon@dwwind.com>
Subject: RE: SFWF - Demersal Fisheries Resources Survey Protocol

Hi Melanie,
A few questions,

- It says the survey is to be a 16 hour soak and then haul, once per season – is that 4 hauls (winter, spring, summer, and fall)?
- Who is determining the mesh size, web thickness, hanging ratio, number of webs per sample string, etc. that will be used for each species surveyed?
- Are the surveys going to be conducted in the same area at the same time?
- Is there some sort of standardization of nets for scientific method concerns? Such as dragging – everybody has their own tweaks and net designs per species specific net, what will be used for these surveys?
- If the fisherman is supplying the nets and fishing in rocky bottom, nets will be damaged; is this factored into the daily fee or will this be extra?
- Why aren't bluefish and scup on the species list – will they be surveyed as well?
- If a fisherman has all the permits listed but does that mean they need a multispecies A permit to conduct that survey. Do they need to use A DAS or Monk days for that survey?
- I assume you will attain an EFP/LOA?

Thank you,

Fred Mattera

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Monday, November 19, 2018 3:19 PM
To: Fred Mattera <fredmattera@cfcri.org>
Cc: John O'Keeffe <jokeeffe@dwwind.com>; Rodney Avila <ravila@dwwind.com>; Caitlin O'Mara <comara@dwwind.com>
Subject: SFWF - Demersal Fisheries Resources Survey Protocol

Hi Fred,

Please find attached the South Fork Wind Farm (SFWF) *Draft Demersal Fisheries Resources Survey Protocol* for CFCRI review. Our team is seeking initial comments on this draft by **December 14, 2018**. This plan is part of the overall science agenda currently under development for the SFWF. This has been submitted to the following agencies for technical review: BOEM, NMFS, MA DMF, MA CZM, RI DEM, RI CRMC, CT DEEP, NYS DEC, NYS DPS, and NYS DOS. In addition, it has been circulated for comment to various regional fisheries organizations and fishermen that the SFWF fisheries outreach team regularly meet with.

I know that Rodney already sent this draft to several folks (including you) last week, but I want to make sure that CFCRI has received the document and is circulating within the Center.

Please let me know if you have any questions.

Thanks!
Melanie

DEEPWATERWIND
Clean energy is just over the horizon.

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwin
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

Subject: FW: SFWF - gill net survey
Date: Friday, November 30, 2018 at 2:34:52 PM Eastern Standard Time
From: Melanie Gearon
To: Caitlin O'Mara
Attachments: image001.png

Caitlin,
Can you please log in our comment tracker for gill net that Rick contacted us and add his concerns below.
Thanks
Mel

From: Aileen Kenney <akenney@dwwind.com>
Date: Friday, November 30, 2018 at 11:53 AM
To: Rick Bellavance <makosrule@verizon.net>, Melanie Gearon <mgearon@dwwind.com>, Drew Carey <drew@INSPIREenvironmental.com>, Rodney Avila <ravila@dwwind.com>
Cc: John O'Keeffe <jokeeffe@dwwind.com>
Subject: SFWF - gill net survey

Mel, Drew, and Rodney:

Rick would like to get together to discuss the gill net survey. He is specifically wondering where the gill nets will be placed since they do a lot of fishing out there and the gill nets can present a conflict.

Mel – please reach out to Rick and set a meeting up.

Thank you,
Aileen

Aileen Kenney
Head of Development and Permitting
Ørsted US
mobile: +1-617-852-7031

From: Melanie Gearon <mgearon@dwwind.com>
Sent: Sunday, January 6, 2019 11:32 AM
To: Caitlin O'Mara <comara@dwwind.com>; Rich Balouskus <rich@inspireenvironmental.com>
Cc: Rodney Avila <ravila@dwwind.com>; John O'Keeffe <jokeeffe@dwwind.com>; Aileen Kenney <AILKE@orsted.com>
Subject: FW: Comments on SF Demersal Fisheries Survey

Caitlin,
Please add this email (make a pdf) from Rick B to the collection of comments on BOX for the gill net survey. Add into the comment tracker that he formally submitted written comments on this date, etc.

Rich,
Please review.

All, Inspire is in the process of reviewing comments and updating the plan accordingly. Next week we need to do some planning for next steps.
Thanks
Mel

From: Rick Bellavance <rickbellavance@gmail.com>
Date: Saturday, January 5, 2019 at 9:38 AM
To: Melanie Gearon <mgearon@dwwind.com>
Cc: Steve Anderson <saboat10@gmail.com>, 'Andy Dangelo' <maridee2@gmail.com>, 'Paul Johnson' <pbjfishing@yahoo.com>, Frank Blount <FrancesFlt@aol.com>
Subject: Comments on SF Demersal Fisheries Survey
Resent-From: <mgearon@dwwind.com>

Hello Melanie,

I have reviewed the Draft Demersal Fisheries Resources Survey Protocol and I would like to offer the following comments.

The Project Area falls within historical fishing grounds for the recreational for hire fishing industry. The area is fishing for Demersal species such has Cod, Haddock, Pollock, Black Sea Bass, Scup, Hake, and Tautog. Bluefish and Winter Flounder are also caught inside the project area. The project area is fished year-round by RI's recreational for hire fishing fleet.

A major concern I have is related to gear conflicts within the survey blocks. Any added survey gear left inside the survey blocks will potentially conflict with our fleet trying to conduct our business. Steaming 20-25 miles only to find out that the area you planned to fish is covered with survey gill nets in addition to the commercially fished gill nets could be problematic. Our clients often reserve their fishing dates in advance and they have expectations of fishing for particular species in the places that will give them the best fishing. That needs to be considered when planning the survey effort. Communication will need to be as clear as possible and timely.

The experimental mesh sizes considered may have a localized depletion affect in the areas where we fish. This will result in diminished fishing experiences for our clients. Gill nets in general can create high mortality when compared to hook and line and it is likely that additional survey nets with experimental mesh sizes will only make matters worse. Hook and Line surveys and Hab Cam type surveys should also be considered when characterizing demersal populations

In addition to demersal species, RI's for hire fleet targets Highly Migratory Species(HMS) in the project area. Bluefin Tuna, Skipjack Tuna, Bonito, Sharks and Billfish are all caught within the project area. I have not seen any attempt to better understand these species and that is also problematic. Many for hire recreational trips will target demersal and HMS on the same trip. The value of HMS to our fleet during the months of June thru September should not be minimized and the relationship between demersal species and HMS should not be underestimated. Many of our clients chose a trip targeting demersal species with consideration that they may encounter HMS and vice versa.

I would also appreciate any information on survey's that will look at forage species within the project area. Herring, mackerel, sand lance, and other species are critical to the availability of the species we target, and any affects construction may have on the behavior of forage species should be understood.

Thanks for the chance to comment on this important survey and I look forward to continued dialogue as you work to better understand the resources within the project area. Feel free to contact me if you have any questions about my comments.

Rick

Capt. Rick Bellavance, President
RI Party and Charter Boat Association
401-741-5648
www.rifishing.com

CC:
RIPCBA Executive Board
Frank Blount NEFMC RAP Chair

EXHIBIT 2

Date	Organizations/Individuals Contacted[2]	Location/Form of Contact and Response	Purpose of Contact
3/25/19	BOEM, CT DEEP, MA CZM, MA DMF, NMFS, NYS DEC, NYS DOS, RI DEM, USACE	Webinar; See Exhibit 2 to Appendix A	Review of FMP and received comments
3/27/19	BOEM, CT DEEP, MA CZM, MA DMF, NMFS, NYS DEC, NYS DOS, RI DEM	Webinar; See Exhibit 2 to Appendix A	Review of FMP and received comments

[2] BOEM – Bureau of Ocean Energy Management; CFCRI – Commercial Fisheries Center of Rhode Island; CFRF – Commercial Fisheries Research Foundation; CT DEEP – Connecticut Department of Energy and Environmental Protection; MA DMF- Massachusetts Division of Marine Fisheries; MA CZM – Massachusetts Center of Coastal Zone Management; MA FWG – Massachusetts Offshore Wind Fisheries Working Group; NEFMC – New England Fisheries Management Council; NOAA/GARFO - National Oceanic and Atmospheric Administration's Greater Atlantic Regional Fisheries Office; NOAA/NMFS – National Oceanic and Atmospheric Administration's National Marine Fisheries Service; NYS DEC – New York State Department of Environmental Conservation; NYS DOS – New York Department of State; NYS DPS – New York State Department of Public Service; NYSERDA – New York State Energy and Research Development Authority; RI CRMC – Rhode Island Coastal Resources Management Council; RI DEM – Rhode Island Department of Environmental Management; RISAA – Rhode Island Saltwater Angler's Association; RODA – Responsible Offshore Development Alliance; ROSA – Responsible Offshore science Alliance; USACE – United States Army Corps of Engineers

SFWF Fisheries Research and Monitoring

Webinar

Ørsted

March 25 & 27, 2019

Webinar Agenda

2:00 – Welcome and Introductions
2:10 – SFWF Fisheries Research Plan Overview
2:45 – Questions and Input from Agencies
3:20 – Next Steps
3:30 – Adjourn

Today's Meeting - federal and state agencies

- Provide an update on fisheries research and monitoring planning for SFWF.

- **Goal:** Continued collection of feedback to prioritize research topics and refine sampling plans.

South Fork Wind Farm research & monitoring

- **Purpose:** Conduct sound, credible science to detect and help prevent or mitigate negative project impacts on fisheries resources.

- **Adapt:** Make changes to meet new monitoring and research needs as we learn and get feedback from stakeholders.

Principles that guide Ørsted's approach

- Producing transparent, unbiased, and clear results
- Working with commercial fishermen to identify areas of importance
- Collecting long-term data sets to determine trends
- Promoting the smart growth of the American offshore wind industry
- Completing scientific research collaboratively with the fishing community
- Utilizing standardized monitoring protocols and building on and supporting existing fisheries research
- Sharing data with stakeholder groups
- Maintaining data confidentiality for sensitive fisheries-dependent monitoring data

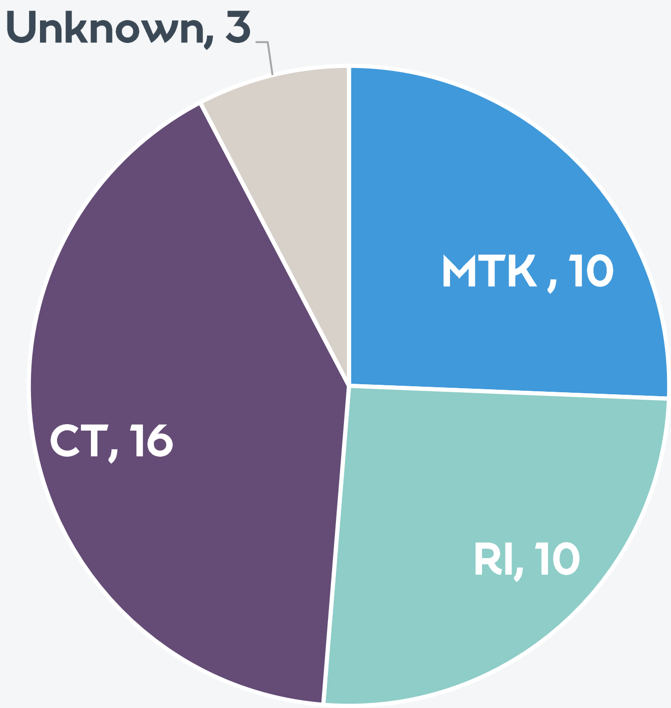
Outreach activities

- Attend fisheries-related meetings to answer questions and seek input
  - NE and Mid-Atlantic Fisheries Management Council meetings
  - State Fishing Industry Advisory Groups
  - Local and regional fishing organization's events
- Questionnaire to solicit fishermen's priorities
- Website
- One-on-one outreach through FRs/FLs
- Circulation and comment on draft plans
- Agency Webinars

Report out from our outreach team……

- Questionnaire:
  - What we have heard so far
  - Continue distribution
- One-on-one conversations about monitoring priorities is effective, will continue at port visits and at fisheries related meetings
- Types of fishing occurring in the project area

39 responses so far.....



Question: Please rank from 1 to 7 the following resources[1] that are most important to monitor (1 being the most important):

- ★ Bottom fish, e.g., flounder, monkfish, Atlantic Cod
- ★ Pelagic fish, e.g., herring and mackerel, tuna, bluefish, sharks
- ★ Structure-associated species, e.g. black sea bass, scup, tautog and benthos
- ____ Sea Scallops
- ____ Lobster
- ★ Spawning activities of relevant fish and shellfish
- ____ Hard and soft benthic habitat in the project area

Results:

12 were not ranked (put all 1s)

25 were fully/partially ranked

2 were N/A

[1] Resources identified by the fishing industry and agencies through stakeholder outreach to date

Question: Please rank from 1 to 3 the following research topics you think should be investigated further:

_★_ Potential impact of electromagnetic fields on fish behavior

_★_ Potential impact of noise from pile driving on fish behavior during construction

_★_ Potential impact on fish from alterations in benthic habitat, like scouring or sedimentation

Results:

19 were not ranked (put all 1s)

18 were fully/partially ranked

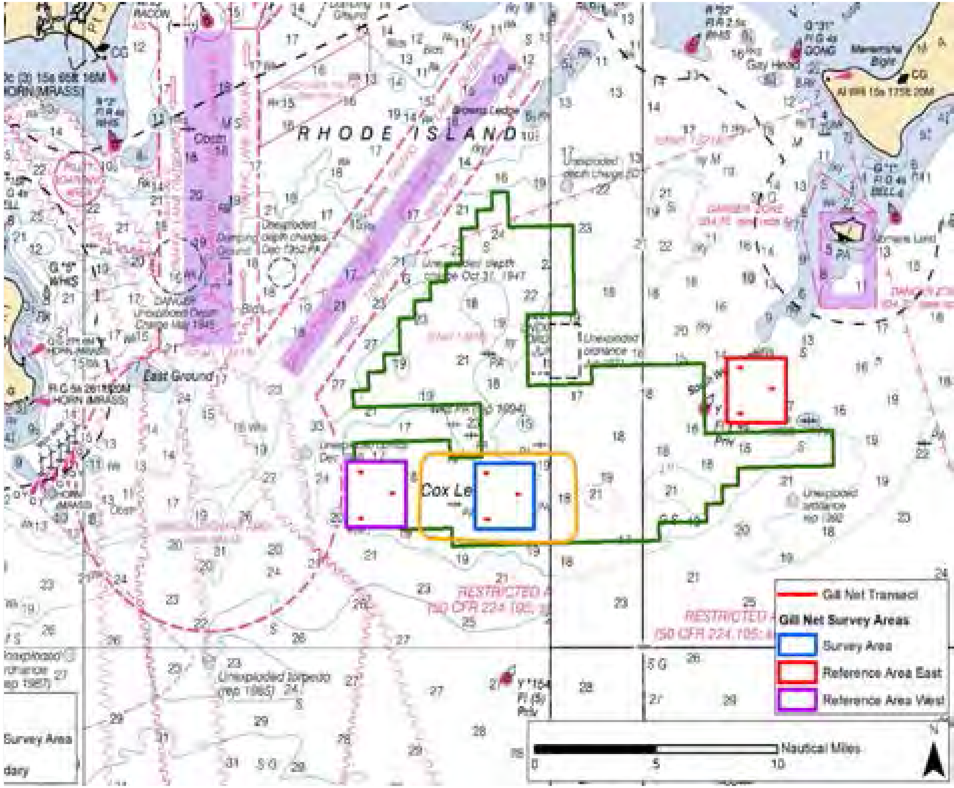
2 were N/A

Potential monitoring & survey methods

- Gillnet
- Scallop dredge
- Ventless trap
- Beam trawls
- Benthic camera and grab sampling
- Hook and line
- Acoustic telemetry

Gillnet Survey

– Rocky habitat prohibits otter trawling
– Common gear used in area to target monkfish, skates
– Low impact on bottom habitat
– Sample pre- and 2 years post-construction
– Continue cod spawning data collection (supplement reconnaissance and observational surveys)



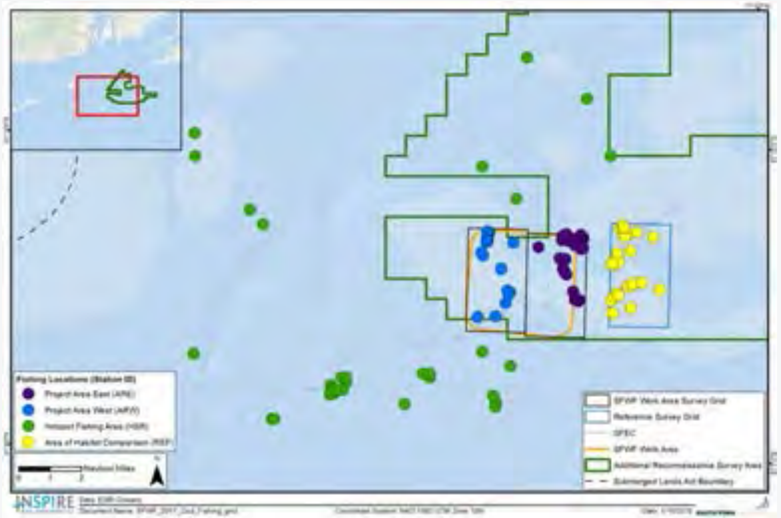
Gillnet Survey – summary of comments circulated November 2018 (fishing stakeholders and agencies)

- **Need for power analysis and description of statistical design –** Initial power analysis predicted an unobtainable level of sampling effort. Asymmetrical BACI design will be utilized (one control area, two reference areas) where data from each string combined to estimate area wide abundance
- **Seasonal sampling frequency inadequate –** Monthly sampling to occur in spring, fall, winter (no gillnetting in March due to harbor porpoise closure; summer sampling may be omitted to minimize interactions with other protected species)
- **More specifics on gear –** 4 panel strings (300ft panels), each panel with different mesh size, two stand-up, two tie-down; 8 hour soak time; 6 strings sampled per trip (2 each area)
- **Gillnet alone not adequate to sample area**

Cod Spawning Survey Update

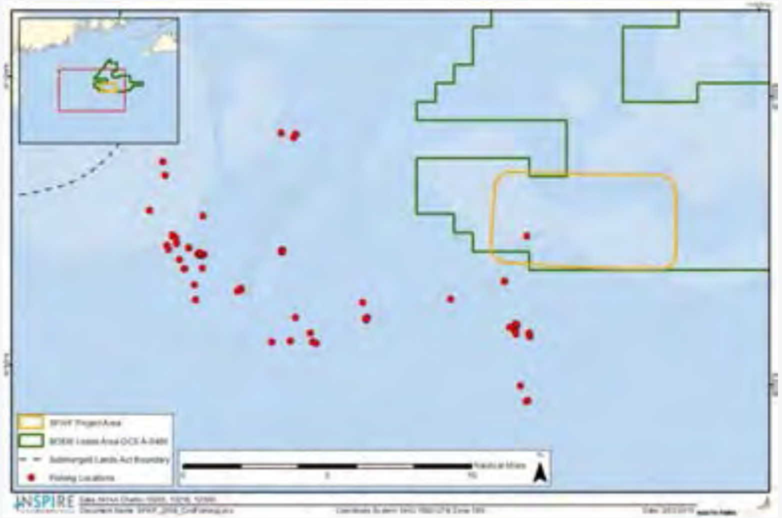
Year 1 (winter/spring 2018)

- Chartered headboat trips with dedicated anglers
- Dedicated sampling areas
- 15 sampling trips conducted
- 17 cod sampled



Year 2 (winter/spring 2018-2019)

- Observers onboard normal headboat trips with paying anglers (voluntary participation)
- Areas fished based on captain's knowledge and historic catches
- 11 sampling trips conducted (targeting 20 trips)
- ~ 60 cod sampled



Agency input & discussion

- Comments on outreach process to the fishing industry?
- Additional monitoring and sampling methods?
- Additional research questions?
- Other feedback?

Next steps

- Continue to solicit input from stakeholders
- Next draft of survey protocols
- Continued development of overall SFWF Fisheries Monitoring & Research Plan
- Planning for pre-construction surveys to begin in 2019

Thank You!

Contact: Melanie Gearon
Melge@Orsted.com
(857)-348-3261

EXHIBIT 3

Date	Organizations/Individuals Contacted[3]	Location/Form of Contact and Response	Purpose of Contact
6/13/19	BOEM, CFRF, CT DEEP, MA CZM MA DMF, MA FWG, NMFS, NYS DEC, NYS DOS, NYS DPS, RI CRMC, RI DEM, RISAA, Individual fishermen	Emails from SFW and recipient responses are attached to Exhibit 3 to Appendix A	Distribution of updated version of FMP for comment

[3] BOEM – Bureau of Ocean Energy Management; CFCRI – Commercial Fisheries Center of Rhode Island; CFRF – Commercial Fisheries Research Foundation; CT DEEP – Connecticut Department of Energy and Environmental Protection; MA DMF- Massachusetts Division of Marine Fisheries; MA CZM – Massachusetts Center of Coastal Zone Management; MA FWG – Massachusetts Offshore Wind Fisheries Working Group; NEFMC – New England Fisheries Management Council; NOAA/GARFO - National Oceanic and Atmospheric Administration's Greater Atlantic Regional Fisheries Office; NOAA/NMFS – National Oceanic and Atmospheric Administration's National Marine Fisheries Service; NYS DEC – New York State Department of Environmental Conservation; NYS DOS – New York Department of State; NYS DPS – New York State Department of Public Service; NYSERDA – New York State Energy and Research Development Authority; RI CRMC – Rhode Island Coastal Resources Management Council; RI DEM – Rhode Island Department of Environmental Management; RISAA – Rhode Island Saltwater Angler's Association; RODA – Responsible Offshore Development Alliance; ROSA – Responsible Offshore science Alliance; USACE – United States Army Corps of Engineers

Brian Gervelis

From: Melanie Gearon <MELGE@orsted.com>
Sent: Thursday, June 13, 2019 5:38 PM
To: lisa.engler@state.ma.us; Boeri, Robert (ENV); annie@rodafisheries.org; andrew.lipsky@noaa.gov; Brunbauer, Morgan A (DEC); Gregory.Lampman@nyserda.ny.gov; mbachman@nefmc.org; Dave Beutel
Cc: McLean, Laura (DOS; Susan Tuxbury - NOAA Federal; Ford, Kathryn (FWE; McNamee, Jason (DEM; Julia Livermore; Gaidasz, Karen M (DEC; Sharon Benjamin - NOAA Affiliate; Mary Colbert; John O'Keeffe; Rodney Avila; Aileen Kenney; Caitlin O'Mara; Julia Prince; Drew Carey; Brian Gervelis; Jill Johnen; Hooker, Brian; Stromberg, Jessica
Subject: SFWF - Fisheries Research and Monitoring Plan
Attachments: 2019-6-13_SFWF_fisheries research & monitoring plan_Draft.pdf

Good Afternoon All,
Thank you for your continued engagement with Orsted on developing the South Fork Wind Farm Fisheries Research and Monitoring Plan. This plan has been previously reviewed and commented on widely by fishing stakeholders and agencies. Attached is the most recent draft ready for circulation.

The next step in vetting the plan is reviewing with the various state fisheries advisory boards and offshore wind fisheries working groups. I ask that you please distribute this draft to members of your representative group(s) (RI FAB, MA FWG, RODA, ROSA, NYS Fish TWG, NEFMC Habitat Committee) for review.

Please submit comments via email on this draft Fisheries Research and Monitoring plan by July 8, 2019 to:

Melanie Gearon
South Fork Wind Farm
Manager, Permitting and Environmental Affairs
melge@orsted.com

We would also like to present and discuss this plan in person with working groups if possible. I will be reaching out to individuals to see if we can be included on upcoming meeting agendas.

Best regards,
Melanie Gearon
Manager, Permitting & Environmental Affairs
Wind Power

Orsted

Learn more at orsted.com

Tel. 857-348-3261

melge@orsted.com
orsted.com

South Fork Wind Farm

South Fork Wind Farm: Fisheries Research and Monitoring Plan - ***Draft***
June 2019

1.0 Introduction

The South Fork Wind Farm (SFWF or project) is proposed to be located in Bureau of Ocean Energy Management (BOEM) Lease Area OCS A-0486, which is within the Rhode Island – Massachusetts Wind Energy Area (RI-MA WEA) (Figure 1). The SFWF includes up to 15 wind turbine generators (WTGs or turbines) with a nameplate capacity of 6 to 12 MW per turbine, submarine cables between the WTGs (Inter-array Cables), and an offshore substation (OSS), all of which will be located approximately 19 miles (30.6 kilometers [km], 16.6 nautical miles [nm]) southeast of Block Island, Rhode Island, and 35 miles (56.3 km, 30.4 nm) east of Montauk Point, New York.

Deepwater Wind South Fork, LLC (DWSF), now a wholly-owned indirect subsidiary of North East Offshore, LLC, a joint venture between Ørsted and Eversource , submitted the major federal permit application, *The South Fork Wind Farm Construction and Operations Plan*[1] (COP), to BOEM in June, 2018 and submitted a revised COP to BOEM in May, 2019. The Project is scheduled to be installed during 2021 and 2022, and to be commissioned and operational by the end of 2022.

The SFWF project team has spoken extensively with regional fishing organizations, working groups, and individual fisherman over the last three years as development of the project has evolved. In addition, through the permitting and development process the SFWF project team has consulted with several state (e.g., NY, CT, RI, and MA) and federal fisheries resource management agencies. It has become clear, based on feedback received to date, that an approach to assess commercially and recreationally targeted demersal fish at the SFWF is a priority.

[1] The full revised COP document can be found online at: https://www.boem.gov/South-Fork/

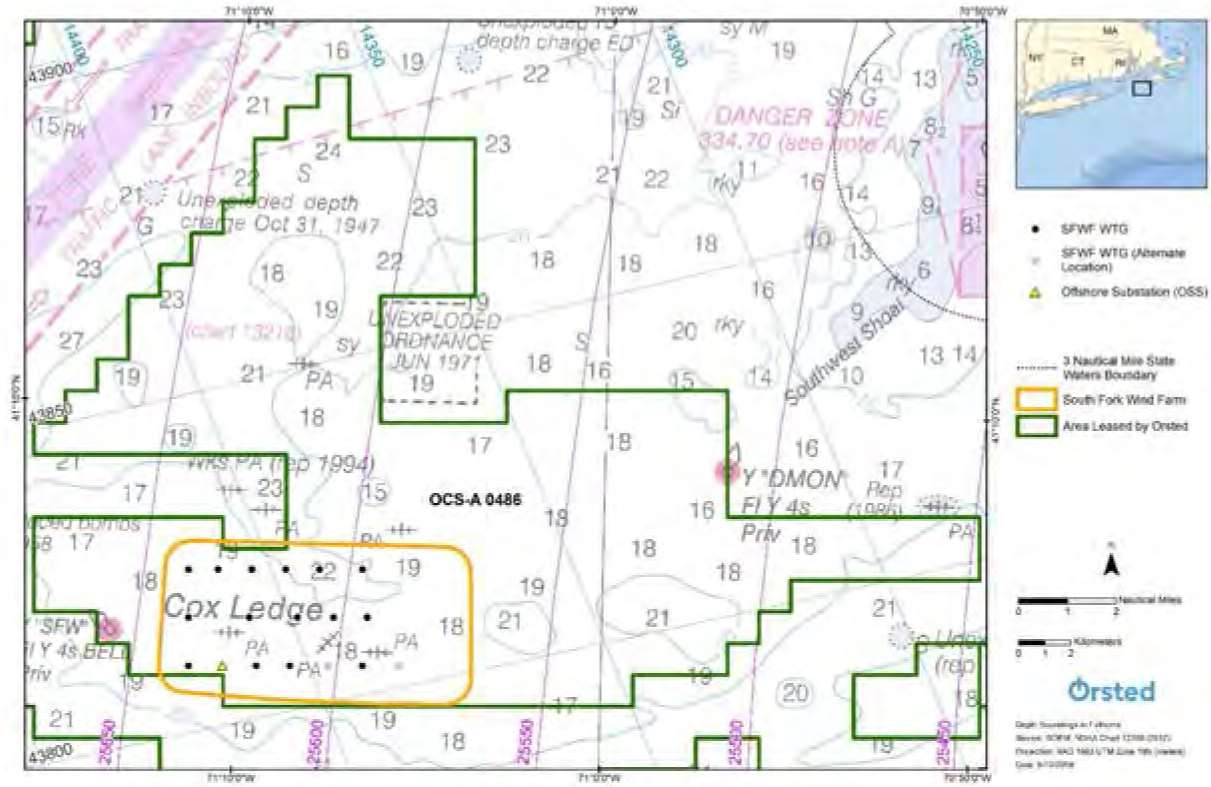


Figure 1: Location of South Fork Wind Farm.

DWSF is committed to conducting sound, credible science. Biological surveys, developed in coordination with the commercial fishing fleet and state agencies, have been conducted at the Block Island Wind Farm (BIWF) since 2012 and will continue through at least 2019. The guiding scientific principles implemented beginning with the BIWF and continuing into the future include:

- Producing transparent, unbiased, and clear results from all research
- Working with commercial fishermen to identify areas important to them
- Collecting long-term data sets to determine trends and develop knowledge
- Promoting the smart growth of the American offshore wind industry
- Focusing on maintaining access and navigation in, and around, our wind farms for all ocean users
- Completing scientific research collaboratively with the fishing community
- Being accessible and available to the fishing industry
- Utilizing standardized monitoring protocols when possible and building on and supporting existing fisheries research
- Sharing data with all stakeholder groups

- Maintaining data confidentiality for sensitive fisheries dependent monitoring data

The SFWF site is situated atop Cox's Ledge, an area with extensive areas of boulders and mobile gear "hangs". Therefore, fishery independent data are lacking in the SFWF because sampling demersal species with bottom otter trawls, similar to those used by the Northeast Fisheries Science Center (NEFSC) Bottom Trawl Survey, NEAMAP[2], and at the BIWF, is less feasible. Feedback from commercial fishermen combined with vessel Monitoring System (VMS) data indicate there is little commercial trawl effort in the area. Details of the SFWF fisheries data assessment and stakeholder feedback can be found in the SFWF COP Appendix Y - *Commercial and Recreational Fisheries Technical Report*.[3]

Through extensive outreach efforts with the fishing community, feedback from state and federal agencies, and exploration of existing datasets, the SFWF project team has developed gillnet and beam trawl survey designs to acquire pre-construction baseline data on demersal species that occur in and around the SFWF. These two gear types can also be used effectively, and with limited impact, on the rocky habitat within the SFWF (Thomsen et al., 2010; Malek, 2015).

Gillnet selectivity depends mainly on fish size and shape and mesh size, but is also affected by the thickness, material, and color of net twine, hanging of net, and method of fishing (Hamley, 1975). Using specific gear placements and prescribed mesh sizes, gillnets may be designed to target specific species, or subgroupings of species, and life stages. Southern New England waters are host to a large monkfish gillnet fishery, as well as a lucrative wing fishery for winter skate. The proposed gillnet survey will focus on monitoring these two species pre- and post-construction of the SFWF.

Veteran fishermen report that sections of the Project Area (defined below) likely allows for collection via beam trawl, as beam trawls are smaller in size than traditional otter trawls and more maneuverable (R. Sykes, pers. comm.). Previous studies have used beam trawls to sample in the vicinity of the Project Area and have proven to be an effective gear for sampling demersal species, including juveniles (Malek, 2015; Walsh and Guida, 2017).

Different gear types select for different fish and macro-invertebrate species, therefore, using multiple gear types to sample species assemblages is needed for assessing potential impacts from the SFWF (Wilson et al., 2010; Walsh and Guida, 2017). Gillnet and beam trawl surveys will monitor a large portion of the species assemblage present in and around the SFWF over a varying temporal scale (Figure 2).

[2] NorthEast Area Monitoring and Assessment Program (NEAMAP)

[3] Appendix Y can be found online at: https://www.boem.gov/Appendix-Y/

Figure 2: Survey timeline for SFWF monitoring.

These surveys will provide data that can be used to evaluate:

1) Demersal species that utilize the area in and around the SFWF.
2) The seasonal timing of the occurrence of these species.
3) Whether the taxonomic compositions of demersal fish assemblages change between the baseline and post-construction time periods. For example, do some species have reduced abundance and/or do new species appear?

The survey protocols have been designed to address requirements and guidelines outlined in the national register (30 CFR 585.626), BOEM fishery guidelines, and Rhode Island Coastal Resources Management Council policies (11.10.9 C).

Final survey protocols will be incorporated into a Request for Proposal (RFP) with the goal of starting the surveys in 2019. Similar to the principles and practices executed for the Block Island Wind Farm, DWSF is committed to conducting science surveys and assessments that are collaborative with the fishing industry. DWSF will select for-hire gillnet fishing vessels from which the survey will be conducted.

2.0 Demersal Fisheries Resources Survey - Gillnet

The survey will help establish pre-construction baseline community composition, with a focus on monkfish and winter skate, and may be used to assess whether detectable shifts occur in fish presence, absence, or abundance before and after construction.

2.1 Survey Design/Procedures

The survey will be conducted from commercial fishing vessel(s) with scientists onboard to process the catch. For-hire vessels will be selected based on criteria such as experience, safety record, knowledge of the area, and cost. The scientific contractor will apply for a Letter of Acknowledgement (LOA) from NOAA Fisheries in order to use the hired fishing vessel(s) as a scientific platform and conduct scientific sampling that is not subject to the Atlantic Coastal Fisheries Cooperative Management Act, Magnuson-Stevens Fishery Conservation and Management Act, and fishery regulations in 50 CFR parts 648 and 697. All survey activities will be subject to rules and regulations outlined under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA). Efforts will be taken to reduce marine

mammal, sea turtle, and seabird injuries and mortalities caused by incidental interactions with fishing gear. All gear restrictions, closures, and other regulations set forth by take reduction plans (e.g., Harbor Porpoise Take Reduction Plan, Atlantic Large Whale Reduction Plan, etc.) will be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury.

2.1.1 Proposed Sampling Stations

The SFWF "Project Area" is defined as the maximum work area required to install the SFWF (yellow outline in Figure 2 below). This includes the maximum extent where vessels or lift barges may anchor during construction around the wind turbines and foundations. Three survey areas are proposed for sampling; one survey area within the SFWF Project Area and two reference areas. Each survey area will contain three predetermined gillnet survey lines. Two gillnet lines per area will be randomly selected for each survey, resulting in six gillnet strings conducted per survey. Final designation of survey areas and survey lines within each area will be based on detailed geophysical seafloor survey data as well as input from commercial gillnet fishermen regarding areas important to them. Location of gillnets may be subject to change due to seasonal location of other fixed fishing gear (e.g., lobster pots). If a survey line is found to have poor conditions for setting gillnets it may be moved based on the captain's professional judgement.

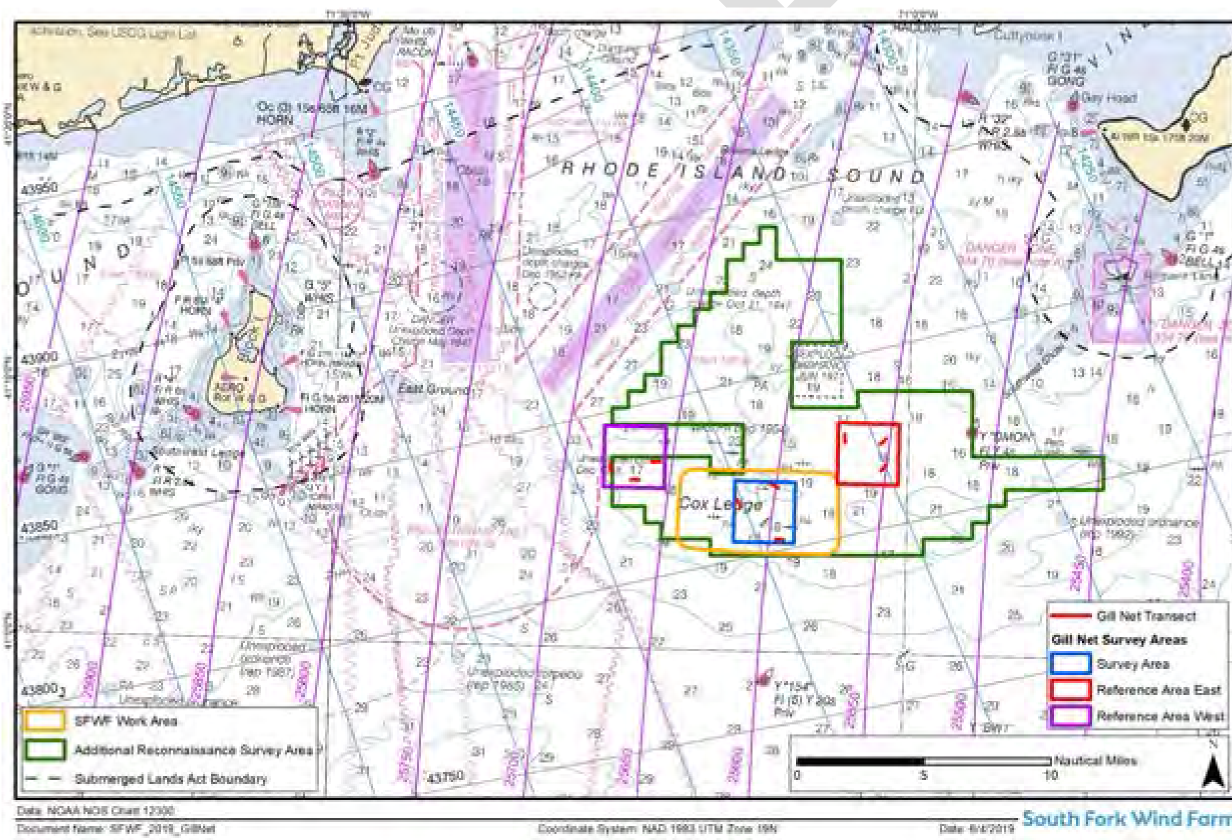


Figure 3. South Fork Wind Farm Project Area with Proposed Gillnet Survey and Reference Areas

Data will be collected in the Project Area and two reference areas with similar habitat characteristics as the Project Area. The reference areas will serve as an index of demersal fish abundance in Rhode Island

Sound in an area outside of the direct influence of the SFWF. Concurrent sampling in the Project Area and the two reference areas will help identify whether temporal changes in demersal fish abundance data observed within the Project Area are consistent with regional trends rather than representing a localized impact in the vicinity of the SFWF. The study will use an asymmetrical before-after-control-impact (BACI) experimental design[4], with statistical evaluation of the differences between control and impact areas contrasted in the before and after construction time periods (Underwood 1994; Smith 2002). A BACI design will allow for assessment of shifts in fish presence, absence, or abundance that correlate with proposed operations at the SFWF.

The study design consists of sampling each of the treatment areas with a gillnet. The proposed sampling locations will be selected such that:

1. There is comparability among all sampling areas with respect to current, habitat and depth condition;
2. Reference areas are outside the area of influence from the SFWF but are still utilized by the same/similar fish populations;
3. Areas allow optimal operational execution of the survey (e.g., minimal travel times between sampling locations);
4. Space conflicts are minimized with other active uses.

2.1.2 Gillnet Methods

A gillnet is a wall of netting that hangs in the water column and is typically made of monofilament or multifilament nylon. Mesh sizes are designed to allow fish to get only their head through the netting, but not their body. The fish's gills then get caught in the mesh as the fish tries to back out of the net. Factors that can influence the catch rate of gillnets for target species include: fish density in the vicinity of gears, the behavior of the target species, the ability of fish to detect and locate the gillnet, and environmental factors such as water temperature, visibility, current direction, and velocity. It is often challenging to calculate catch per unit effort (CPUE) from gillnets due to potential changes in efficiency (e.g., fluctuating soak time and catch rate). This survey is designed to account for as many variables as possible to standardize CPUE. Comparison of this gillnet survey data to other baseline sampling efforts (e.g., nearby federal NEAMAP trawl stations) will be limited due to gear and effort differences.

The gillnet survey may be conducted using gillnets that are typical of the commercial fishery in Rhode Island and Massachusetts. Each gillnet string will consist of six net panels of 12-inch mesh with a hanging ratio of 1/2 (50%) and using net tie-downs. Sampling will take place once per month from April-June and October-December. These months see the majority of commercial gillnet activity as monkfish and skates migrate through the area in spring and fall. Sampling in July-September has been eliminated to minimize interactions with protected species and elasmobranchs that are common in the area during that time. The standard soak time of approximately 48 hours is proposed after input from industry, to maximize catch and standardize catch rates, while also ensuring the gear fishes properly during the soak (i.e., not collapsed from saturation), minimize depredation of catch, and keeping the survey trip length logistically feasible. Soak time will remain consistent throughout the duration of the survey. Each survey

[4] In this asymmetrical BACI design there is a single putative impact area, and two control areas. The area is assumed to be the observational unit and the two gillnet lines per area are subsamples which will be combined to estimate the area-wide abundance (or CPUE) during each sampling event.

event will be managed by a team of qualified scientists including a lead scientist with experience performing fisheries research. The catch will be removed from the gillnets by the boat crew for processing. The lead scientist will be responsible for collection of data and data recording.

Fish collected in each gillnet will be identified, weighed, and enumerated consistent with the sampling approach of NEAMAP. Scientists will sort and identify fish, and weigh each species by the following protocol:

All organisms will be identified to species. Taxonomic guides include: *NOAA's Guide to Some Trawl-Caught Marine Fishes* (Flescher, 1980), Kells and Carpenter's (2011) *Field Guide to Coastal Fishes from Maine to Texas*, and *Peterson's Field Guide to the Atlantic Seashore* (Gosner, 1999).

The catch will be sorted by species. All specimens are sorted by species and size (if appropriate) into buckets or fish totes as needed. This process continues until all specimens are sorted, and the lead scientist verifies that the sorting areas are clear of all specimens.

Notwithstanding sub-sampling procedures, up to 50 individuals of each species/size are measured and the rest counted. Individual lengths are recorded on the field data sheet. Fork length is recorded for all fishes with a forked tail. Total length is measured for all other fishes. Exceptions to these rules are the measurement of rays (disc width), sharks (straight-line fork length), dogfish (stretched total length), crabs (carapace width), lobsters (carapace length), and squids (mantle length). Total weight of all individuals of each respective species will be recorded. Stomach content analysis will be performed for commercially important species (gadids, flounder, black sea bass) to determine if construction and operation of the project could affect fish prey items. Each fish sampled will be sampled for length and weight individually to assess relative condition before the stomach is removed.

2.1.3 Atlantic Cod Reproductive Stage Methods

Atlantic cod is historically an important cultural and commercial species in New England and is believed to be dependent on geographically specific spawning areas. Cod spawning on or near Cox Ledge are thought to belong to a southern, winter-spawned complex to the south of Cape Cod (Zemeckis et al., 2014a). Cod spawning has been associated with bottom water temperatures that range from 0^{o}C to 10^{o}C (Brander, 1993) and areas of rough bottom habitat (Siceloff and Howell, 2013), such as rocky slopes (Meager et al., 2010) and cobble or boulder outcrops (Dean et al., 2012). Inter-annual spawning site fidelity has been well described through tagging/telemetry studies (Robichaud and Rose, 2001; Skjæraasen et al., 2011; Dean et al., 2014; Zemeckis et al. 2014b). These characteristics make it important to gather site-specific information on Atlantic cod spawning. Atlantic cod length, weight, location caught, and spawning condition will be recorded for all individuals caught. All Atlantic cod caught will be examined externally for signs indicating they are in the ripe and running maturity stage (Table 1). When caught individuals are not in the ripe and running maturation stage, they will be dissected to determine maturation stage (Hutchings et al., 1999; Siceloff and Howell, 2013; Dean et al., 2014). The maturity stage of each individual dissected will be assigned based on guidelines determined by Burnett et al. (1989) and updated by O'Brien et al. (1993): immature, developing, ripe, ripe and running, spent, resting, unknown. All Atlantic cod caught on the gillnet survey will be assessed for reproductive stage and spawning condition and these data will supplement data collected previously on the SFWF Atlantic Cod Spawning Survey that occurred during the winters of 2018 and 2019.

Table 1. Maturity staging criteria used during the Northeast Fisheries Science Center trawl surveys and to be utilized in determining Atlantic cod maturity (from O'Brien et al., 1993)

Stage	Description and Criteria
Female	
Immature	Ovary paired, tube-like, small relative to body cavity; colorless to pink jell-like tissue, no visible eggs; thin transparent outer membrane.
Developing	Ovaries large, occupying up to 2/3 of the body cavity; blood vessels prominent when present; ovary appears granular as yellow to orange yolked eggs develop. A mix of yolked and hydrated eggs.
Ripe	Ovaries large, may fill entire body cavity; hydrated eggs present. Transparent ovary wall.
Ripe and Running	Eggs flow from vent with little or no pressure to abdomen.
Spent	Ovaries flaccid, sac-like similar in size to ripe ovaries; color red to purple; ovary wall thickened, cloudy and translucent; some hydrated eggs may adhere to ovary wall.
Resting	Ovaries smaller than ripe ovaries, but larger than immature. Interior jell-like, no visible eggs.
Male	
Immature	Testes small relative to body cavity, colorless to gray and translucent. Testes narrow, lobed and elongated, resembles crimped ribbon.
Developing	Testes large, grey to off-white, firm consistency with very little or no milt present.
Ripe	Testes larger than 'Developing', chalk white, consistency mostly liquid. Milt flows easily when testes dissected.
Ripe and Running	Chalk white milt flows easily from the vent with little or no pressure on abdomen. Once dissected, milt flows easily.
Spent	Testes flaccid, may contain residual milt, less robust than 'Ripe'. Edges or other parts of testes starting to turn reddish to brown or grey as milt recedes.
Resting	Testes shrunken in size relative to 'Ripe'. Color is yellow, brown or grey with little or no milt.

2.1.4 Hydrographic and Atmospheric Data

Hydrographic data will be collected using a YSI 6820 V2 multi parameter sonde coupled with a YSI 650 MDS display system (or similar). The sonde is lowered overboard and held in surface waters until the instrument equilibrates. Water temperature (degrees C), dissolved oxygen concentration (mg/l), and salinity (ppt) data are recorded for the near-surface waters. The sonde is then lowered to near-bottom and water temperature, dissolved oxygen, and salinity data are recorded. Measurements are recorded for each station at the end of each tow.

Sea state and weather conditions are recorded from visual observations. Air temperature may be downloaded from a local weather station if not available onboard.

2.1.5 Gillnet Station Data

The following data will be collected during each sampling effort:

- Station number

- Latitude and longitude
- Soak start and end time and date
- Water depth
- Wind speed
- Wind direction
- Wave height
- Air temperature
- Surface and bottom water temperature, salinity, and dissolved oxygen

2.1.6 Data Entry and Reporting

Data will be transcribed from hard copy datasheets into electronic worksheets. The data sheets will be reviewed for data entry errors prior to importing into a relational database. Quality control checks will be performed on database tables by running standardized, systematic queries to identify anomalous data values and input errors. Species names (common and scientific) are verified and tabulated for consistency. All data used in analysis will be exported from the relational database.

Annual reports containing catch data will be prepared after the conclusion of each year of sampling and shared with State and Federal resource agencies. One final report will also be produced synthesizing the findings of the pre- and post-construction evaluations.

2.1.7 Data Analysis

Prior to the project being built, data analysis will focus on comparing the fish communities in the impact and the control areas to describe spatial differences. CPUE and length data will be quantitatively compared on a per species basis between the impact and the control areas. Similar analyses will occur using the post-construction data, however the focus will be on identifying changes in the fish community in the impact area between pre- and post- construction that did not also occur at the control areas that could be attributed to either construction or operation of the wind turbines. Confidence intervals for the size of the apparent effects of the SFWF will be the focus of the analyses, rather than simply Yes or No statements about the statistical significance of any observable effects. More detailed or appropriate analyses may be included as the project progresses.

3.0 Demersal Fisheries Resources Survey – Beam Trawl

The survey will help establish pre-construction baseline community composition, with a focus on demersal fish and macroinvertebrates species, and may be used to assess whether detectable shifts occur in fish presence, absence, or abundance before and after construction.

3.1 Survey Design/Procedures

The survey will be conducted from commercial fishing vessel(s) with scientists onboard to process the catch. For-hire vessels will be selected based on criteria such as experience, safety record, knowledge of the area, and cost. The scientific contractor will apply for a Letter of Acknowledgement (LOA) from NOAA Fisheries in order to use the hired fishing vessel(s) as a scientific platform and conduct scientific sampling that is not subject to the Atlantic Coastal Fisheries Cooperative Management Act, Magnuson-Stevens Fishery Conservation and Management Act, and fishery regulations in 50 CFR parts 648 and 697. All survey activities will be subject to rules and regulations outlined under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA). Efforts will be taken to reduce marine

mammal, sea turtle, and seabird injuries and mortalities caused by incidental interactions with fishing gear. All gear restrictions, closures, and other regulations set forth by take reduction plans (e.g., Harbor Porpoise Take Reduction Plan, Atlantic Large Whale Reduction Plan, etc.) will be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury.

3.1.1 Proposed Sampling Stations

The SFWF "Project Area" is defined as the maximum work area required to install the SFWF (yellow outline in Figure 3 below). This includes the maximum extent where vessels or lift barges may anchor during construction around the wind turbines and foundations. Three survey areas are proposed for sampling; one survey area within the SFWF Project Area and two reference areas. Each survey area will contain three predetermined beam trawl lines. Two beam trawl lines per area will be randomly selected for each survey, resulting in six beam trawls conducted per survey. Final designation of survey areas and survey lines within each area will be based on detailed geophysical seafloor survey data as well as input from commercial gillnet fishermen regarding areas important to them. Location of beam trawls may be subject to change due to seasonal location of other fixed fishing gear (e.g., lobster pots). If a survey line is found to have poor conditions for beam trawling it may be moved based on the captain's professional judgement.

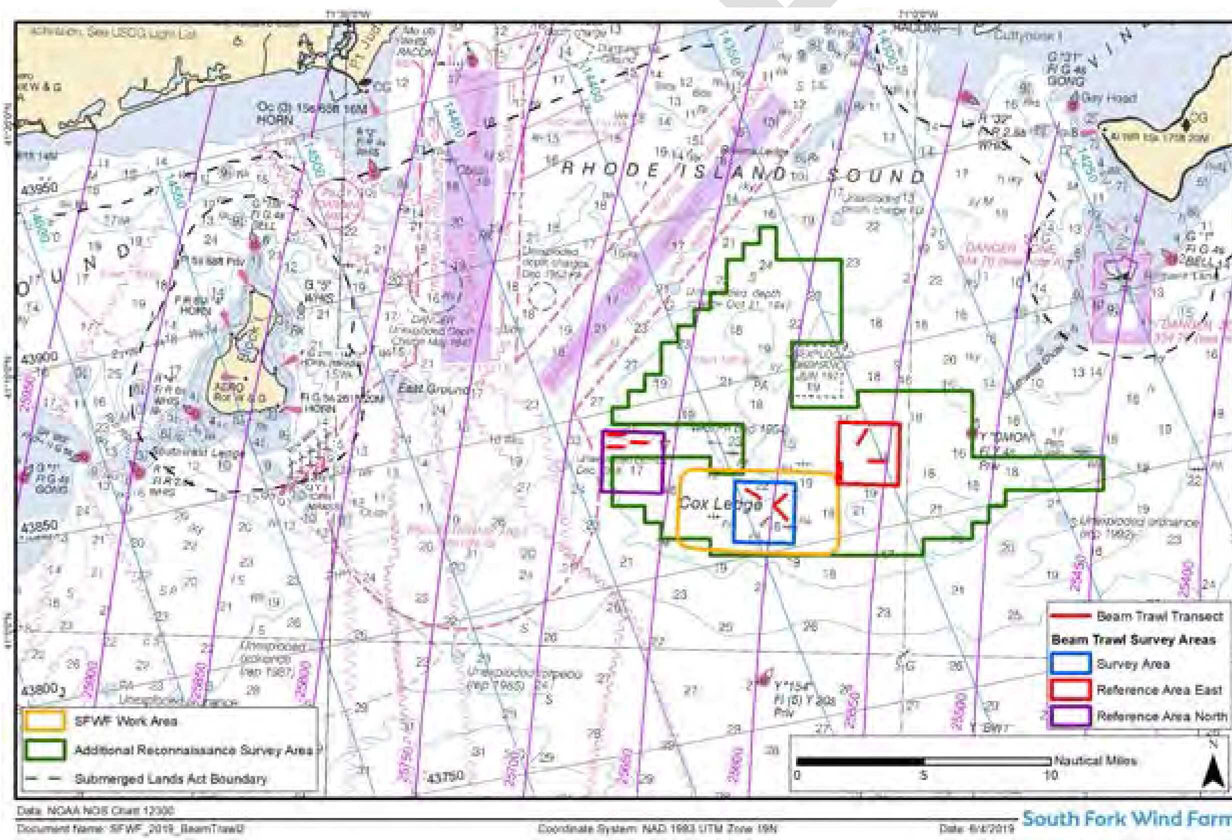


Figure 4. South Fork Wind Farm Project Area with Proposed Beam Trawl Survey and Reference Areas

3.1.2 Beam Trawl Methods

Beam trawling will be conducted monthly by a commercial fishing vessel using a 5.5-m beam trawl and a 1-inch (2.54-cm) knotless cod end liner (or similar; equivalent to NEAMAP cod end) to ensure retention of the smaller fish (Malek, 2015). Once on station, the crew of the vessel lowers the net into the water fully and allows it to drag behind the boat. When the gear is fully deployed and the winch brakes are set, the timer is set for 20 minutes, and the start coordinates, start time, date, tow direction, water depth, and tow speed are recorded. Towing speed is maintained at approximately 2.0 knots (Malek, 2015). Upon completion of the tow, end time and end coordinates are recorded.

Fish collected in each tow will be identified, weighed, and enumerated consistent with the sampling approach of Northeast Area Monitoring and Assessment Program (NEAMAP).

Onboard scientists will sort and identify fish, and weigh each species by the following protocol:

All organisms will be identified to species including fish and mega-invertebrates such as squid, lobsters, *Cancer* spp. crabs, sand dollars, and urchins. Taxonomic guides include: NOAA's *Guide to Some Trawl-Caught Marine Fishes* (Flescher, 1980), Kells and Carpenter's (2011) *Field Guide to Coastal Fishes from Maine to Texas* and *Peterson's Field Guide to the Atlantic Seashore* (Gosner, 1999).

The catch will be sorted by species. In the case of large catches with a range of size classes, the catch may be sorted by relative size categories within each species. The use of size categories is to ensure that all sizes are equally represented in the data if subsampling is used. The chief biologist will determine the categories and approximate length ranges to be used for each species.

All specimens, fishes and invertebrates, are sorted by species and size (if appropriate) into buckets or fish totes as needed. This process continues until all specimens are sorted, and the chief biologist verifies that the sorting areas are clear of all specimens.

Notwithstanding sub-sampling procedures, up to 50 individuals of each species/size are measured and the rest counted. Individual lengths are recorded on the field data sheet. Fork length is recorded for all fishes with a forked tail. Total length is measured for all other fishes. Exceptions to these rules are the measurement of rays (disc width), sharks (straight-line fork length), dogfish (stretched total length), crabs (carapace width), lobsters (carapace length), and squids (mantle length). Miscellaneous invertebrates (e.g. worms, hermit crabs, snails) will be counted but not measured. Total weight of all individuals of each respective species will be recorded. Stomach content analysis will be performed for commercially important species (gadids, flounder, black sea bass) to determine if construction and operation of the project could affect fish prey items. Each fish sampled will be sampled for length and weight individually to assess relative condition before the stomach is removed.

In the case of larger catches (e.g., >900 kg), one or multiple subsampling procedures may be used. Subsampling protocols for the beam trawl are adapted from the subsampling procedures of the NEAMAP survey (Bonzek et al., 2008). The decision of which subsampling protocol, or protocols, to use will be at the discretion of the chief biologist.

3.1.3 Hydrographic and Atmospheric Data

Hydrographic data will be collected using a YSI 6820 V2 multi parameter sonde coupled with a YSI 650 MDS display system (or similar). The sonde is lowered overboard and held in surface waters until the instrument equilibrates. Water temperature (degrees C), dissolved oxygen concentration (mg/l), and salinity (ppt) data are recorded for the near-surface waters. The sonde is then lowered to near-bottom and water temperature, dissolved oxygen, and salinity data are recorded. Measurements are recorded for each station at the end of each tow.

Sea state and weather conditions are recorded from visual observations. Air temperature may be downloaded from a local weather station if not available onboard.

3.1.4 Tow Station Data

The following data will be collected during each sampling effort:

- Station number
- Start latitude and longitude
- Start time and date
- Start water depth
- Tow direction
- Tow speed
- Tow duration
- End latitude and longitude
- End time and date
- Wind speed
- Wind direction
- Wave height
- Air temperature
- Surface and bottom water temperature, salinity, and dissolved oxygen

3.1.5 Data Entry and Reporting

Data will be transcribed from hard copy datasheets into electronic worksheets. The data sheets will be reviewed for data entry errors prior to importing into a relational database. Quality control checks will be performed on database tables by running standardized, systematic queries to identify anomalous data values and input errors. Species names (common and scientific) are verified and tabulated for consistency. All data used in analysis will be exported from the relational database.

Annual reports containing catch data will be prepared after the conclusion of each year of sampling and shared with State and Federal resource agencies. One final report will also be produced synthesizing the findings of the pre- and post-construction evaluations.

3.1.6 Data Analysis

The BACI survey design will allow for characterization of baseline pre-construction demersal fish and invertebrate community structure. By continuing sampling during and after construction the survey will allow quantification of any substantial changes in species presence, absence, or abundance associated with proposed operations. The use of reference control sites will ensure that larger regional changes in demersal fish and invertebrate community structure will be captured and delineated from potential impacts of the proposed SFWF. The survey plan allows the comparison of the catch of key, numerically dominant species between the before and after construction periods, using a BACI statistical model.

4.0 References

Brander, K. 1993. Comparison of spawning characteristics of cod (*Gadus morhua*) stocks in the North Atlantic. Northwest Atlantic Fisheries Organization Scientific Council Studies 18:13–20.

Burnett, J., O'Brien, L., Mayo, R. K., Darde, J., and Bohan, M. 1989. Finfish maturity sampling and classification schemes used during Northeast Fisheries Center bottom trawl surveys, 1963–1989. NOAA Tech. Mem. NMFS-F/NEC, vol. 76. 14 p.

Dean, M.J., W.S. Hoffman, and M.P. Armstrong. 2012. Disruption of an Atlantic Cod spawning aggregation resulting from the opening of a directed gill-net fishery. North American Journal of Fisheries Management 32: 124–134.

Dean, M.J., W.S. Hoffman, D.R. Zemeckis, and M.P. Armstrong. 2014. Fine-scale diel and gender-based patterns in behaviour of Atlantic cod (*Gadus morhua*) on a spawning ground in the Western Gulf of Maine. ICES Journal of Marine Science 71: 1474-1489.

Flescher, D.D. 1980. Guide to Some Trawl Caught Marine Fishes from Maine to Cape Hatteras, North Carolina. NOAA Technical Report NMFS Circular 431. March 1980.

Gosner, K.L. 1999. A Field Guide to the Atlantic Seashore: From the Bay of Fundy to Cape Hatteras. Houghton Mifflin Harcourt, 329 p.

Hamley, J.M. 1975. Review of gillnet selectivity. Journal of the Fisheries Board of Canada. 32(11): 1943-1969.

Hutchings, J.A., T.D. Bishop, and C.R. McGregor-Shaw. 1999. Spawning behaviour of Atlantic Cod, G*adus morhua*: evidence of mate competition and mate choice in a broadcast spawner. Canadian Journal of Fisheries and Aquatic Sciences 56:97–104.

Kells, V. and K. Carpenter. 2011. A Field Guide to Coastal Fishes from Maine to Texas. Johns Hopkins University Press, 448 p.

Malek, A. 2015. An Investigation of the Fisheries Ecosystem Dynamics in Rhode Island's Nearshore Waters. *Open Access Dissertations.* Paper 352. https://digitalcommons.uri.edu/oa_diss/352

Meager, J.J., J.E. Skaeraasen, A. Ferno, and S. Løkkeborg. 2010. Reproductive interactions between fugitive farmed and wild Atlantic cod (*Gadus morhua*) in the field. Canadian Journal of Fisheries and Aquatic Sciences 67: 1221–1231.

O'Brien, L., J. Burnett, and R. Mayo. 1993. Maturation of nineteen species of finfish off the northeast coast of the United States, 1985-1990. NOAA Technical Report NMFS-113. June 1993.

Robichaud, D. and G.A. Rose. 2001. Multiyear homing of Atlantic cod to a spawning ground. Canadian Journal of Fisheries and Aquatic Sciences 58: 2325–2329.Siceloff, L., and H. Howell. 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.

Underwood, A.J. 1994. On beyond BACI: sampling designs that might reliably detect environmental disturbances. Ecol Appl 4: 3–15.

Siceloff, L., and H. Howell. 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.

Skjæraasen, J.E., J.J. Meager, Ø. Karlsen, J.A. Hutchings, and A. Ferno. 2011. Extreme spawning-site fidelity in Atlantic Cod. ICES Journal of Marine Science 68:1472–1477.

Smith, E.P. 2002. BACI Design. In: Encyclopedia of Envirometrics, Vol. 1, pp 141-148. Edited by: Abdel H. El-Shaarawi and Walter W. Piegorsch. John Wiley & Sons, Ltd, Chichester, 2002.

Thomsen B., Humborstad O. B., Furevik D. M. 2010. Fish pots: fish behaviour, capture processes, and conservation issues. *In Behaviour of Marine Fishes: Capture Processes and Conservation Challenges*, pp. 143–158. Ed. by He P. John Wiley and Sons, Iowa. 392 pp.

Walsh, H. J., Guida V.G. 2017. Spring occurrence of fish and macro-invertebrate assemblages near designated wind energy areas on the northeast U.S. continental shelf. Fishery Bulletin 115:437-450.

Zemeckis, D.R., M.J. Dean, and S.X. Cadrin. 2014a. Spawning dynamics and associated management implications for Atlantic cod. North American Journal of Fisheries Management, 34: 424-442.

Zemeckis, D.R., W.S. Hoffman, M.J. Dean, M.P. Armstrong, and S.X. Cadrin. 2014b. Spawning site fidelity by Atlantic cod (*Gadus morhua*) in the Gulf of Maine: implications for population structure and rebuilding. ICES Journal of Marine Science 71:1356-1365.

From:	Melanie Gearon
To:	Drew Carey; Brian Gervelis; Jill Johnen
Subject:	FW: NOAA Fisheries comments
Date:	Tuesday, July 9, 2019 4:31:52 PM
Attachments:	NOAA_Comments_SFWF_Monitoring_July7_2019.docx

NEFSC comments on plan

Best regards,
Melanie Gearon
Manager, Permitting & Environmental Affairs
Wind Power

Ørsted
Tel. 857-348-3261

From: Sharon Benjamin - NOAA Affiliate <sharon.benjamin@noaa.gov>
Sent: Tuesday, July 9, 2019 4:27 PM
To: mgearon@dwwind.com
Cc: Sue Tuxbury <susan.tuxbury@noaa.gov>; Andrew Lipsky - NOAA Federal <andrew.lipsky@noaa.gov>; Christopher Boelke - NOAA Federal <Christopher.Boelke@noaa.gov>; Douglas Christel - NOAA Federal <douglas.christel@noaa.gov>
Subject: NOAA Fisheries comments

Hi Melanie,

I hope you are well. My apologies for the delay in sending you this, I know you were looking to have feedback in by yesterday. Please find attached the combined comments from NOAA Fisheries' Greater Atlantic Regional Office and the NEFSC.

Thank you,
Sharon

--
Sharon Benjamin
Marine Habitat Resource Specialist
978-281-9197 ext. 6197

Habitat Conservation Division | Greater Atlantic Regional Fisheries Office
NOAA National Marine Fisheries Service
Gloucester, MA 01930
http://www.nmfs.noaa.gov/

Contractor with Integrated Statistics.

NOAA Fisheries comments regarding the
***South Fork Wind Farm Fisheries research and Monitoring* Plan (June 2019)**

Plan Page #	Comment
1-3	The introduction is generally good; particularly like the inclusion of "guiding principles"
3	A beam trawl survey as the second method is a good compromise when weighing the need for representative demersal catches against the issue of difficult bottom topography for otter trawl nets.
3	Acknowledgement of strength of multiple sampling methods (last paragraph) is good, but even this combination has weaknesses that should be acknowledged. You won't catch much pelagic fauna: squids, butterfish, and herring species in the MA-RI Wind Energy area are numerically important, but easily escape large mesh gill nets and slow-moving beam trawls. This should be acknowledged.
4	#3 in list in 1st paragraph: the data being collected do not only address "taxonomic composition", but also numerical abundance and biomass; that should be stated
4	Paragraph 1: There needs to be a clear statement as to the purpose of this program: is it a once-and-done assessment or is it a program to monitor effects for some extended period? It is not clear from the rest of the document which it is.
4	It would be helpful to include e-links to this and other documents mentioned in the document.
4	There needs to be a clarification on how sampling is going to be done in time and how that relates to analysis and reporting. How many times will sampling be conducted and at what intervals? BACI design assumes there will be before and after sampling and there is mention of during construction as well, but will there be any extended monitoring program to detect slow-developing effects? When will reports be made? A Gantt chart to suggest the conduct of the entire project would be useful. The Gantt chart provided (Fig. 2) is inadequate: it seems to indicate seasonal gill netting, but continuous beam trawling (year round) and does not address the issue of how many times over what period the entire project is planned.
N/A	The survey methodology refers repeatedly to collection of “pre-construction baseline data” but does not state the number of years of data that will be collected. The survey timeline also indicates “the goal of starting the surveys in 2019.” It should be noted that BOEM’s Fisheries Survey Guidelines note that pre-construction baseline surveys should be conducted for 2 years, and the research plan indicates construction will begin in 2021. It would be helpful to provide a more detailed explanation of the survey timeline and plan.

N/A	Both gillnets and trawl sampling methods pose risks to protected species, including critically endangered North Atlantic right whales. Additionally, right whales occur in the proposed sampling areas in the spring and fall periods identified for the gillnet gear. Effects to listed species (large whales, sea turtles, Atlantic sturgeon) should be considered before any sampling occurs and measures to avoid, minimize and monitor effects should be incorporated into study plans. South Fork should ensure that any necessary ESA and MMPA authorizations/consultations are completed before sampling occurs.
N/A	Reference areas used to compare with the survey areas are located in an existing lease area that may be used to site other wind turbines. Therefore, they are not appropriate as controls for a BACI design.
N/A	The plan notes that lobster traps are in the area (p. 5), but does not include any ventless trap survey to assess impacts to lobsters and crabs. This should be included to monitor and fully evaluate potential impacts of this project.
5-6	Gill net and beam trawl sites will be placed randomly for each survey…that's necessary for statistical validity…but with some concessions to commercial fishing activity, poor setting, and untrawlable conditions: understandable. Thus this is a randomized unstratified BACI sampling design. However, there is a problem with that in this case. While the limits of project area in human terms is set to encompass the placement patterns for the turbines plus a buffer to accommodate construction activity, we cannot assume that the biological effects will follow the same system of boundaries. Previous experience in Europe has indicated that there are measurable effects, but they are largely confined to a limited radius (300 m) from turbine foundations. Fifteen 300 m – radius circles within South Fork would occupy about 4 sq km, or ~6% of the area of the wind farm (est.72 sq km). Under these conditions, an unstratified random sampling pattern within South Fork would have only a 6% chance of encountering an effect, even a very large one. A sampling program utilizing only 3 samples (gill net sets or beam trawls) per treatment would have only a small chance of "hitting" a measurably affected area, even if the effects were very large within those small areas. If the small areas around the turbines would support 10X the number of black sea bass per unit area than the rest of the farm (not unreasonable), the output for the entire farm would increase by 1.5X, but that would remain undetected because the unstratified random sampling program would likely miss sampling it. In other words, this could be a sampling scheme guaranteed to find no effect. One possible solution might be to create a stratified random sampling program in which the strata are determined by distance from turbine foundations. The simplest case would be two strata: one stratum with sampling sites within 300 m or some other distance considered appropriate, and one with sites outside 300 m or another appropriate distance. This could preserve the BACI design, but have a better chance of capturing any highly measureable effects of limited areal extent. This would involve additional sampling to cover the strata.

6	It is not clear in the description of the proposed study design's location conditions (#2) how the "area of influence" will be determined and measured for establishing reference areas. It should be clarified how the area of influence is determined - whether it is by the extent of scour protection around turbine bases, or by the detection of sound/EMF in the water column. This is also confusing because the reference areas must also be comparable in terms of current, habitat and depth, which are additional factors that complicate the selection of reference sites if the "area of influence" is not well defined.
6	As noted in the gillnet methods, comparison of this gillnet survey data to other baseline sampling efforts will be limited due to gear and effort differences; furthermore, although typical of the commercial fleet in RI and MA, it is not clearly explained why the 12" mesh will be use, which may not catch all species in the area (a noted goal of the gillnet survey is to establish a pre-construction baseline community composition).
N/A	The sample size needed to assess cod spawning condition is undefined and should be specified in this report. As written, an unlimited number of cod could be sampled.
7	Stomach content analysis is valuable, but should be described in greater detail, including the classification level of prey species, sampling and sample preservation methods, and other basic details of protocol.
8	The Hydrographic/Atmospheric data collection programs are adequate, though they provide only snapshots of conditions during sampling excursions.
N/A	The duration of sampling is not specified in this draft plan. We cannot determine if sufficient sampling will occur after construction has been completed to assess whether the sampling design is sufficient to conduct a BACI approach.
N/A	The stated goal of the proposed plan is to assess commercially and recreationally important demersal fish species. However, there are other resources that should also be evaluated to understand project impacts, such as benthic and pelagic habitats, and macrobenthic communities. Project effects on fisheries resources and habitat should be considered, including effects from electromagnetic fields along the cable corridor, changes in hydrodynamics, conversion of habitat, and acoustic effects. We recommend that you review the NOAA Fisheries June 27, 2019 letter to BOEM that provide EFH conservation recommendations and discusses monitoring needs.
N/A	The acoustic environment is a key component of marine habitat; the proposed monitoring plan does not indicate any monitoring of project-related construction or operational noise. Noise from these activities may affect how some commercially and recreationally important species utilize the area in both the short and long term. Acoustic monitoring is strongly recommended along gradients from near field to areas outside the range of expected project effects. . This should be done before,

	during, and after construction. Not only will it provide an acoustic metric to compare to other survey data, but the data can also be used to detect changes in species presence. Passive acoustics studies could detect biological sounds and be used to see if there are any deterrent or attractive responses to changes in ambient noise or suitable habitat.
N/A	As one of the stated guiding scientific principles of this proposed plan is to share data with all stakeholder groups, it would be helpful for the research plan to provide more details on how the data will be made available, and if it will be shared in accordance with BOEM's guidelines.
General	It appears that some our comments we provided on the previous draft proposal were not fully addressed in the latest draft. For example, the sampling period suggested for establishing baseline conditions is not clearly defined, but still appears to be limited to 1 year. This will be insufficient to understand impacts because there is no control for interannual variability.

Brian Gervelis

From:	Douglas Christel - NOAA Federal <douglas.christel@noaa.gov>
Sent:	Thursday, December 12, 2019 2:24 PM
To:	Melanie Gearon; Brian Gervelis; Drew Carey; Robert Soden
Cc:	Susan Tuxbury - NOAA Federal; Nick Sisson - NOAA Affiliate; Ryan Silva - NOAA Federal
Subject:	Re: SFWF Gillnet/Beam Trawl we lan
Attachments:	2019-9-19_SFWF_fisheries research monitoring plan_Dec 2019.docx

Good morning all,
See attached for additional comments from Center staff regarding this monitoring plan. We're happy to discuss these with you further if you have any questions or are interested in following up. I'll forward any additional comments I receive through Friday.

Once again, we're hoping you will reach out to our Protected Species folks in preparation of the LOA request before you begin the research. I've cc'd Nick Sisson on this email in case you need anything in that regard.
Thanks,
Doug

On Thu, Dec 5, 2019 at 12:59 PM Douglas Christel - NOAA Federal <douglas.christel@noaa.gov> wrote:

> Hi Melanie,
> I hope you are well and had a good Thanksgiving. Do you have any update on the LOA submission? We're trying to plan out future workload. I spoke with Ryan today and he hasn't received anything. We're trying to better keep everyone informed of what's going on, so he'll be meeting with our Protected Species Division to ensure marine mammal issues are properly considered in such surveys.
>
> Also, are you still considering comments on this? Perhaps I misheard something, but I thought you suggested at the FWG there may still be an opportunity for refinement. If so, we may have some additional input. If not, please forgive me for misunderstanding. We're all trying to keep our heads above water and tracking all of these simultaneous projects has been challenging.
> Doug
>
> On Fri, Nov 22, 2019 at 3:27 PM Melanie Gearon <MELGE@orsted.com> wrote:
>
>> Hi Doug,
>> Latest plan attached. And today's ppt. We have also been asked by Sue Tuxbury re: permits to check in with Jordon Carduner and Julie Crocker which we will be doing in the near future. We will keep you and Ryan looped in to those conversations.
>>
>> Best regards,
>> **Melanie Gearon**
>> Manager, Permitting & Environmental Affa
>> US Permitting
>> Offshore
>>
>> Learn more at orsted.com
>>
>> One International Place, 2610

MA-02110 Boston
Tel. +1 857 348 3261

melge@orsted.com
orsted.com

--
Douglas W. Christel
Fishery Policy Analyst

National Marine Fisheries Service
Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930
Phone: (978) 281-9141
Fax: (978) 281-9135

--
Douglas W. Christel
Fishery Policy Analyst

National Marine Fisheries Service
Greater Atlantic Regional Fisheries Office
55 Great Republic Drive
Gloucester, MA 01930
Phone: (978) 281-9141
Fax: (978) 281-9135

South Fork Wind Farm

South Fork Wind Farm: Fisheries Research and Monitoring Plan
September 2019

1.1 Introduction

The South Fork Wind Farm (SFWF or project) is proposed to be located in Bureau of Ocean Energy Management (BOEM) Lease Area OCS A-0486, which is within the Rhode Island – Massachusetts Wind Energy Area (RI-MA WEA) (Figure 1). The SFWF includes up to 15 wind turbine generators (WTGs or turbines) with a nameplate capacity of 6 to 12 MW per turbine, submarine cables between the WTGs (Inter-array Cables), and an offshore substation (OSS), all of which will be located approximately 19 miles (30.6 kilometers [km], 16.6 nautical miles [nm]) southeast of Block Island, Rhode Island, and 35 miles (56.3 km, 30.4 nm) east of Montauk Point, New York.

Deepwater Wind South Fork, LLC (DWSF), now a wholly-owned indirect subsidiary of North East Offshore, LLC, a joint venture between Ørsted and Eversource , submitted the major federal permit application, The South Fork Wind Farm Construction and Operations Plan[1] (COP), to BOEM in June, 2018 and submitted a revised COP to BOEM in May, 2019. The Project is scheduled to be installed during 2021 and 2022, and to be commissioned and operational by the end of 2022.

The SFWF project team has spoken extensively with regional fishing organizations, working groups, and individual fisherman over the last three years as development of the project has evolved. In addition, through the permitting and development process the SFWF project team has consulted with several state (e.g., NY, CT, RI, and MA) and federal fisheries resource management agencies. It has become clear, based on feedback received to date, that an approach to assess commercially and recreationally targeted demersal fish at the SFWF is a priority.

Commented [1]: There is no indication in this Introduction of the legal obligation of the developer that is driving this proposer's investigation, nor the details of how the conduct of the proposed study relates to the actual development of the South Fork Wind Farm. The assumption is that it will be conducted before construction and afterward, hence the BACI design. Will this be before-during-after construction and continued for some period thereafter? How long? What is required legally or as guidelines from BOEM and how does this plan fulfill those requirements? Don't assume that the reviewer is totally cognizant of all the details of these issues. This needs to be stated. Proper evaluation of this proposal depends on understanding the requirements and this monitoring plan in the context of the larger wind farm development plan.

[1] The full revised COP document can be found online at: https://www.boem.gov/South-Fork/

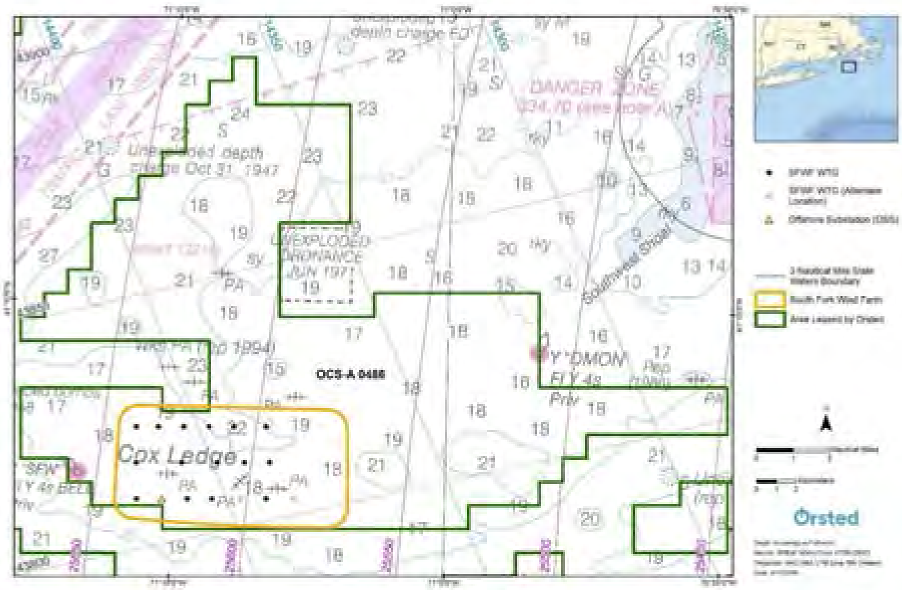


Figure 1: Location of South Fork Wind Farm.

DWSF is committed to conducting sound, credible science. Biological surveys, developed in coordination with the commercial fishing fleet and state agencies, have been conducted at the Block Island Wind Farm (BIWF) since 2012 and will continue through at least 2019. The guiding scientific principles implemented beginning with the BIWF and continuing into the future include:

- Producing transparent, unbiased, and clear results from all research
- Working with commercial fishermen to identify areas important to them
- Collecting long-term data sets to determine trends and develop knowledge
- Promoting the smart growth of the American offshore wind industry
- Focusing on maintaining access and navigation in, and around, our wind farms for all ocean users
- Completing scientific research collaboratively with the fishing community
- Being accessible and available to the fishing industry
- Utilizing standardized monitoring protocols when possible and building on and supporting existing fisheries research
- Sharing data with all stakeholder groups

Commented [2]: How will these data be shared?

- Maintaining data confidentiality for sensitive fisheries dependent monitoring data

The SFWF site is situated atop Cox's Ledge, an area with extensive areas of boulders and mobile gear "hangs". Therefore, fishery independent data are lacking in the SFWF because sampling demersal species with bottom otter trawls, similar to those used by the Northeast Fisheries Science Center (NEFSC) Bottom Trawl Survey, NEAMAP[2], and at the BIWF, is less feasible. Feedback from commercial fishermen combined with vessel Monitoring System (VMS) data indicate there is little commercial trawl effort in the area. Details of the SFWF fisheries data assessment and stakeholder feedback can be found in the SFWF COP Appendix Y - Commercial and Recreational Fisheries Technical Report.[3]

Through extensive outreach efforts with the fishing community, feedback from state and federal agencies, and exploration of existing datasets, the SFWF project team has developed gillnet and beam trawl survey designs to acquire pre-construction data on demersal species that occur in and around the SFWF. These two gear types can also be used effectively, and with limited impact, on the rocky habitat within the SFWF (Thomsen et al., 2010; Malek, 2015).

Gillnet selectivity depends mainly on fish size and shape and mesh size, but is also affected by the thickness, material, and color of net twine, hanging of net, and method of fishing (Hamley, 1975). Using specific gear placements and prescribed mesh sizes, gillnets may be designed to target specific species, or subgroupings of species, and life stages. Southern New England waters are host to a large monkfish gillnet fishery, as well as a lucrative wing fishery for winter skate. The proposed gillnet survey will focus on monitoring these two species pre- and post-construction of the SFWF.

Veteran fishermen report that sections of the Project Area (defined below) likely allows for collection via beam trawl, as beam trawls are smaller in size than traditional otter trawls and more maneuverable (R. Sykes, pers. comm.). Previous studies have used beam trawls to sample in the vicinity of the Project
Area and have proven to be an effective gear for sampling demersal species, including juveniles (Malek, 2015; Walsh and Guida, 2017).

Commented [3]: Perhaps a study of the variance structures in these data sets could inform the sample size needed to detect effects.

Different gear types select for different fish and macro-invertebrate species, therefore, using multiple gear types to sample species assemblages is needed for assessing potential impacts from the SFWF (Wilson et al., 2010; Walsh and Guida, 2017). Gillnet and beam trawl surveys will monitor a large portion of the species assemblage present in and around the SFWF over a varying temporal scale (Figure 2).

[2] NorthEast Area Monitoring and Assessment Program (NEAMAP)

[3] Appendix Y can be found online at: https://www.boem.gov/Appendix-Y/

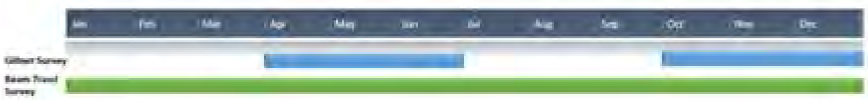


Figure 2: Survey timeline for SFWF monitoring.

These surveys will provide data that can be used to evaluate:

Commented [4]: How will the survey design be adapted once turbines are in place? Previous studies suggest that the strongest effects occur nearer the turbines. How close to the turbines do you plan to sample and is there any plan to conduct distance-based sampling?

Commented [5]: In support of the issue of adaptive survey design, assuming that, as in Europe, strong effects are confined to the regions immediately around turbines, a random sampling scheme with a small number of replicates that does not take into account turbine placement has little chance of detecting an effect, even if it exists, and even if it is quite strong. My preliminary estimate is that only 5-10% of a wind farm's area may be subject to strong effects, but that those effects, e.g. probable large increases in black sea bass aggregation due to habitat creation, could be quite substantial nevertheless and have important implications for the larger fishery for that species. There needs to be some concession expressed here regarding sample positioning to capture effects close to turbines in recognition of the likelihood of this kind of change.

1) Demersal species that utilize the area in and around the SFWF.
2) The seasonal timing of the occurrence of these species.
3) Whether the taxonomic composition, abundance, and/or biomass of demersal fish assemblages change between the pre-construction and post-construction time periods. For example, do some species have reduced abundance and/or do new species appear?

The survey protocols have been designed to address requirements and guidelines outlined in the national register (30 CFR 585.626), BOEM fishery guidelines, and Rhode Island Coastal Resources Management Council policies (11.10.9 C).

Final survey protocols will be incorporated into a Request for Proposal (RFP) with the goal of starting the surveys in 2019. Similar to the principles and practices executed for the Block Island Wind Farm, DWSF is committed to conducting science surveys and assessments that are collaborative with the fishing industry. DWSF will select for-hire fishing vessels from which these surveys will be conducted.

2.1 Demersal Fisheries Resources Survey - Gillnet

The survey will help establish pre-construction community composition, with a focus on monkfish and winter skate, and may be used to assess whether detectable shifts occur in fish presence, absence, or abundance before and after construction.

2.1 Survey Design/Procedures

The survey will be conducted from commercial fishing vessel(s) with scientists onboard to process the catch. For-hire vessels will be selected based on criteria such as experience, safety record, knowledge of the area, and cost. The scientific contractor will apply for a Letter of Acknowledgement (LOA) from NOAA Fisheries in order to use the hired fishing vessel(s) as a scientific platform and conduct scientific sampling that is not subject to the Atlantic Coastal Fisheries Cooperative Management Act, Magnuson- Stevens Fishery Conservation and Management Act, and fishery regulations in 50 CFR parts 648 and 697. All survey activities will be subject to rules and regulations outlined under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA). Efforts will be taken to reduce marine

mammal, sea turtle, and seabird injuries and mortalities caused by incidental interactions with fishing gear. All gear restrictions, closures, and other regulations set forth by take reduction plans (e.g., Harbor Porpoise Take Reduction Plan, Atlantic Large Whale Reduction Plan, etc.) will be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury.

2.1.1 Proposed Sampling Stations

The SFWF "Project Area" is defined as the maximum work area required to install the SFWF (yellow outline in Figure 2 below). This includes the maximum extent where vessels or lift barges may anchor during construction around the wind turbines and foundations. Three survey areas are proposed for sampling; one survey area within the SFWF Project Area and two reference areas. Each survey area will contain three predetermined gillnet survey lines. Two gillnet lines per area will be randomly selected for each survey, resulting in six gillnet strings conducted per survey. Final designation of survey areas and survey lines within each area will be based on detailed geophysical seafloor survey data as well as input from commercial gillnet fishermen regarding areas important to them. Location of gillnets may be subject to change due to seasonal location of other fixed fishing gear (e.g., lobster pots). If a survey line is found to have poor conditions for setting gillnets it may be moved based on the captain's professional judgement.

> **Commented [6]:** Several comments here: 1) Assigning sampling stations in this way assumes that each box is homogeneous with regard to habitat variables that affect the distribution of fish which is unlikely to be true, 2) How were the reference stations chosen? They appear to still overlap the WEA which means they could be the site of future wind farm development, 3) n=2 is a small sample size. How was this sample size determined? Is there some statistically-based justification that indicates that this sample size would be able to detect a change if in fact one occurs?, 4) What are the criteria by which sites will be "predetermined.", 5) Are sampling sites proposed to be fixed for the duration of the study (following random selection from a predetermined set)?

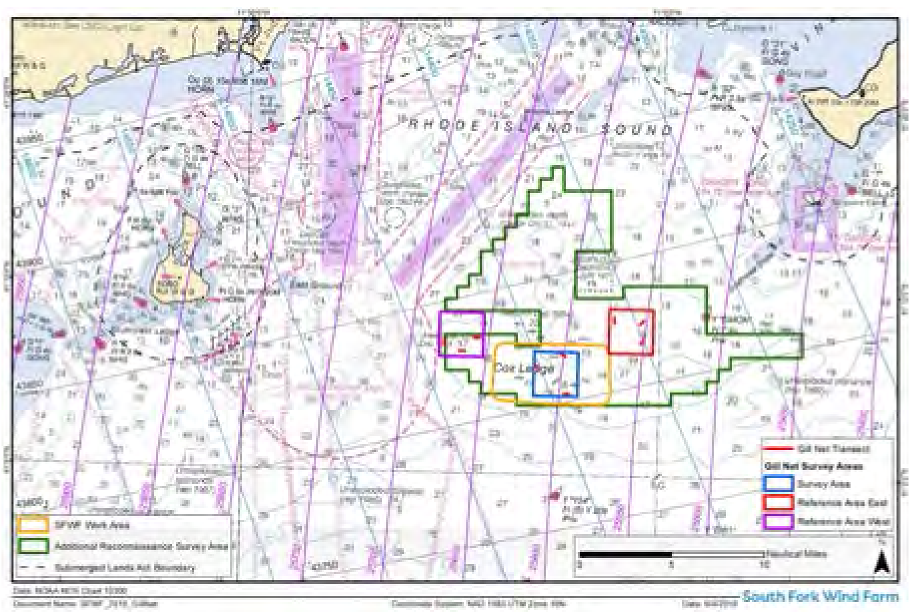


Figure 3. South Fork Wind Farm Project Area with Proposed Gillnet Survey and Reference Areas

> **Commented [7]:** What are the areas (km2) of these boxes?

Data will be collected in the Project Area and two reference areas with similar habitat characteristics as the Project Area. The reference areas will serve as an index of demersal fish abundance in Rhode Island

Sound in an area outside of the direct influence of the SFWF. Concurrent sampling in the Project Area and the two reference areas will help identify whether temporal changes in demersal fish abundance data observed within the Project Area are consistent with regional trends rather than representing a localized impact in the vicinity of the SFWF. The study will use an asymmetrical before-after-control- impact (BACI) experimental design[4], with statistical evaluation of the differences between control and impact areas contrasted in the before and after construction time periods (Underwood 1994; Smith 2002). A BACI design will allow for assessment of shifts in fish presence, absence, or abundance that correlate with proposed operations at the SFWF.

The study design consists of sampling each of the treatment areas with a gillnet. The proposed sampling locations will be selected such that:

1. There is comparability among all sampling areas with respect to current, habitat and depth condition;
2. Reference areas are outside the area of influence from the SFWF but are still utilized by the same/similar fish populations;
3. Areas allow optimal operational execution of the survey (e.g., minimal travel times between sampling locations);
4. Space conflicts are minimized with other active uses.

2.1.2 Gillnet Methods

A gillnet is a wall of netting that hangs in the water column and is typically made of monofilament or multifilament nylon. Mesh sizes are designed to allow fish to get only their head through the netting, but not their body. The fish's gills then get caught in the mesh as the fish tries to back out of the net. Factors that can influence the catch rate of gillnets for target species include: fish density in the vicinity of gears, the behavior of the target species, the ability of fish to detect and locate the gillnet, and environmental factors such as water temperature, visibility, current direction, and velocity. It is often challenging to calculate catch per unit effort (CPUE) from gillnets due to potential changes in efficiency (e.g., fluctuating soak time and catch rate). This survey is designed to account for as many variables as possible to standardize CPUE. Comparison of this gillnet survey data to other pre-construction sampling efforts (e.g., nearby federal NEAMAP trawl stations) will be limited due to gear and effort differences.

The gillnet survey may be conducted using gillnets that are typical of the commercial fishery in Rhode Island and Massachusetts. Each gillnet string will consist of six, 300-ft net panels of 12-inch mesh with a hanging ratio of 1/2 (50%) and using net tie-downs. Sampling will take place once per month from April- June and October-December. These months see the majority of commercial gillnet activity as monkfish and skates migrate through the area in spring and fall. Sampling in July-September has been eliminated to minimize interactions with protected species and elasmobranchs that are common in the area during that time. The standard soak time of approximately 48 hours is proposed after input from industry, to maximize catch and standardize catch rates, while also ensuring the gear fishes properly during the soak (i.e., not collapsed from saturation), minimize depredation of catch, and keeping the survey trip length logistically feasible. Soak time will remain consistent throughout the duration of the survey. Each survey

[4] In this asymmetrical BACI design there is a single putative impact area, and two control areas. The area is assumed to be the observational unit and the two gillnet lines per area are subsamples which will be

Commented [8]: A BACI design will only work if the control areas are truly uninfluenced by the impact (likely in this case), and if they remain control areas for the entire lifetime of the study. The control areas are within the RIMA WEA. Can the proposer state unequivocally that they will remain undeveloped throughout the lifetime of this study? If not, then the study needs to be redesigned, either with different control areas that will remain undeveloped, or through use of some scheme that does not require control areas. This is part of the reason why it is essential to state the lifetime of the project and the context within the WEA development plan in the Introduction. If future developments are not clear, perhaps a contingency plan could be offered.

Commented [9]: What aspects of habitat will be considered?

Commented [10]: The scale of effect of offshore wind farms on fish is not well understood. How will you know when you are outside the area of influence?

Commented [11R10]: Agree- impact producing effects that we are trying to measure a response from occur at different scales, e.g., sound is much greater distances than changes in habitat (reef effect), wind wake effects recently reported by Thunen show a 80KM effect area

Commented [12]: Agreed that this is unfortunate, but this area is not trawlable by standard survey methods and there have not been any rigorous inter-calibration efforts between survey trawl and gill net methods in this region. That is what would be needed to rectify this deficiency. As is, gill net catches can at least reveal the kinds of changes taking place in semi-quantitative terms.

Commented [13]: This is particularly unfortunate. Comparability of this information with that collected by other regional surveys is crucial.

combined to estimate the area-wide abundance (or CPUE) during each sampling event.

event will be managed by a team of qualified scientists including a lead scientist with experience performing fisheries research. The catch will be removed from the gillnets by the boat crew for processing. The lead scientist will be responsible for collection of data and data recording.

Fish collected in each gillnet will be identified, weighed, and enumerated consistent with the sampling approach of NEAMAP. Scientists will sort and identify fish, and weigh each species by the following protocol:

All organisms will be identified to species. Taxonomic guides include: NOAA's Guide to Some Trawl-Caught Marine Fishes (Flescher, 1980), Kells and Carpenter's (2011) Field Guide to Coastal Fishes from Maine to Texas, and Peterson's Field Guide to the Atlantic Seashore (Gosner, 1999).

The catch will be sorted by species. All specimens are sorted by species and size (if appropriate) into buckets or fish totes as needed. This process continues until all specimens are sorted, and the lead scientist verifies that the sorting areas are clear of all specimens.

Notwithstanding sub-sampling procedures, up to 50 individuals of each species/size are measured and the rest counted. Individual lengths are recorded on the field data sheet. Fork length is recorded for all fishes with a forked tail. Total length is measured for all other fishes. Exceptions to these rules are the measurement of rays (disc width), sharks (straight-line fork length), dogfish (stretched total length), crabs (carapace width), lobsters (carapace length), and squids (mantle length). Total weight of all individuals of each respective species will be recorded. Stomach content analysis will be performed for commercially important species (monkfish, winter skate, gadids, black sea bass) to determine if construction and operation of the project could affect fish prey items. Each fish sampled will be sampled for length and weight individually to assess relative condition before the stomach is removed. Atlantic cod are known to spawn on or near Cox Ledge (Zemeckis et al., 2014). In addition to stomach sampling, any Atlantic cod caught on the gillnet survey will be assessed for reproductive stage and spawning condition according to the protocols used for SFWF Atlantic Cod Spawning Survey (adapted from

Burnett et. al [1989] and O'Brien et al. [1993]) that occurred during the winters of 2018 and 2019.

2.1.3 Hydrographic and Atmospheric Data

Hydrographic data will be collected using a YSI 6820 V2 multi parameter sonde coupled with a YSI 650 MDS display system (or similar). The sonde is lowered overboard and held in surface waters until the instrument equilibrates. Water temperature (degrees C), dissolved oxygen concentration (mg/l), and salinity (ppt) data are recorded for the near-surface waters. The sonde is then lowered to near-bottom and water temperature, dissolved oxygen, and salinity data are recorded. Measurements are recorded for each station at the end of each tow.

Sea state and weather conditions are recorded from visual observations. Air temperature may be downloaded from a local weather station if not available onboard.

2.1.4 Gillnet Station Data

The following data will be collected during each sampling effort:

- Station number
- Latitude and longitude
- Soak start and end time and date

- Water depth
- Wind speed
- Wind direction
- Wave height
- Air temperature
- Surface and bottom water temperature, salinity, and dissolved oxygen

2.1.5 Data Entry and Reporting

Data will be transcribed from hard copy datasheets into electronic worksheets. The data sheets will be reviewed for data entry errors prior to importing into a relational database. Quality control checks will be performed on database tables by running standardized, systematic queries to identify anomalous data values and input errors. Species names (common and scientific) are verified and tabulated for consistency. All data used in analysis will be exported from the relational database.

Annual reports containing catch data will be prepared after the conclusion of each year of sampling and shared with State and Federal resource agencies. One final report will also be produced synthesizing the findings of the pre- and post-construction evaluations.

2.1.6 Data Analysis

Prior to the project being built, data analysis will focus on comparing the fish communities in the impact and the control areas to describe spatial differences. CPUE and length data will be quantitatively compared on a per species basis between the impact and the control areas. Similar analyses will occur using the post-construction data, however the focus will be on identifying changes in the fish community in the impact area between pre- and post- construction that did not also occur at the control areas that could be attributed to either construction or operation of the wind turbines. Confidence intervals for the size of the apparent effects of the SFWF will be the focus of the analyses, rather than simply Yes or No statements about the statistical significance of any observable effects. More detailed or appropriate analyses may be included as the project progresses.

Commented [14]: How will stomach content data and data on cod reproductive stage/spawning be analyzed?

Commented [15]: How will data be temporally aggregated? Do you plan to examine monthly, seasonal, and/or annual changes or just pre vs. post construction?

Commented [16]: Before-After-Control-Impact studies rely heavily on having appropriate controls. What will you do if the controls differ from the wind farm area before construction, or if patterns in the controls diverge from each other after construction? These scenarios have arisen in previous wind farms studies and have made it difficult to discern wind farm effects.

Commented [17]: Given that sample size is small (n=2 per time point) and that sites are not stratified by any habitat variables that are meaningful to fish, the confidence intervals are likely to be large. This will make it difficult to discern real effects.

3.0 Demersal Fisheries Resources Survey – Beam Trawl

The survey will help establish pre-construction community composition, with a focus on demersal fish and macroinvertebrates species, and may be used to assess whether detectable shifts occur in fish presence, absence, or abundance before and after construction.

3.1 Survey Design/Procedures

The survey will be conducted from commercial fishing vessel(s) with scientists onboard to process the catch. For-hire vessels will be selected based on criteria such as experience, safety record, knowledge of the area, and cost. The scientific contractor will apply for a Letter of Acknowledgement (LOA) from NOAA Fisheries in order to use the hired fishing vessel(s) as a scientific platform and conduct scientific sampling that is not subject to the Atlantic Coastal Fisheries Cooperative Management Act, Magnuson- Stevens Fishery Conservation and Management Act, and fishery regulations in 50 CFR parts 648 and 697. All survey activities will be subject to rules and regulations outlined under the Marine Mammal Protection Act (MMPA) and Endangered

Species Act (ESA). Efforts will be taken to reduce marine mammal, sea turtle, and seabird injuries and mortalities caused by incidental interactions with fishing gear. All gear restrictions, closures, and other regulations set forth by take reduction plans (e.g., Harbor

Porpoise Take Reduction Plan, Atlantic Large Whale Reduction Plan, etc.) will be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury.

3.1.1 Proposed Sampling Stations

The SFWF "Project Area" is defined as the maximum work area required to install the SFWF (yellow outline in Figure 3 below). This includes the maximum extent where vessels or lift barges may anchor during construction around the wind turbines and foundations. Three survey areas are proposed for sampling; one survey area within the SFWF Project Area and two reference areas. Each survey area will contain three predetermined beam trawl lines. Two beam trawl lines per area will be randomly selected for each survey, resulting in six beam trawls conducted per survey. Final designation of survey areas and survey lines within each area will be based on detailed geophysical seafloor survey data as well as input from commercial gillnet fishermen regarding areas important to them. Location of beam trawls may be subject to change due to seasonal location of other fixed fishing gear (e.g., lobster pots). If a survey line is found to have poor conditions for beam trawling it may be moved based on the captain's professional judgement.

Commented [18]: Repeating previous comments regarding adaptive design: There needs to be some concession expressed here regarding sample positioning to capture effects close to turbines in recognition of the likelihood of this kind of change. Otherwise there is little chance of detecting strong, but localized effects in the vicinity of turbines.

Commented [19]: Same questions as above: 1) Assigning sampling stations in this way assumes that each box is homogeneous with regard to habitat variables that affect the distribution of fish which is unlikely to be true, 2) How were the reference stations chosen? They appear to still overlap the WEA which means they could be the site of future wind farm development, 3) n=2 is a small sample size. How was this sample size determined? Is there some statistically-based justification that indicates that this sample size would be able to detect a change if in fact one occurs?, 4) What are the criteria by which sites will be "predetermined.", 5) Are sampling sites proposed to be fixed for the duration of the study (following random selection from a predetermined set)?

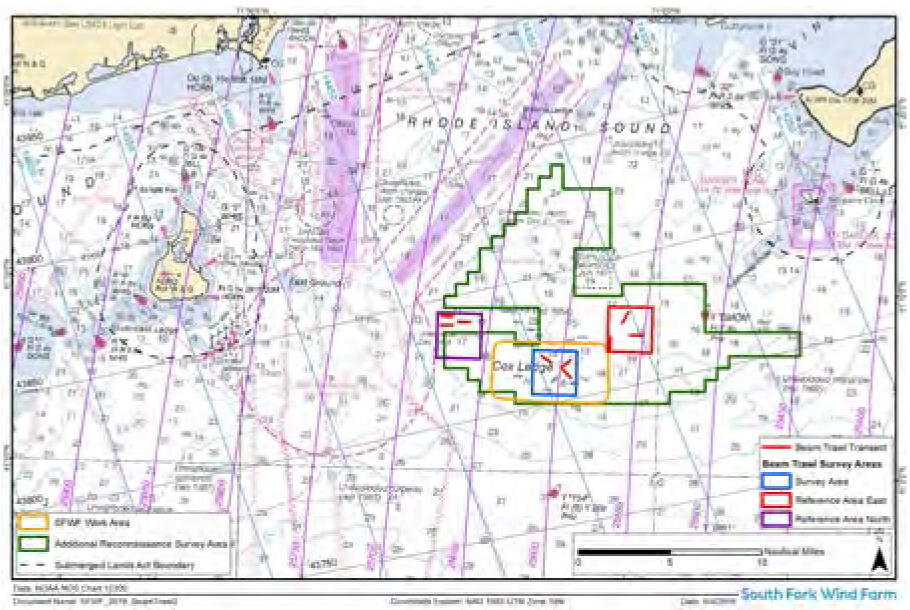


Figure 4. South Fork Wind Farm Project Area with Proposed Beam Trawl Survey and Reference Areas

3.1.2 Beam Trawl Methods

Beam trawling will be conducted monthly by a commercial fishing vessel using a 3-m beam trawl, with a cod-end of double 4.75 inch mesh and a 1-inch (2.54-cm) knotless cod end liner (or similar; equivalent

to NEAMAP cod end) to ensure retention of the smaller fish (Malek, 2015). Rock chains will also be fitted across the mouth of the beam trawl to prevent larger rocks from entering and damaging the catch or net. Once on station, the crew of the vessel lowers the net into the water fully and allows it to drag behind the boat. When the gear is fully deployed and the winch brakes are set, the timer is set for 20 minutes, and the start coordinates, start time, date, tow direction, water depth, and tow speed are recorded. Towing speed is maintained at approximately 4.0 knots (Malek, 2015). Upon completion of
the tow, end time, and end coordinates are recorded.

Commented [20]: It was mentioned previously that gill net catches can not be compared with NEAMAP trawl survey data, but you don't say anything about comparison between beam trawl and NEAMAP trawls. Can these be compared or not? Again, if not, another gear calibration exercise would be required for comparison to render results comparable. Need to state comparability (or lack thereof) as with gill net catches.

Fish collected in each tow will be identified, weighed, and enumerated consistent with the sampling approach of Northeast Area Monitoring and Assessment Program (NEAMAP).

Onboard scientists will sort and identify fish, and weigh each species by the following protocol:

All organisms will be identified to species including fish and mega-invertebrates such as sea scallops, squid, lobsters, Cancer spp. crabs, sand dollars, and urchins. Taxonomic guides include: NOAA's Guide to Some Trawl-Caught Marine Fishes (Flescher, 1980), Kells and Carpenter's (2011) Field Guide to Coastal Fishes from Maine to Texas and Peterson's Field Guide to the Atlantic Seashore (Gosner, 1999).

The catch will be sorted by species. In the case of large catches with a range of size classes, the catch may be sorted by relative size categories within each species. The use of size categories is to ensure that all sizes are equally represented in the data if subsampling is used. The chief biologist will determine the categories and approximate length ranges to be used for each species.

All specimens, fishes and invertebrates, are sorted by species and size (if appropriate) into buckets or fish totes as needed. This process continues until all specimens are sorted, and the chief biologist verifies that the sorting areas are clear of all specimens.

Notwithstanding sub-sampling procedures, up to 50 individuals of each species/size are measured and the rest counted. Individual lengths are recorded on the field data sheet. Fork length is recorded for all fishes with a forked tail. Total length is measured for all other fishes. Exceptions to these rules are the measurement of rays (disc width), sharks (straight-line fork length), dogfish (stretched total length), crabs (carapace width), lobsters (carapace length), sea scallops (shell height), and squids (mantle length). Miscellaneous invertebrates (e.g. worms, hermit crabs, snails) will be counted but not measured. Total weight of all individuals of each respective species will be recorded. Stomach content analysis will be performed for commercially important species (gadids, flounder, black sea bass) to determine if construction and operation of the project could affect fish prey items. Each fish sampled will be sampled for length and weight individually to assess relative condition before the stomach is removed. In addition to stomach sampling, any Atlantic cod caught on the beam trawl survey will be assessed for reproductive stage and spawning condition according to the protocols used for SFWF Atlantic Cod Spawning Survey (adapted from Burnett et. al (1989) and O'Brien et al. (1993)) that occurred during the winters of 2018 and 2019.

In the case of larger catches (e.g., >900 kg), one or multiple subsampling procedures may be used. Subsampling protocols for the beam trawl are adapted from the subsampling procedures of the NEAMAP survey (Bonzek et al., 2008). The decision of which subsampling protocol, or protocols, to use will be at the discretion of the chief biologist.

3.1.3 Hydrographic and Atmospheric Data

Hydrographic data will be collected using a YSI 6820 V2 multi parameter sonde coupled with a YSI 650 MDS display system (or similar). The sonde is lowered overboard and held in surface waters until the instrument equilibrates. Water temperature (degrees C), dissolved oxygen concentration (mg/l), and salinity (ppt) data are recorded for the near-surface waters. The sonde is then lowered to near-bottom and water temperature, dissolved oxygen, and salinity data are recorded. Measurements are recorded for each station at the end of each tow.

Sea state and weather conditions are recorded from visual observations. Air temperature may be downloaded from a local weather station if not available onboard.

3.1.4 Tow Station Data

The following data will be collected during each sampling effort:

- Station number
- Start latitude and longitude
- Start time and date
- Start water depth
- Tow direction
- Tow speed
- Tow duration
- End latitude and longitude
- End time and date
- Wind speed
- Wind direction
- Wave height
- Air temperature
- Surface and bottom water temperature, salinity, and dissolved oxygen

3.1.5 Data Entry and Reporting

Data will be transcribed from hard copy datasheets into electronic worksheets. The data sheets will be reviewed for data entry errors prior to importing into a relational database. Quality control checks will be performed on database tables by running standardized, systematic queries to identify anomalous data values and input errors. Species names (common and scientific) are verified and tabulated for consistency. All data used in analysis will be exported from the relational database.

Annual reports containing catch data will be prepared after the conclusion of each year of sampling and shared with State and Federal resource agencies. One final report will also be produced synthesizing the findings of the pre- and post-construction evaluations.

3.1.6 Data Analysis

The BACI survey design will allow for characterization of pre-construction demersal fish and invertebrate community structure. By continuing sampling during and after construction the survey will allow quantification of any substantial changes in species presence, absence, or abundance associated with proposed operations. The use of reference control sites will ensure that larger regional changes in demersal fish and invertebrate community structure will be captured and delineated from potential impacts of the proposed SFWF. The survey plan allows the comparison of the catch of key, numerically dominant species between the before and after construction periods, using a BACI statistical model.

Commented [21]: As before, suggest a contingency plan if the character and/or endurance of control areas is not clear.

Commented [22]: Same comment as above: Before-After-Control-Impact studies rely heavily on having appropriate controls. What will you do if the controls differ from the wind farm area before construction, or if patterns in the controls diverge from each other after construction? These scenarios have arisen in previous wind farms studies and have made it difficult to discern wind farm effects.

4.0 References

Burnett, J., O'Brien, L., Mayo, R. K., Darde, J., and Bohan, M. 1989. Finfish maturity sampling and classification schemes used during Northeast Fisheries Center bottom trawl surveys, 1963–1989. NOAA Tech. Mem. NMFS-F/NEC, vol. 76. 14 p.

Flescher, D.D. 1980. Guide to Some Trawl Caught Marine Fishes from Maine to Cape Hatteras, North Carolina. NOAA Technical Report NMFS Circular 431. March 1980.

Gosner, K.L. 1999. A Field Guide to the Atlantic Seashore: From the Bay of Fundy to Cape Hatteras. Houghton Mifflin Harcourt, 329 p.

Hamley, J.M. 1975. Review of gillnet selectivity. Journal of the Fisheries Board of Canada. 32(11): 1943-1969.

Kells, V. and K. Carpenter. 2011. A Field Guide to Coastal Fishes from Maine to Texas. Johns Hopkins University Press, 448 p.

Malek, A. 2015. An Investigation of the Fisheries Ecosystem Dynamics in Rhode Island's Nearshore Waters. Open Access Dissertations. Paper 352. https://digitalcommons.uri.edu/oa_diss/352

O'Brien, L., J. Burnett, and R. Mayo. 1993. Maturation of nineteen species of finfish off the northeast coast of the United States, 1985-1990. NOAA Technical Report NMFS-113. June 1993.

Smith, E.P. 2002. BACI Design. In: Encyclopedia of Envirometrics, Vol. 1, pp 141-148. Edited by: Abdel H. El-Shaarawi and Walter W. Piegorsch. John Wiley & Sons, Ltd, Chichester, 2002.

Thomsen B., Humborstad O. B., Furevik D. M. 2010. Fish pots: fish behaviour, capture processes, and conservation issues. In Behaviour of Marine Fishes: Capture Processes and Conservation Challenges, pp. 143–158. Ed. by He P. John Wiley and Sons, Iowa. 392 pp.

Underwood, A.J. 1994. On beyond BACI: sampling designs that might reliably detect environmental disturbances. Ecol Appl 4: 3–15.

Walsh, H. J., Guida V.G. 2017. Spring occurrence of fish and macro-invertebrate assemblages near designated wind energy areas on the northeast U.S. continental shelf. Fishery Bulletin 115:437-450.

Zemeckis, D.R., M.J. Dean, and S.X. Cadrin. 2014. Spawning dynamics and associated management implications for Atlantic cod. North American Journal of Fisheries Management, 34: 424-442.

From:	Melanie Gearon
To:	Drew Carey; Brian Gervelis; Jill Johnen
Subject:	FW: SFWF - Draft Demersal Fisheries Resources Survey
Date:	Monday, July 8, 2019 4:33:22 PM
Attachments:	DMF to SFWF fisheries survey 12-13-2018 with June 2019 Revised Monitoring Plan_Final.doc

More comments from MA DMF, you know the drill!

Best regards,
Melanie Gearon
Manager, Permitting & Environmental Affairs
Wind Power

Ørsted
Tel. 857-348-3261

From: Logan, John (FWE) <john.logan@state.ma.us>
Sent: Monday, July 8, 2019 3:25 PM
To: Melanie Gearon <mgearon@dwwind.com>
Cc: Pierce, David (FWE) <david.pierce@state.ma.us>; Pol, Mike (FWE) <mike.pol@state.ma.us>; Burke, Erin (FWE) <erin.burke@state.ma.us>; Whitmore, Kelly (FWE) <kelly.whitmore@state.ma.us>; OKeefe, Catherine (FWE) <catherine.okeefe@state.ma.us>; DeCelles, Gregory (FWE) <gregory.decelles@state.ma.us>; Pugh, Tracy (FWE) <tracy.pugh@state.ma.us>; Callaghan, Todd (ENV) <todd.callaghan@state.ma.us>; Carlisle, Bruce (ENV) <bruce.carlisle@state.ma.us>; Susan Tuxbury - NOAA Federal <Susan.tuxbury@noaa.gov>; Livermore, Julia (DEM) <Julia.Livermore@dem.ri.gov>; dbeutel@crmc.ri.gov; Brunbauer, Morgan A (DEC) <morgan.brunbauer@dec.ny.gov>; Michelle Bachman <mbachman@nefmc.org>; Brian Hooker <brian.hooker@boem.gov>; Ford, Kathryn (FWE) <kathryn.ford@state.ma.us>
Subject: RE: SFWF - Draft Demersal Fisheries Resources Survey

Melanie,

Please find attached comments from MA DMF on the revised fisheries monitoring plan.

Best,

John

____

John Logan, Ph.D.
MA Division of Marine Fisheries
836 South Rodney French Boulevard
New Bedford, MA 02744
(508) 742-9722
http://www.mass.gov/eea/agencies/dfg/dmf/
https://www.researchgate.net/profile/John_Logan
Join the conversation! DMF is on Twitter, Flickr, Facebook, and YouTube.

From: Ford, Kathryn (FWE) <kathryn.ford@mass.gov>
Sent: Thursday, December 13, 2018 7:36 PM
To: Melanie Gearon <mgearon@dwwind.com>
Cc: Pierce, David (FWE) <david.pierce@mass.gov>; Pol, Mike (FWE) <mike.pol@mass.gov>; Logan, John (FWE) <john.logan@mass.gov>; Burke, Erin (FWE) <erin.burke@mass.gov>; Whitmore, Kelly (FWE) <kelly.whitmore@mass.gov>; O'Keefe, Catherine (FWE) <Catherine.OKeefe@mass.gov>; DeCelles, Gregory (FWE) <gregory.decelles@mass.gov>; Pugh, Tracy (FWE) <tracy.pugh@mass.gov>; Callaghan, Todd (EEA) <todd.callaghan@mass.gov>; Carlisle, Bruce (EEA) <bruce.carlisle@mass.gov>; Susan Tuxbury - NOAA Federal <Susan.tuxbury@noaa.gov>; Livermore, Julia (DEM)

<Julia.Livermore@dem.ri.gov>; dbeutel@crmc.ri.gov; Brunbauer, Morgan A (DEC) <morgan.brunbauer@dec.ny.gov>; Michelle Bachman <mbachman@nefmc.org>; Brian Hooker <brian.hooker@boem.gov>
Subject: RE: SFWF - Draft Demersal Fisheries Resources Survey

Melanie,
Please see attached comments from Mass DMF. Regards, Kathryn

From: Melanie Gearon [mailto:mgearon@dwwind.com]
Sent: Thursday, November 15, 2018 12:22 PM
To: Ford, Kathryn (FWE)
Cc: Pierce, David (FWE); Stephanie Wilson; Caitlin O'Mara; Mary Colbert; John O'Keeffe; Aileen Kenney
Subject: SFWF - Draft Demersal Fisheries Resources Survey

Hi Kathryn,
Please find attached the SFWF *Draft Demersal Fisheries Resources Survey Protocol* for MA DMF review. Please provide comments by December 14, 2018.
Thanks,
Melanie

DEEPWATERWIND
Clean energy is just over the horizon.

Melanie Gearon
Manager, Permitting & Environmental Affairs – www.dwwind.com
Direct: 401-648-2628 **Mobile:** 401-486-7797
56 Exchange Terrace, Suite 300, Providence, RI 02903

Commonwealth of Massachusetts
Division of Marine Fisheries
251 Causeway Street, Suite 400
Boston, Massachusetts 02114
(617) 626-1520
fax (617) 626-1509

David E. Pierce, Ph.D.
Director

Charles D. Baker
Governor
Karyn E. Polito
Lieutenant Governor
Kathleen Theoharides
Secretary
Ronald Amidon
Commissioner
Mary-Lee King
Deputy Commissioner

Ms. Melanie Gearon
Manager, Permitting and Environmental Affairs
South Fork Wind Farm
56 Exchange Terrace
Providence, RI 02903

July 8, 2019

Dear Ms. Gearon,
Thank you for providing the Massachusetts Division of Marine Fisheries (MA DMF) the opportunity to provide comments on the document, "Fisheries Research and Monitoring Plan-Draft" dated June 2019 for the South Fork Wind Farm (SFWF). This document is the second draft of a document we reviewed in December 2018 which was titled, "Demersal Fisheries Resources Survey Protocol-Draft" dated November 14, 2018.

SFWF has proposed to define the study area's pre- and post-construction demersal fisheries community composition by conducting gillnet and beam trawl surveys. According to SFWF, these surveys will provide data that can be used to evaluate:

1) Demersal species that utilize the area in and around the SFWF.
2) The seasonal timing of the occurrence of these species.
3) Whether the taxonomic compositions of demersal fish assemblages change between the baseline and post-construction time periods. For example, do some species have reduced abundance and/or do new species appear?

The gillnet survey "will focus on monitoring [monkfish and winter skates] pre- and post-construction of the SFWF" (page 3). The beam trawl survey will "focus on demersal fish and macroinvertebrate species" (page 9).

The survey plan includes deploying six 6-panel gillnets with 12 inch mesh (standard commercial gillnets used in the area) for 48 hours[1]. These nets will be used to sample 2 control and 1 impact treatment areas monthly from Apr-Jun and Oct-Dec at two fixed stations (a total of six stations per sampling event). The plan is to start surveys in 2019 (page 4) and the project will be constructed in 2021 (page 1), so it is possible the survey could occur nine times pre-construction. The length of post-construction monitoring effort is not identified (in the first draft, a 2-year post-construction timeline was laid out). The survey has changed from a random stratified design (stratified by bottom type into three strata: rocks and boulder, gravel, and sand/fines) to a fixed station design. Whatever is captured in the gillnets will be identified, counted, and measured for length (with subsampling as necessary) and stomach contents analysis will be performed on gadids, flounders, and black sea bass. Any Atlantic cod captured will also be assessed for maturity stage. Surveys will be done using for hire vessels (e.g., commercial vessels hired for the purpose of conducting the survey).

[1] The original plan recommended using 4-panel nets with 5, 6, 6.5, and 7 inch mesh with a soak time of 16 hours.

This plan has added beam trawls as a second sampling gear type, which is responsive to comments from MA DMF, RIDEM, and NMFS that multiple gear types are necessary to adequately characterize the fish community in this area. A 5.5-m beam trawl with 1 inch knotless cod end liner will be used to sample 2 control and 1 impact treatment areas monthly at two fixed stations (a total of six tows per month). Tow speed will be 2 knots and tow duration will be 20 minutes. The plan is to start surveys in 2019 and construction will occur in 2021, so it is possible the survey could occur monthly from about Oct 2019 to Dec 2020, or about 15 months pre-construction. Whatever is captured in the beam trawl will be identified, counted, and measured for length (with subsampling as necessary) and stomach contents analysis will be done on gadids, flounders, and black sea bass. No Atlantic cod maturity staging is specified.

The process used to draft, review, and redraft this survey plan has been sensible. Several of our initial comments were incorporated, including the inclusion of multiple gear types, longer soak times, a clear sampling frequency, the inclusion of stomach contents analysis, the addition of a second control site, and more clearly stated goals. However, there remain some vulnerabilities which will limit the value of this data collection effort.

Our comments on the updated plan are organized by topic area below.

Survey purpose

- The survey purpose is more clear than the first draft and identifies pre- and post-construction impact assessment as the primary goal and species composition and relative abundance as key metrics (as opposed to say, focusing on spatial distribution). Additional metrics such as length frequencies, spawning condition (for cod), and stomach contents (for gadids, flounder, and black sea bass) will also be addressed.
- A section describing reproductive sampling of cod is included but, as noted in our previous comment letter, the purpose for that sampling is not described.
    - If the objective is to define the timing of spawning, then samples should be obtained on a monthly basis (at a minimum).
    - If the objective is to determine whether or not cod spawn in the construction area, there are much more direct and effective ways to answer that question (e.g., high resolution rod and reel survey, passive acoustics, or a dedicated acoustic telemetry experiment).
    - What is the plan if few or no cod are caught during sampling in that quarter? Will additional gillnet sets be made to obtain samples?
    - Prior training with fresh or preserved samples to assess reproductive condition is recommended to ensure accuracy.

Survey design

- A major change from the original survey design is moving from a habitat-stratified survey to a fixed station survey in treatment blocks (1 impact and 2 controls). Each treatment block will be described by 2 gillnet stations (6 months a year) and 2 beam trawls (12 months a year).
    - o The proposed level of replication (2 sets or tows per station per sampling date for gillnet and beam trawl surveys, respectively) is likely inadequate given expected variability across replicates. Given the expected variability in catch rates, the low sample sizes will likely result in large confidence intervals that will preclude definitive statements about the effects of the wind farm construction. A power analysis is needed to determine a more appropriate level of replication. Existing fishery dependent data from the gillnet fishery could be used as the basis for a power analysis to estimate the statistical power that would result from this sampling design and, presuming 2 replicates are inadequate to detect changes, provide guidance towards a more appropriate number of replicates.
    - o In the gillnet survey description, it is stated that there will be “comparability among all sampling areas with respect to current, habitat and depth condition” (page 6). This is appropriate but it should be stated which habitat (we assume habitat means substrate type of either rocks and boulder, gravel, and sand/fines) will be targeted with gillnets. More

information is also required to confirm that the proposed reference areas are in fact similar to Cox's Ledge in terms of sediment type, depth, and other abiotic characteristics.
    - The same statement is not made in the beam trawl survey description and it should be.
    - Given that the same fixed stations may not be available for surveying at all time points (e.g., "may be subject to change due to seasonal location of other fixed fishing gear" (page 5)), a stratified random survey may be more appropriate than a fixed station survey. For either approach, more detail is required regarding when a station will be abandoned (e.g., what constitutes "poor conditions" on page 5).
- The two reference areas will not be "outside of the direct influence of the SFWF" (page 6) during construction if sound travels to those areas. We recommend sound levels be measured specifically in those locations to help with interpretation.

Survey method

- While we support the inclusion of complementary sampling gears in addition to the originally proposed gillnet survey, MA DMF recommends a ventless trap survey as a more appropriate gear type than a beam trawl for this study site for several reasons:
    - A trap survey will provide information on lobsters and *Cancer* crabs as well as any structure-seeking finfish species in these areas (e.g., black sea bass, tautog).
    - Trap survey data will be comparable to other survey work currently being conducted in nearby waters.
    - A trap survey has less potential gear conflict with existing pot gear fisheries in the study area than a beam trawl survey.

  We recommend the ventless lobster trap study utilize a fishery-independent BACI design with stratified random placement of stations using substrate type to define the strata (complex and not complex).
- Of particular interest is the effect of construction and operation on abundance and presence of Atlantic cod. Will existing rod and reel surveys for Atlantic cod be continued? If not, please describe why not? If they are (and our initial thought is that they should be), they should be incorporated into this survey plan. The gillnet approach to assessing spawning cod is insufficient since the gillnet mesh of 12" is unlikely to catch many cod and the timing of the survey misses part of the spawning period, which appears to extend to February. Therefore, timing on gillnet survey (Apr-Jun and Oct-Dec) will miss important reproductive periods for cod. Additional winter sampling, when a large recreational fleet targets cod in this area, is needed.
- The updated plan changed the gillnet sampling design from a multi-panel net with different mesh sizes to a single mesh size (12") with tie down (page 6). It is unclear why single mesh size gillnets will be deployed. The rationale for this sampling is that it is "typical of the commercial fishery in Rhode Island and Massachusetts" (page 6). However, it is not recommended for abundance or assemblage changes, since you will likely have very low encounter rates for other commercially important species (e.g., black sea bass), because of mesh selectivity issues. The gillnet survey as proposed will not adequately sample juvenile fish for the same reason. We recommend using a multi-panel gillnet with a wider range of mesh sizes that would allow for more representative sampling of the entire fish community in the area. As mentioned in our previous letter, the order of meshes within gillnet strings should either be randomized or designed so that each mesh occupies a position within the string an equal number of times.
- Verification of fish species identification through freezing or photographing of samples is needed to assure accuracy.
- The plan states, "The catch will be sorted by species. All specimens are sorted by species and size (if appropriate) into buckets or fish totes as needed. This process continues until all specimens are sorted, and the lead scientist verifies that the sorting areas are clear of all specimens" (page 7). However, when gillnetting, fish will typically arrive singly and can be weighed and measured immediately; sorting is likely not necessary unless processing for scientific samples occurs later.
- Will catch be landed or discarded?

Results

- The description of planned analyses and data management is very vague. Additional information is required specifically with respect to the following:
    - o Please define how survey results will be made available and incorporated into data management systems such as NE Ocean Data Portal, BOEM data management systems, or systems run by NOAA-NMFS.
    - o Exploring more specifically how the data will be used to assess change is worthwhile.

General comments

- There remains significant compartmentalization of the different surveys being conducted. Other surveys are highly relevant to fisheries habitat, including surveys and/or modeling for benthic biota, oceanographic conditions, and sound. Are studies of these variables being conducted, and what fisheries concerns can they address? For example, we recommend that benthic grab studies be used to assess changes in prey composition. Benthic photo surveys should be used to assess changes in prey composition and shellfish abundance.
- The monitoring plan refers to extensive discussions "with regional fishing organizations, working groups, and individual fisherman (page 1)" but does not specifically identify which stakeholders have been part of these discussions. It would be helpful to identify these user groups to ensure that all of the fleets using the windfarm area were included.
- We are glad to see the inclusion of stomach contents analysis of gadids, flounder, and black sea bass as such data can be used to track potential food web changes resulting from the wind farm.
    - o We recommend including monkfish and winter skate since those are target species.
    - o Details on this part of the study are generally lacking. Specifically, information on how samples will be preserved, level of taxonomic classification, how contents will be quantified, how they will be compared between reference and control sites, and how many individuals per species will be sampled are needed.

Questions pertaining to this review can be directed to John Logan (john.logan@mass.gov) or Kathryn Ford (kathryn.ford@mass.gov).

Sincerely,

Kathryn H. Ford

Kathryn Ford, Ph.D.
Habitat Program Leader

cc:
Pierce, Logan, Pol, Pugh, Burke, Whitmore, O'Keefe, DeCelles, MA DMF
Callaghan, MA CZM
Carlisle, MA CEC
Tuxbury, NOAA-NMFS
Livermore, RIDEM; Beutel, RI CRMC
Brunbauer, NYDEC
Bachman, NEFMC
Hooker, BOEM

Brian Gervelis

From: Melanie Gearon <MELGE@orsted.com>
Sent: Thursday, June 27, 2019 3:15 PM
To: Brian Gervelis
Cc: Drew Carey
Subject: FW: SFWF - Fisheries Research and Monitoring Plan

Brian,
See the set of comments below

Please keep adding these comments as they come in, to the comment register and tracking sheet Inspire has been keeping.

We need the record

Best regards,
Melanie Gearon
Manager, Permitting & Environmental Affairs
Wind Power

Ørsted
Tel. 857-348-3261

From: McLean, Laura (DOS) <Laura.McLean@dos.ny.gov>
Sent: Thursday, June 27, 2019 1:35 PM
To: Melanie Gearon <MELGE@orsted.com>
Cc: Hogan, Chris M (DEC) <chris.hogan@dec.ny.gov>; McReynolds, Dawn (DEC) <dawn.mcreynolds@dec.ny.gov>; Brunbauer, Morgan A (DEC) <morgan.brunbauer@dec.ny.gov>; Gaidasz, Karen M (DEC) <karen.gaidasz@dec.ny.gov>; Snyder, Michael (DOS) <Michael.Snyder@dos.ny.gov>; Maraglio, Matthew (DOS) <Matthew.Maraglio@dos.ny.gov>
Subject: RE: SFWF - Fisheries Research and Monitoring Plan

Melanie,
DOS and DEC provide the following consolidated comments on the June 2019 version of the Fisheries Research and Monitoring Plan. The draft plan was also shared with the F-TWG members.

General comments:

1. Was a power analysis conducted to determine that an adequate sample size is being proposed?
2. Was Orsted successful in getting survey responses from other NY fishing ports like Greenport and Hampton Bay-Shinnecock? This was discussed during a coordination meeting in March 2019. It is important that NY commercial fishermen are well-represented when designating final survey areas.
3. Discuss how the proposed methods are scalable and/or transferable to other regional monitoring proposals being developed in the RI/MA WEA. This was also discussed during a coordination meeting in March 2019. It would be beneficial if the SFWF plan discussed ways that Orsted is coordinating with other research initiatives.
4. Currently there is very little information provided as to how the data will be shared. What efforts will be made to ensure that this data is publicly available and useable by others? Will data be available on the numerous data portals?

Specific comments:

5. Page 2, 8th bullet – Utilizing standard monitoring protocols is necessary to compare findings from these studies to existing datasets. All efforts should be made to ensure that data is comparable.

6. Page 4, Section 2.0 – While monkfish and winter skate are the focus of this study all efforts should be made to report out findings from all species encountered.
7. Page 5, Section 2.1 – There is no specific mention of an NOAA Take Permit. Please confirm one will be applied for and followed. If incidental take numbers become a problem (marine mammals, sea turtles, sturgeon, etc.) please elaborate on how sampling methods will be changed to accomplish study goals and reduce resource impacts.
8. Page 6, Section 2.1.2 – These methods are appropriate. Sampling time frames align with data from dealer reports. There is no mention of how long these studies will run; For example, 1, 2, or 3 years prior to construction and 1, 2, or 3 years post construction?
9. Page 8, Section 2.1.4 -The principle scientist should have a thermometer onboard to measure air temperature. This is an inexpensive piece of equipment . They should not need to rely solely on a fisherman's equipment or download the data after the fact.
10. Page 9, Section 2.1.5 – The latitude and longitude for each end of the gillnet should be recorded.
11. Page 11, Section 3.1.2 – These methods are appropriate. Will this monitoring study be conducted year round? There is no mention of how long these studies will run; For example, 1, 2, or 3 years prior to construction and 1, 2, or 3 years post construction
12. Page 12, Section 3.1.3 - The principle scientist should have a thermometer onboard to measure air temperature. This is an inexpensive piece of equipment . They should not need to rely solely on a fisherman's equipment or download the data after the fact.

Thanks,
Laura McLean
New York Department of State
O: (315) 235-0351 | Laura.McLean@dos.ny.gov

From: Melanie Gearon <MELGE@orsted.com>
Sent: Thursday, June 13, 2019 5:38 PM
To: lisa.engler@state.ma.us; Boeri, Robert (ENV) <robert.boeri@state.ma.us>; annie@rodafisheries.org; andrew.lipsky@noaa.gov; Brunbauer, Morgan A (DEC) <morgan.brunbauer@dec.ny.gov>; Lampman, Gregory G (NYSERDA) <Gregory.Lampman@nyserda.ny.gov>; mbachman@nefmc.org; Dave Beutel <dbeutel@crmc.ri.gov>
Cc: McLean, Laura (DOS) <Laura.McLean@dos.ny.gov>; Susan Tuxbury - NOAA Federal <susan.tuxbury@noaa.gov>; Ford, Kathryn (FWE <kathryn.ford@state.ma.us>; McNamee, Jason (DEM <jason.mcnamee@dem.ri.gov>; Livermore, Julia (DEM) <Julia.Livermore@dem.ri.gov>; Gaidasz, Karen M (DEC) <karen.gaidasz@dec.ny.gov>; Sharon Benjamin - NOAA Affiliate <sharon.benjamin@noaa.gov>; Mary Colbert <MACOL@orsted.com>; John O'Keeffe <JOHNO@orsted.com>; Rodney Avila <RODAV@orsted.com>; Aileen Kenney <AILKE@orsted.com>; Caitlin O'Mara <CAIMA@orsted.com>; Julia Prince <JULPR@orsted.com>; Drew Carey <drew@inspireenvironmental.com>; Brian Gervelis <brian@inspireenvironmental.com>; Jill Johnen <jill@inspireenvironmental.com>; Hooker, Brian <brian.hooker@boem.gov>; Stromberg, Jessica <jessica.stromberg@boem.gov>
Subject: SFWF - Fisheries Research and Monitoring Plan

Good Afternoon All,
Thank you for your continued engagement with Orsted on developing the South Fork Wind Farm Fisheries Research and Monitoring Plan. This plan has been previously reviewed and commented on widely by fishing stakeholders and agencies. Attached is the most recent draft ready for circulation.

The next step in vetting the plan is reviewing with the various state fisheries advisory boards and offshore wind fisheries working groups. I ask that you please distribute this draft to members of your representative group(s) (RI FAB, MA FWG, RODA, ROSA, NYS Fish TWG, NEFMC Habitat Committee) for review.

Please submit comments via email on this draft Fisheries Research and Monitoring plan by July 8, 2019 to:

Melanie Gearon
South Fork Wind Farm
Manager, Permitting and Environmental Affairs
melge@orsted.com

We would also like to present and discuss this plan in person with working groups if possible. I will be reaching out to individuals to see if we can be included on upcoming meeting agendas.

Best regards,
Melanie Gearon
Manager, Permitting & Environmental Affairs
Wind Power

Orsted

Learn more at orsted.com

Tel. 857-348-3261

melge@orsted.com
orsted.com

From:	Melanie Gearon
To:	Drew Carey; Brian Gervelis; Jill Johnen
Subject:	FW: [EXTERNAL] : SFWF - Fisheries Research and Monitoring Plan
Date:	Tuesday, July 9, 2019 11:47:14 AM
Attachments:	image001.png RIDEM_SFWF_Monitoring_Comments_6-20-19.docx

Comments from RIDEM

Best regards,
Melanie Gearon
Manager, Permitting & Environmental Affairs
Wind Power

Ørsted
Tel. 857-348-3261

From: Livermore, Julia (DEM) <Julia.Livermore@dem.ri.gov>
Sent: Tuesday, July 9, 2019 11:20 AM
To: Melanie Gearon <MELGE@orsted.com>
Subject: RE: [EXTERNAL] : SFWF - Fisheries Research and Monitoring Plan

Hi Melanie,

Apologies for the delay on sending in these comments! Here is our input at the RIDEM DMF.

Best,
Julia

Julia Livermore, Supervising Marine Biologist
RIDEM Division of Marine Fisheries
3 Ft. Wetherill Rd.
Jamestown, RI 02835
Office: 401.423.1937
Fax: 401.423.1925

From: Melanie Gearon [mailto:MELGE@orsted.com]
Sent: Thursday, June 13, 2019 5:38 PM
To: lisa.engler@state.ma.us; Boeri, Robert (ENV) <robert.boeri@state.ma.us>; annie@rodafisheries.org; andrew.lipsky@noaa.gov; Brunbauer, Morgan A (DEC) <morgan.brunbauer@dec.ny.gov>; Gregory.Lampman@nyserda.ny.gov; mbachman@nefmc.org; Dave Beutel <dbeutel@crmc.ri.gov>
Cc: McLean, Laura (DOS <Laura.McLean@dos.ny.gov>; Susan Tuxbury - NOAA Federal <susan.tuxbury@noaa.gov>; Ford, Kathryn (FWE <kathryn.ford@state.ma.us>; McNamee, Jason (DEM) <jason.mcnamee@dem.ri.gov>; Livermore, Julia (DEM) <Julia.Livermore@dem.ri.gov>; Gaidasz, Karen M (DEC <karen.gaidasz@dec.ny.gov>; Sharon Benjamin - NOAA Affiliate <sharon.benjamin@noaa.gov>; Mary Colbert <MACOL@orsted.com>; John O'Keeffe <JOHNO@orsted.com>; Rodney Avila <RODAV@orsted.com>; Aileen Kenney <AILKE@orsted.com>; Caitlin O'Mara <CAIMA@orsted.com>; Julia Prince <JULPR@orsted.com>; Drew Carey

<drew@inspireenvironmental.com>; Brian Gervelis <brian@inspireenvironmental.com>; Jill Johnen <jill@inspireenvironmental.com>; Hooker, Brian <brian.hooker@boem.gov>; Stromberg, Jessica <jessica.stromberg@boem.gov>
Subject: [EXTERNAL] : SFWF - Fisheries Research and Monitoring Plan

Good Afternoon All,
Thank you for your continued engagement with Orsted on developing the South Fork Wind Farm Fisheries Research and Monitoring Plan. This plan has been previously reviewed and commented on widely by fishing stakeholders and agencies. Attached is the most recent draft ready for circulation.

The next step in vetting the plan is reviewing with the various state fisheries advisory boards and offshore wind fisheries working groups. I ask that you please distribute this draft to members of your representative group(s) (RI FAB, MA FWG, RODA, ROSA, NYS Fish TWG, NEFMC Habitat Committee) for review.

Please submit comments via email on this draft Fisheries Research and Monitoring plan by July 8, 2019 to:

Melanie Gearon
South Fork Wind Farm
Manager, Permitting and Environmental Affairs
melge@orsted.com

We would also like to present and discuss this plan in person with working groups if possible. I will be reaching out to individuals to see if we can be included on upcoming meeting agendas.

Best regards,
Melanie Gearon
Manager, Permitting & Environmental Affairs
Wind Power

Orsted

Learn more at orsted.com [orsted.com]

Tel. 857-348-3261

melge@orsted.com
orsted.com [orsted.com]

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
DIVISION OF MARINE FISHERIES
3 Fort Wetherill Road
Jamestown, RI 02835

June 20, 2019

Melanie Gearon
South Fork Wind Farm
Ørsted Offshore Wind
Manager, Permitting and Environmental Affairs

Re: South Fork Wind Farm: Fisheries Research and Monitoring Plan

Dear Ms. Gearon:

The Rhode Island Department of Environmental Management Division of Marine Fisheries (RIDEM DMF) has received and reviewed the South Fork Wind Farm Fisheries Research and Monitoring Plan and offers the following comments:

- We commend Ørsted for the development of a research and monitoring plan that will allow for approximately two years of baseline sampling prior to the commencement of offshore construction.
- We also support the use of two different sampling methodologies (gillnet and beam trawl) within and around the project area to address both fishery resource concerns and more general resource questions.
- The gillnet survey will serve to sample the species most heavily harvested commercially in the South Fork Wind Farm area.
    - The current net design (12-inch mesh size and use of net tie-downs) and seasonality (during migrations) of sampling clearly target monkfish and skates.
    - There is no issue with designing the survey to specifically assess potential changes in CPUE and length of monkfish and skates, as these are two of the most important fisheries in the area. However, the data collected may not be suitable for "identifying changes in the fish community in the impact area between pre- and post- construction…" Data used to analyze fish community assemblages should come from gears that do not target specific species, as the portion of the fish community effectively sampled using a targeted design may not be representative of the overall fish community. For example, "sampling in July-September has been eliminated to minimize interactions with protected species and elasmobranchs." This means that certain biological community components (e.g., dogfish) may not be fully addressed.
    - We encourage Ørsted to strongly engage with research collaborators on this project (e.g., CFRF, University of Rhode Island, non-profits) to extend the value of the data and samples to be collected. This could take the form of age and growth processing and analysis for use in management, stomach content or

isotope analysis for use in food web modeling, or evaluating the presence of certain parasites.

- It is not clear how the area of influence was determined? Is the distance required from the area of primary effect specific to certain sources of disruption (physical disturbance, suspended sediments, noise/vibration) or all sources?
    - Additionally, Reference Area East falls in the middle of the overall lease area. Is this portion of the lease slated for future development? It will not be an effective reference site for post-construction monitoring if development occurs nearby in the future.
- Additional detail regarding potential statistical tests to be performed on the data would also be of interest for both surveys.
    - We understand that the dearth of existing gillnet survey data may preclude conducting a power analysis to determine what level of change in abundance may be detectible, hence the use of an adaptive approach to analysis. Notwithstanding, will the data solely be used to identify simple trends or are there plans to develop more informative models (e.g., GLMs incorporating environmental and survey design covariates)?
    - A similar question arose regarding the "quantification of any substantial changes in species presence, absence, or abundance associated with proposed operations." Beam trawl data may not exist for this particular area, but can be acquired for other areas for use in a power analysis. If a power analysis is not possible, additional discussion on potential methods of analysis and a description of what is meant by "substantial changes" would be helpful.
- Will the relational databases for either survey ever be shared with the public or government agencies? Is there a data release plan, or will these data remain exclusive property of Ørsted?
    - Some of these data may be of value to stock assessment, and more generally fisheries management, by way of supplementing existing sampling. We would support the implementation of standard data delivery dates to fishery management agencies.
    - There are a few ongoing regional offshore wind science efforts (NYSERDA-led consortium, MA CEC and BOEM cooperative agreement, ROSA, etc.) and all have suggested the development of a clearinghouse where not only research findings could be shared publicly, but also the raw data. RIDEM DMF would also support this approach.

The RIDEM DMF appreciates the opportunity to review and provide comment on the draft monitoring plan. We look forward to working with you in the future. 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).

Commercial Fisheries Center of Rhode Island

P.O. Box 5161, Wakefield, RI 02880
Tel: (401) 874-4568 Web: www.cfcri.org
Email: fredmattera@cfcri.org shayerooney@cfcri.org

CRMC & FAB
c/o Grover Fugate & Lanny Dellinger
Stedman Government Center
Suite 3
4808 Tower Hill Road
Wakefield, RI 02879-1900

October 2, 2019

Dear Grover and Lanny,

Commercial Fisheries Center of RI is submitting comments on the South Fork Wind Farm project to address, turbine layout design, environmental impacts and baseline research survey.

From the beginning of the Fishing Industry and OSW Developers meetings, there has been a consistent consensus from the industry of 1 nautical mile spacing in all directions between the turbines. The SFW proposes 1nm spacing in a N & S pattern, with only .6 to .7 nm in an E & W pattern, posing navigation, fishing and transiting concerns that will lead to unsafe measures. Commercial fishing is by far the most dangerous industry in the Nation and with proposed limited spacing of less than 1nm in the course of limited visibility, high winds and heavy sea conditions vessel navigation is in peril. USCG will present their final determination on appropriate turbine spacing in order to conduct safe and effective search and rescue missions. To reflect back, originally, there was a sea floor topographical chart identifying the hard-glacial terrain that engineers utilized to map the placement of the 15 turbines using .7 nm spacing. We were able to place the turbines with 1nm spacing using the identical chart avoiding the rocky terrain acknowledging it was doable.

We have grave concerns pertaining to the limited gear types proposed to use for the Baseline Survey. Gillnetting is effective for harvesting Monkfish and Skates and at times more so than a trawl. However, this gear type is not effective to sample species assemblage, very selective.

Due to the historical presence of Codfish on Cox's Ledge, we would suggest that half of the 6 – 300ft panels (strings) use 12" and 6" mesh for Codfish retention.

Especially since research conducted in the North Sea has determined that Codfish and similar species have been driven from the grounds due to noise acoustics. This research will provide a more accurate stock assessment during and post construction of Codfish, Monkfish and Skates.

The use of a 10' wide beam trawl will provide extremely limited demersal species composition due to the narrow width and low height (3'-6'). The swept area in coverage with this Beam Trawl is approximately 15% of a conventional trawl net, which is the traditionally ideal gear type for a baseline survey. The Beam Trawl survey would need 6-7 times more replicates to compare and calibrate using the NEAMAP survey. There will be negligible representation of scup, whiting, ling, cod, butterfish, squid, etc. attributable to the low headrope height. Again, we question the viability of determining accurate species assemblage for stock assessment with only a 10' wide Beam Trawl and Gillnet.

We encourage the use of additional gear types to conduct an accurate baseline survey. Cox's Ledge has been the principal spawning and migratory grounds in Southern New England for decades and is declared an essential fish habitat for as many as 36 specie. We have suggested a Trawler that has tows in the experimental and control areas and recommend adding this Trawler to your baseline survey. The continuation of a ventless trap survey should augment the baseline survey. We request that a scoping meeting and workshop be held to determine additional gear types to be applied to the SWF Wind baseline research study.

It is understood and expected that Inspire will forward and initiate an RFP to conduct all of the Baseline Research Surveys to institute a fair, balanced and transparent process. To maintain the vein of transparency, we would advocate for Inspire to establish a science review board (scientist, academia, stakeholders) to approve proposals and peer review of the research.

Thank you for the opportunity to comment on the South Fork Wind Farm Project.

Respectfully,

Frederick J Mattera

Brian Gervelis

From: Melanie Gearon <MELGE@orsted.com>
Sent: Friday, June 28, 2019 12:37 PM
To: Brian Gervelis
Cc: Drew Carey
Subject: FW: SFWF - Fisheries Research and Monitoring Plan
Attachments: Comments on SFWF draft proposal (Stokesbury).pdf

Comments from Stokesbury, please add to the tracker

Best regards,
Melanie Gearon
Manager, Permitting & Environmental Affairs
Wind Power

Ørsted
Tel. 857-348-3261

From: Kevin D.e. Stokesbury <kstokesbury@umassd.edu>
Sent: Friday, June 28, 2019 12:18 PM
To: Melanie Gearon <MELGE@orsted.com>
Cc: Murray, Eva (ENV) <eva.murray@state.ma.us>
Subject: RE: SFWF - Fisheries Research and Monitoring Plan

Hi Melanie, thank you for asking the members of the Fisheries Working Group on Offshore Renewable Energy to comment on the South Fork Wind Farm Fisheries Research and Monitoring Plan draft. Here are my comments. I have also been working with Beth Casoni on a possible proposal for a ventless trap survey, a draft of which she sent you earlier today. I hope you find these comments of use as you create your proposal.

Regards, Kevin

Comments on “South fork Wind Farm: Fisheries Research and Monitoring Plan – Draft” June 2019, for the Fisheries Working Group on Offshore Renewable Energy. (K. Stokesbury).

Thank you for asking me to comment on this draft proposal. The SFWF is situated on Cox’s Ledge, an area with hard-bottom including boulders, which presents a challenge for some types of sampling gear. The proposal suggests using a gillnet and beam trawl survey to monitor the demersal species assemblage in the area.

I have several comments and concerns for you to consider:

1. These two types of gear are not standardized with ongoing survey programs along the continental shelf, such as the NEMAP survey, SMAST drop camera survey, Habcam survey, and lobster ventless trap surveys conducted by the New England state agencies. In a previous meeting with Orsted representatives, they explicitly expressed their concern that any sampling be standardized and comparable to other larger data sets. It is unclear why this shift in sampling is being suggested. It does not make use of the larger monitoring efforts underway.
2. These types of gear will not estimate the microbenthic invertebrate community and only a very limited portion of the benthic fish species.
3. Selectivity will have to be determined for both types of gear, in both cases selectivity will be very low except for a few target species.
4. Gill nets are a very selective gear, in monitoring and scientific assessments usually a series are used with multiple mesh sizes. It seems only one mesh size of 12” will be used (page 6). Have trammel nets been considered? This increase the size range and body type of fish collected. No information on the length of the nets is presented.
5. The survey BACI design is “asymmetrical”, the reasoning for choosing this design is unclear. The design proposed is 1 impact area and 2 control areas (both control areas are in locations that could be later developed). So, you will be examining the difference between the 2 control areas, and/or comparing each control area to the impact area or averaging the two control areas and comparing it to the impact size? Either way you are adding a spatial component to the controls that is not there for the impact. What if the fish assemblage changes in one control but not the other? The statement, “The area is assumed to be the observational unit and the two gillnet lines per area are subsamples which will be combined to estimate the area-wide abundance (or CPUE) during each sampling event” is unclear (page 6 footnote). What exactly is the hypothesis? That after the impact the species abundance and composition will differ from each control area? Both control areas? The variation between the two control areas will differ? The statistical design to test the hypothesis is not presented. No statistical signified level is presented, what does “Confidence intervals for the size of the apparent effects of the SFWF will be the focus of the analyses, rather than simply Yes or No statements about the statistical significance of any observable effect” mean (page 9)? This sounds like an attempt to determine the level of “meaningful results” after the study has already been conducted; basically, deciding if the data mean anything once you’ve already seen the data. BACI impact studies usually follow a $p = 0.05$ significant level which means that you have a 1 in 20 (or less) chance encountering the observed difference randomly.
6. (page 5) It is not clear how many samples will be collected in each area (for both the gill nets and the beam trawls). In the text it states that “Each survey area will contain three predetermined gillnet survey lines. Two gillnet lines per area will be randomly selected for each

survey, resulting in six gillnet strings conducted per survey" (pages 5 and 10). Does this mean that on any observation you will only have 2 samples per area? Has there been a power analysis to ensure this is enough sampling to detect a change in species abundance or composition at the desired level (the desired level of measurable change is also not mentioned)? The document refers to previous studies with the beam trawl, so for at least that gear these could be easily estimated. Usually a monitoring design seeks to measure a 25% difference in the abundance of the target species. I suspect 2 samples per observation will be insufficient to do that. This leads back to my previous comment, rather than an asymmetrical design why not increase the number of samples collected within the impact and one control area so that a statistically rigorous comparison can be completed?

From:	Melanie Gearon
To:	Drew Carey; Brian Gervelis; Jill Johnen
Cc:	Aileen Kenney; John O"Keeffe
Subject:	FW: Response to SFWF Research and Monitoring Plan
Date:	Monday, July 8, 2019 2:09:41 PM
Attachments:	CFF Response to SFWF RMP - FINAL 07.08.2019.docx

FYI – From Coonamessett Farm, please add to the comment tracking sheet, and please make sure we are prepared to respond at either a follow up call or MA FWG meeting (which we are trying to schedule)

Best regards,
Melanie Gearon
Manager, Permitting & Environmental Affairs
Wind Power

Ørsted
Tel. 857-348-3261

From: Mary Newton-Lima <mary@cfarm.org>
Sent: Monday, July 8, 2019 1:52 PM
To: Eva.Murray@mass.gov; Melanie Gearon <MELGE@orsted.com>
Cc: ERIC HANSEN <ehansen4b@comcast.net>; kstokesbury@umassd.edu; nbsc@comcast.net; Peter Anthony <Peter@easternfisheries.com>; rodavila@comcast.net; warrendoty@verizon.net; Eddie Welch <welch.edward@comcast.net>; welchstephen@comcast.net; PATRIOTTOO@aol.com; jarrett@drakelobster.com; Ronald Smolowitz <cfarm@capecod.net>; beth.casoni@lobstermen.com; cpfcharters@yahoo.com; john@capecodfishermen.org; shelley.edmundson@gmail.com; seth@capecodfishermen.org; john@seakeeper.net; j st thomas <padapac@yahoo.com>; cbrayton@atlanticcapes.com; Edward Anthes-Washburn <Edward.Anthes-Washburn@newbedford-ma.gov>; silverdollarseafood@gmail.com; BasicPatrick@aol.com; dorchard@fishingpartnership.org; annie@rodafisheries.org; fredmattera@cfcri.org; kalmeida@towndock.com; Edward.G.LeBlanc@uscg.mil; susan.tuxbury@noaa.gov; andrew.lipsky@noaa.gov; Christopher.Boelke@noaa.gov; Daniel (EEA) <daniel.sieger@mass.gov>; BCarlisle@masscec.com; David (FWE) <david.pierce@mass.gov>; Lisa Berry (EEA) <lisa.engler@mass.gov>; Kathryn (FWE) <kathryn.ford@mass.gov>; NBolgen@masscec.com; Hooker, Brian <brian.hooker@boem.gov>; jessica.stromberg@boem.gov; Mike (FWE) <mike.pol@mass.gov>; Catherine (FWE) <Catherine.OKeefe@mass.gov>; estephens@vineyardwind.com; Rachel Pachter <rpachter@vineyardwind.com>; Lauren Burm <LAUBU@orsted.com>; Michael Evans <MICEV@orsted.com>; Laura Morse <LAURM@orsted.com>; James Neveu <JANEV@orsted.com>; Aileen Kenney, external user <akenney@dwwind.com>; mmorrissey@dwwind.com; jokeeffe@dwwind.com; ravila@dwwind.com; cbank@vineyardwind.com; Enrique.Alvarez-Uria@edpr.com; j.hartnett@shell.com; LMORA@equinor.com; Ruth.Perry@shell.com; William.Straus@mahouse.gov; Cynthia.Trabucco@mahouse.gov; fpullaro@renew-ne.org; fcourt@usowc.org; Sam Martin <smartin@atlanticcapes.com>; Cshriver@atlantic.com; Prassede (EEA) <prassede.vella@mass.gov>; Seth.Kaplan@edpr.com; emarc@equinor.com; emarchetti@searisksolutions.com; greenfluke@optonline.net
Subject: Response to SFWF Research and Monitoring Plan

Hello Melanie and Eva,

Attached please find CFF's responses to the South Fork Wind Farm Fisheries Research and Monitoring Plan.

Our two primary concerns, mentioned in the letter, are; 1) this plan is woefully inadequate to meet the stated goals of capturing pre- and post-construction demersal assemblages and documenting seasonal and construction impacts to these assemblages; and 2) why these comments are only requested to be sent to the company that is building the wind farm. Shouldn't the federal and state agencies and stakeholders be informed of these comments? What is the process by which this plan will be approved, and how will these comments be reviewed/incorporated into the final plan?

Please contact CFF if you have any questions.

Sincerely,

Mary Newton Lima

--

Mary Newton Lima
Research Coordinator
Coonamessett Farm Foundation
508-356-3601

Coonamessett Farm Foundation
Conducting scientific research projects that support sustainable fisheries, aquaculture, and agriculture
277 Hatchville Road • East Falmouth, MA 02536
Tel: (508) 356-3601 • Fax: (508) 356-3603
Website: www.coonamessettfarmfoundation.org

July 8, 2019

Melanie Gearon
Manager of Permitting and Environmental Affairs
Ørsted Deepwater Wind
melge@orsted.com

Dear Ms. Gearon,

Thank you for the opportunity to review and provide responses to the *South Fork Wind Farm Fisheries Research and Monitoring Plan* (RMP). Please find Coonamessett Farm Foundation's (CFF) comments below. Overall, this research plan, if it is the entire plan, is inadequate to meet the objectives of evaluating the demersal species, taxonomic assemblages, and seasonal variability in and around the proposed South Fork Wind Farm. We have made recommendations throughout this response that will assist in revising this RMP.

SURVEY SUMMARY

Ørsted is proposing to use beam trawls and large-mesh gillnets to evaluate the habitat and communities of demersal fish and invertebrates within and near the proposed South Fork Wind Farm (SFWF) in Lease Area OCS-A 486 of the RI/MA Wind Energy Area (WEA). One survey area (Survey Area) within the proposed maximum Work Area and two control areas, Reference Areas East (RAE) and Reference Area West (RAW), have been designated for surveying (**Figure 1)**. Each of these three areas will have three pre-determined gillnet survey lines and three beam trawl paths. Two of these gillnet lines and two beam trawl paths will be surveyed in each of the Survey Area, RAE, and RAW for a total of six gillnet lines and six beam trawl paths being surveyed at each deployment (**Figure 2)**. Beam trawl surveys will occur monthly and gillnetting will occur between Apr-Jun and Oct-Dec. Each gillnet string will consist of six net panels of 12-inch mesh with a hanging ratio of 1/2 (50%) and using net tie-downs with a soak time of 48 hours. Each beam trawl survey will be performed using a 5.5-m beam trawl and a 1-in knotless cod end liner, which is equivalent to the NEAMAP cod end, and tows will be 20 minutes long at a speed of 2.0 knots.

Coonamessett Farm Foundation
Conducting scientific research projects that support sustainable fisheries, aquaculture, and agriculture
277 Hatchville Road • East Falmouth, MA 02536
Tel: (508) 356-3601 • Fax: (508) 356-3603
Website: www.coonamessettfarmfoundation.org

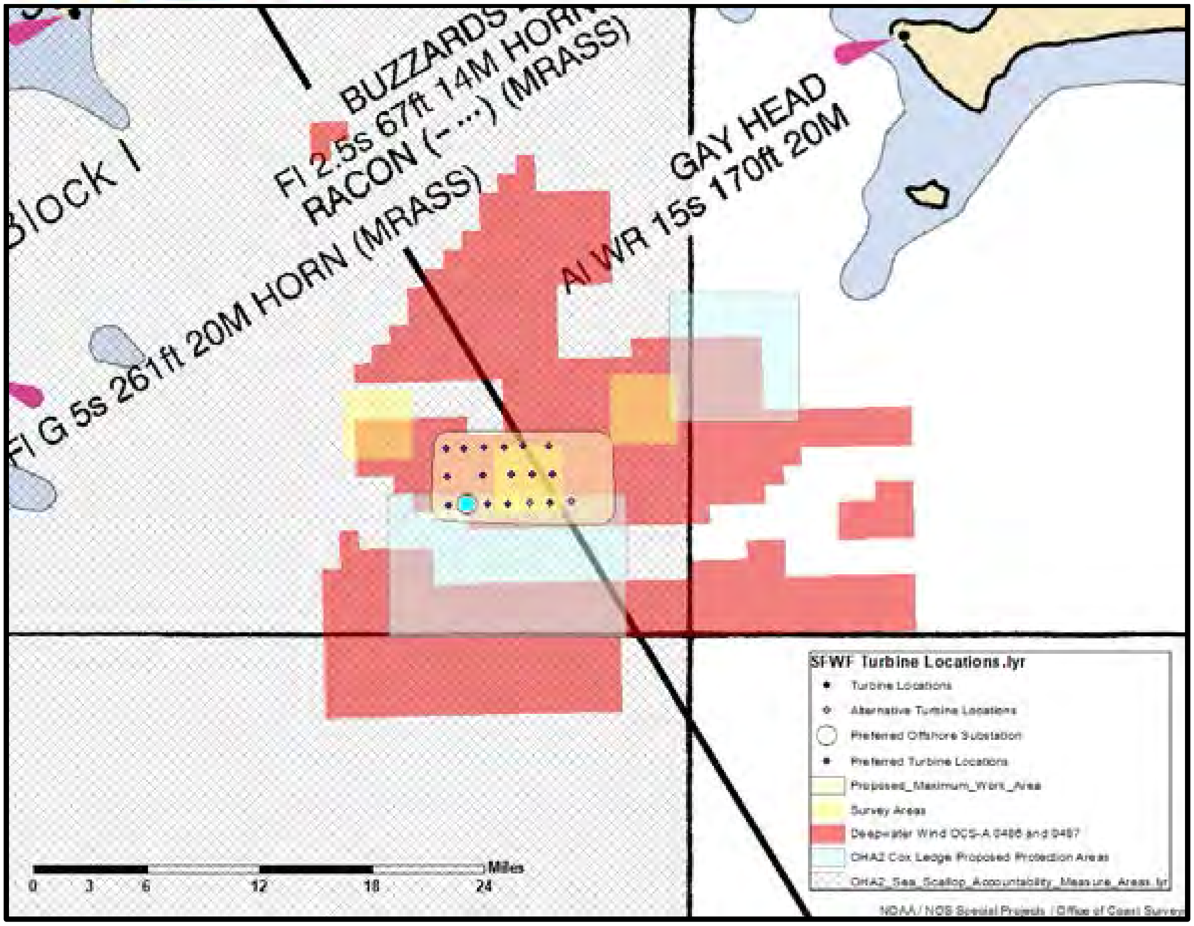


Figure 1: Proposed South Fork Wind Farm showing survey areas, proposed turbines, and survey locations. Black lines are approximate gillnet lines; green lines are approximate beam trawl paths.

REVIEW OF RESEARCH PLAN

The stated objectives of this research plan, listed on page 4 of the RMP, are to evaluate:

1) Demersal species that utilize the area in and around the SFWF.

2) The seasonal timing of the occurrence of these species.

3) Whether the taxonomic compositions of demersal fish assemblages change between the baseline and post-construction time periods. For example, do some species have reduced abundance and/or do new species appear?

Coonamessett Farm Foundation

Conducting scientific research projects that support sustainable fisheries, aquaculture, and agriculture

277 Hatchville Road • East Falmouth, MA 02536
Tel: (508) 356-3601 • Fax: (508) 356-3603
Website: www.coonamessettfarmfoundation.org

CFF has serious concerns about the design on this study and doubts its ability to fulfill the stated objectives. This letter outlines our concerns by objective.

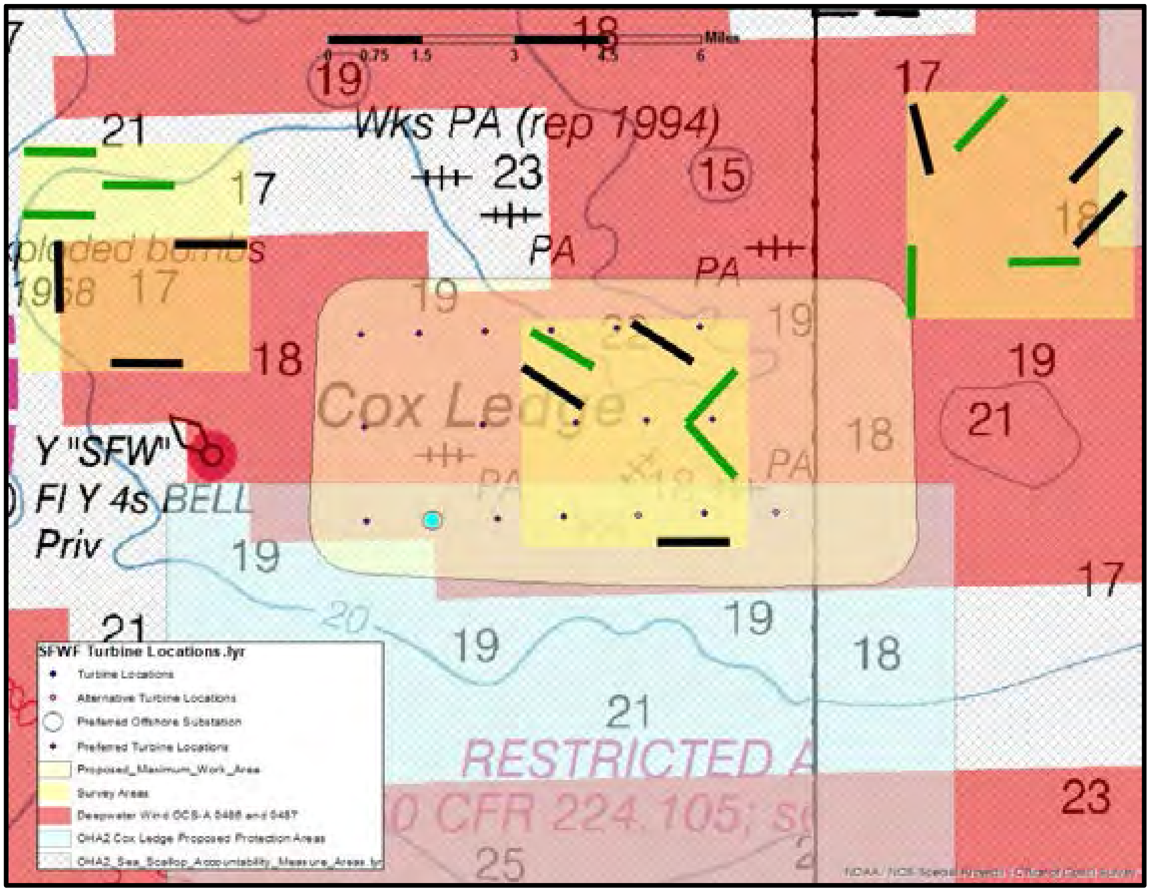


Figure 2: Closeup of Figure 1. Black lines are approximate gillnet lines; green lines are approximate beam trawl paths.

Objective 1: evaluate demersal species that utilize the area in and around the SFWF.

CFF questions the design of the gillnet survey and the focus on the monkfish and skate fishery if the intention of the RMP is to evaluate all demersal species. While monkfish and skate are both common species on Cox Ledge, other potentially important species are also present that are unlikely to be captured in this survey. Focusing on two fisheries is incompatible with the idea of a general habitat survey. It is imperative that the gillnet and trawl surveys are more comprehensive and less selective to provide a broader range of data. For example, CFF's seasonal survey of Georges' Bank is primarily to evaluate the health of the scallop habitat, but data is collected about every species captured because other species such as yellowtail and windowpane flounder are key bycatch species to the industry.

The choice of a 12-inch mesh size is more than the minimum 10-inch mesh size for the monkfish fishery, and will likely result in no catch of other commercially important species (except dogfish, a primary bycatch of monkfish). Because the objective is to catch all species that utilize the area, a smaller mesh size must be implemented. CFF recommends using the regulatory minimum mesh size of 6.5-inches used by the groundfish fleet. This will allow capture of demersal species for which Cox Ledge is designated as Essential Fish Habitat (EFH), including highly valuable New England fish species such as Atlantic cod, Atlantic herring, haddock, monkfish, ocean pout, pollock, red hake, windowpane flounder, winter flounder, witch flounder, and yellowtail flounder (Appendix O of the SFWF COP).

Section 2.1.3, part of the gillnet survey section of the RMP, states it is "important to gather site-specific information on Atlantic cod spawning". However, using a 12-inch mesh will substantially limit the number of cod caught and at the very least will not generate a representative picture of demersal species on Cox Ledge, which is the stated objective of the RMP. A study plan to look at mature cod for spawning condition is pointless if the survey design won't catch adult cod. The change to a smaller mesh size may require an Exempted Fishing Permit (EFP) instead of a Letter of Acknowledgement, but without using a smaller mesh size, the gillnet portion of this survey will not meet this objective.

The RMP also outlines the beam trawl survey to establish baseline community composition with a focus on demersal fish and macroinvertebrate species. CFF questions using only three predetermined trawl survey lines within the Survey Area, RAE and RAW for the duration of the pre- and post-construction period. Beam trawl surveys are destructive, and parts of the southernmost section of the Survey Area and northeast corner of RAE are within areas of highly sensitive bottom habitat considered for protection under the recently passed Omnibus Habitat Amendment 2 (OHA2). In addition, survey data collected by CFF indicates the bottom in this area changes seasonally from silt to boulders (CFF 2017). Because these paths are to be sampled monthly, other locations within the Survey Area, RAE and RAW should be selected and sampled from to allow the bottom to recover between surveys and to collect a reasonable assemblage of undisturbed bottom habitat.

Objective 2: The seasonal timing of the occurrence of these species.

CFF applauds the plan to sample monthly using the beam trawl, but questions restricting the gillnet sampling to April, May and June, and then October, November, and December. This design leaves half of the year unsurveyed and will thus miss important seasonal changes in finfish species assemblages. Cox Ledge is traditionally a productive midsummer fishing ground and potential spawning ground for cod and other groundfish. The RMP is correct in that sampling may be more difficult in the summer months, but every effort should be made to collect data using the gillnet survey in the summer and winter months.

Coonamessett Farm Foundation

Conducting scientific research projects that support sustainable fisheries, aquaculture, and agriculture

277 Hatchville Road • East Falmouth, MA 02536
Tel: (508) 356-3601 • Fax: (508) 356-3603
Website: www.coonamessettfarmfoundation.org

Objective 3: Whether the taxonomic compositions of demersal fish assemblages change between the baseline and post-construction time periods. For example, do some species have reduced abundance and/or do new species appear?

We question the ability of using beam trawls during and after construction. Fishers at several meetings of the Fisheries Working Group have stated that they would not be able to dredge within wind farms, and therefore this portion of the survey may be prematurely shut down, leaving only the gillnet survey in the project area. As we have stated above, the gillnet survey will not give a representative picture of the community(ies) on Cox Ledge and within the MA/RI WEA unless the mesh size is drastically reduced. In addition, no indication is given when these surveys will begin and end in relation to construction. Surveys should begin at least one year prior to construction and continue for at least five years to fully understand the changes brought about by the wind farm.

General Concerns

As stated earlier this research plan is significantly inadequate to meet the stated objectives of evaluating the demersal species, taxonomic assemblages, and seasonal variability in and around the proposed South Fork Wind Farm. Ørsted/Deepwater Wind should substantially increase the number and types of year-round surveys to be performed. Incorporating the suggestions made by CFF is a start, but hopefully further additions will be highlighted by other members of the Fisheries Working Group as well as state and federal authorities.

As shown in Figure 1, the Survey Area, RAW and RAE are all in the Sea Scallop Accountability Measure Area designated by the OHA2, however this is not mentioned in the RMP. CFF requests that all requirements under this area be followed and incorporate in the RMP.

The RMP states the "scientific contractor will apply for a Letter of Acknowledgement (LOA) from NOAA Fisheries…to…conduct scientific sampling that is **not subject to** the ACFCMA, Mag-Stevenson, and 50 CFR parts 648 and 697." As outlined in our comments to Objective 1, Deepwater Wind may need to apply for an EFP to reduce mesh size and to "monitor a large portion of the species assemblage present in and around the SFWF over a varying temporal scale" (p. 3 of the RMP). Overall, CFF supports a before and after habitat assessment of the region; however expects that these assessment actually cover the needs of the environment and local stakeholders. Through our years of fisheries research in the region, we feel confident that our suggested changes to your plan will both improve the survey design and capture the appropriate data to fulfill your objectives.

Finally, CFF questions why these comments were only to be sent to Ørsted/Deepwater Wind. In the spirit of open discussion CFF has sent our comments to Ørsted/Deepwater Wind as well a their partners in the Fisheries Working Group in the hopes that a more inclusive and open discussion can be started.

Coonamessett Farm Foundation
Conducting scientific research projects that support sustainable fisheries, aquaculture, and agriculture
277 Hatchville Road • East Falmouth, MA 02536
Tel: (508) 356-3601 • Fax: (508) 356-3603
Website: www.coonamessettfarmfoundation.org

Thank you for the opportunity to comment on the Deepwater Wind RMP. Please contact Mary Newton Lima if you have any questions or need any clarification of this document.

Sincerely,

Frank Almeida, President

Coonamessett Farm Foundation

EXHIBIT 4

Date	Organizations/Individuals Contacted[4]	Location/Form of Contact and Response	Purpose of Contact
9/30/19	RI CRMC FAB	URI Coastal Institute, Narragansett, RI; subsequent communications with RI CRMC FAB included in Exhibit 4 to Appendix A	Marine Affairs and FMP updates

[4] BOEM – Bureau of Ocean Energy Management; CFCRI – Commercial Fisheries Center of Rhode Island; CFRF – Commercial Fisheries Research Foundation; CT DEEP – Connecticut Department of Energy and Environmental Protection; MA DMF- Massachusetts Division of Marine Fisheries; MA CZM – Massachusetts Center of Coastal Zone Management; MA FWG – Massachusetts Offshore Wind Fisheries Working Group; NEFMC – New England Fisheries Management Council; NOAA/GARFO - National Oceanic and Atmospheric Administration's Greater Atlantic Regional Fisheries Office; NOAA/NMFS – National Oceanic and Atmospheric Administration's National Marine Fisheries Service; NYS DEC – New York State Department of Environmental Conservation; NYS DOS – New York Department of State; NYS DPS – New York State Department of Public Service; NYSERDA – New York State Energy and Research Development Authority; RI CRMC – Rhode Island Coastal Resources Management Council; RI DEM – Rhode Island Department of Environmental Management; RISAA – Rhode Island Saltwater Angler's Association; RODA – Responsible Offshore Development Alliance; ROSA – Responsible Offshore science Alliance; USACE – United States Army Corps of Engineers

DESAUTEL LAW

Marisa A. Desautel
marisa@desautelesq.com
401.477.0023

October 23, 2019

<u>VIA FIRST CLASS MAIL, POSTAGE PREPAID
AND ELECTRONIC MAIL</u>

Melanie Gearon
South Fork Wind Farm
56 Exchange Terrace
Providence, RI 02903

Re: ***South Fork Wind Farm Updated Fisheries Research and Monitoring Plan September 2019 ("Plan")***

Ms. Gearon:

This office represents the Fishermen's Advisory Board ("FAB") with respect to the above-referenced matter. My client received correspondence from CRMC staff indicating that the project applicant was "willing to extend the time for the FAB's response on the [Plan] beyond October 23 by the number of days between September 30 and the date on which it responds substantively to the power analyses question including whether it will be done on the gill net -- with one caveat: Orsted would like input from the FAB on controls sites by October 23."

This letter serves as the FAB's formal response to the project applicant's request above, regarding control sites. The FAB also previously forwarded comments on the above issue, on October 18th. The comments were sent via email to CRMC staff, a copy of which is appended hereto.

To date, the project applicant has not produced a power analysis for the Plan, despite the FAB's continued request. The project applicant has, likewise, failed to submit or otherwise respond to the information requested in the attached October 18th letter from the FAB. The absence of the power analysis in this case precludes the FAB from providing "input" on control sites. To the extent that the FAB is required to provide input, the FAB's recommendation is to object to the Plan and deny any approval of its contents. This recommendation is based on insufficient information.

Thank you for your attention to this correspondence.

Sincerely,

Marisa Desautel
ec: R. Main, Esq., Client, D. Beutel, G. Fugate

Grover

As you know, the FAB requested a copy of the power analysis conducted for the South Fork monitoring plan. Since the date of that request, the FAB has not received this analysis. Instead, the applicant is countering with a request for selection of "control sites." Please be advised that control sites cannot be selected and the FAB cannot provide input on control sites, based on the current factual situation.

Again, in the absence of a power analysis, our review of the management plan and/or control site input is not possible.

Cox's Ledge is an incredibly unique area that requires an adequate assessment. To date, the FAB has not seen any such assessment. Careful selection of reference sites is essential to being able to detect potential impacts. If the reference sites are of different habitat types or are within an area where they may be affected by construction activities or operation, they are not true reference areas. The selected locations must be suitable for the type of surveying to be done (beam trawling, gillnetting).

The goal of power analysis for the monitoring plan is to ensure that impacts of a certain size (e.g., 5% or 10%) on fish populations/biomass are detected with high probability (usually 80% or 90% -- though this gets more complicated when testing multiple populations). This requires information about how much variability can be expected in the sampling for each species to be evaluated (the COP indicates Cox's Ledge is Essential Fish Habitat for 37 species), both at the target site and at the control site(s). This variability is a function of seasonal biological/migration patterns, the sampling methods themselves, and selection of the control site(s). It's entirely possible that no single control site exists for each sampling method (especially beam trawl and gillnet) to adequately measure all of the key species, and that multiple control sites would be needed. However, the FAB cannot make determinations as the power analysis glaringly absent from the application materials and has not been provided to the FAB, despite its several requests.

Further, the FAB is not clear how the area of influence was determined.

The FAB requests a clear list of primary species of concern and the size/scale/cohort of population changes designed to be detected (e.g. a 10% drop in juvenile Atlantic Cod) as the basis for a series of hypothesis testing approaches.

It is not reasonable to require the FAB to agree on control sites when other choices (list of species, mesh size/sampling method, sampling frequency/timing) potentially affecting the power analysis remain unresolved.

The FAB suggests that, in order to provide informed feedback, the FAB be provided with the resources to conduct their own power analysis, or to have such analysis done by expert staff at a state agency.

We are not waiving our opportunity to later comment further on these issues, either. This email serves to supplement the record for this matter.

Chairman FAB

Lanny Dellinger

South Fork Wind Farm

December 12, 2019

Via First Class Mail and
Electronic Mail
marisa@desautelesq.com
Marisa A. Desautel, Esq.
Desautel Law
38 Bellevue Ave., Unit H
Newport, RI 02840

Re: South Fork Wind Farm ("SFWF") Fisheries Monitoring Plan

Dear Fishermen's Advisory Board and Attorney Desautel:

Orsted thanks the Fishermen's Advisory Board ("FAB") for their comments on the updated gillnet/beam trawl plan dated September 20, 2019 (the "Plan"). The Plan has been the subject of numerous reviews, meetings, and comments since November 2018. For example, Orsted has received comments from the FAB, individual fishermen, the Coastal Resources Management Council ("CRMC"), representatives of the Rhode Island Department of Environmental Management Division of Marine Fisheries ("RIDEM DMF"), and the Massachusetts Division of Marine Fisheries ("MA DMF"), among others.

At the September 30, 2019 FAB meeting, Orsted asked the FAB to provide it with proposed control sites by October 23, 2019. In letters on behalf of the FAB dated October 18 and 23, 2019, the FAB instead asked for power analyses for the gillnet and beam trawl plan before it provided input on the proposed control sites. Orsted considered the FAB's request and has spent a considerable amount of time and resources on the power analyses issue and in reviewing again the control site areas with various stakeholders.

This letter will describe Orsted's work on the power analyses and identification of control sites. The work on the power analyses for the beam trawl and gillnet surveys is labor intensive. Orsted commits to doing such work even though part of it, particularly for the gillnet survey, will extend into 2020 and early 2021. For the gill net survey, Orsted needs to sample in 2020 and then perform the power analysis on that data toward the end of 2020 and potentially into early 2021. The power analyses will be the statistical tools to determine the level of sampling needed to detect meaningful impacts with a degree of confidence. While this tool will be used to determine the level of sampling within each identified control site, it does not impact the selection of areas suitable for control sites now. Selection of these sites will consider comparable habitat, depth, and suitability for the use of sampling gear in the region outside of the influence of any potential wind energy work area. For this reason, identification of control sites is independent of the power analyses, so control site determinations will be finalized in the near future as discussed below.

<u>Power Analyses</u>

As for the power analysis for the beam trawl survey, Orsted immediately began requesting data for such power analysis when it received the FAB's request. Those data are held by others, and it took some time to obtain the data. We are pleased to now have the data and have completed a detailed power analysis for the beam trawl survey. We have attached that power analysis in Exhibit A for your information. The data were used to formulate a relevant list of species from which a total abundance was calculated, and to establish the proximate range of a meaningful effect size in measuring change over time. The study designs had a range of statistical power, with the optimal design having a minimum 80% statistical power or, in other words, at least an 80% probability of detecting an effect that is present.

Conducting a power analysis for the gillnet survey is not currently feasible because no comparable gillnet datasets exist that can be used in the analysis. For this reason, Orsted will conduct an elevated level of sampling in the first year of the survey to collect data that can be used to inform a power analysis to determine the level of sampling for subsequent years. Orsted will conduct sampling twice per month during the survey season (Apr.-June; Oct.-Dec.) and set up to five gillnet strings in each sampling area per sampling trip. Gear parameters will remain the same as previously presented, but the increased frequency of sampling and the increased amount of gear set will allow for more data collection over the level previously proposed. A portion of the data collected will serve as pre-construction survey data allowing for survey timelines to remain unchanged. Sampling levels will then be adjusted in subsequent years based on the results of the power analysis conducted after the first year of the survey has concluded. This approach has been presented to staff at RI DEM and MA DMF and has been deemed reasonable given the lack of comparable data for a power analysis. The power analysis for the gillnet survey will be shared with interested parties, including the FAB, when it is available.

Control Site Determination

The SFWF Plan will use an asymmetrical Before-After-Control-Impact (BACI) design to assess shifts in fish presence, absence, or abundance that correlate with proposed operations at the SFWF. This design uses one impact area located within the SFWF and two control areas outside the area. The control areas selected must be comparable in habitat and depth, utilized by similar fish populations, and "fishable" by the survey gear. In initial versions of the Plan, the two reference areas were located outside the SFWF, but were still located within the RI Wind Energy Area ("RI WEA") (Figure 1).

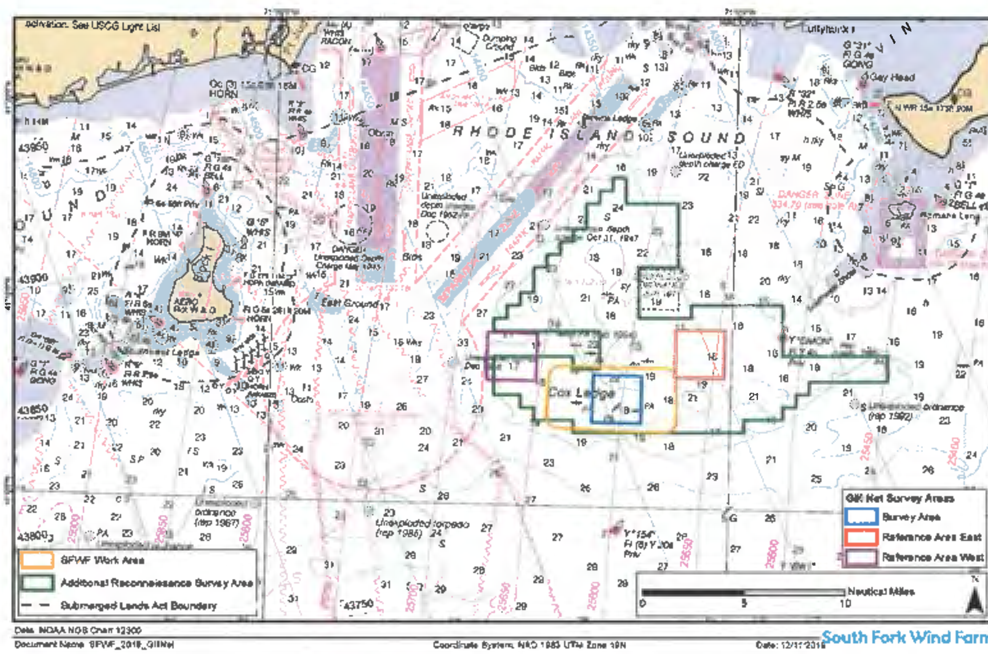


Figure 1. Original locations of control areas for SFWF research and monitoring plan.

As stated above, the Plan has been circulated for many months and has been the subject at numerous meetings including before the FAB. Multiple comments were received highlighting the need to move the control sites outside of the RI WEA to avoid impacts from future development. During the September 30, 2019 FAB meeting, Orsted requested feedback from the FAB to identify the two control areas to appropriate sites outside the RI WEA to ensure that the sites act as true reference locations. On October 18, 2019, the FAB indicated in a letter to Orsted that it could not provide input on control sites until a power analysis was provided. A power analysis is independent of control site selection. For this reason, Orsted has continued to move forward on site selection and has taken great effort to identify proposed sites outside any potential work areas. Multiple inputs were used to decide on potential locations for these sites. These included:

- Bathymetry data available through the Northwest Atlantic Marine Ecoregional Assessment
- Bathymetry data available through NOAA's online Bathymetric Data Viewer
- Gillnet activity data (VTR) for 2011-2015 available through the Northeast Ocean Data Portal
- Monkfish vessel activity data (VMS) for 2015-2016 available through the Northeast Ocean Data Portal
- Anna Mercer's beam trawl location data collected as part of her dissertation work
- Personal communications with commercial fishermen
- Consultation with staff at RI DEM and MA DMF

The areas selected (Figure 2) are of similar depth and habitat based on the available data and are equidistant (~24km) from the work area. The proposed sites appear adequate for both survey gears (gillnet and beam trawl), but additional feedback from members of the FAB would aid in assessing if these sites are appropriate for both gear types.

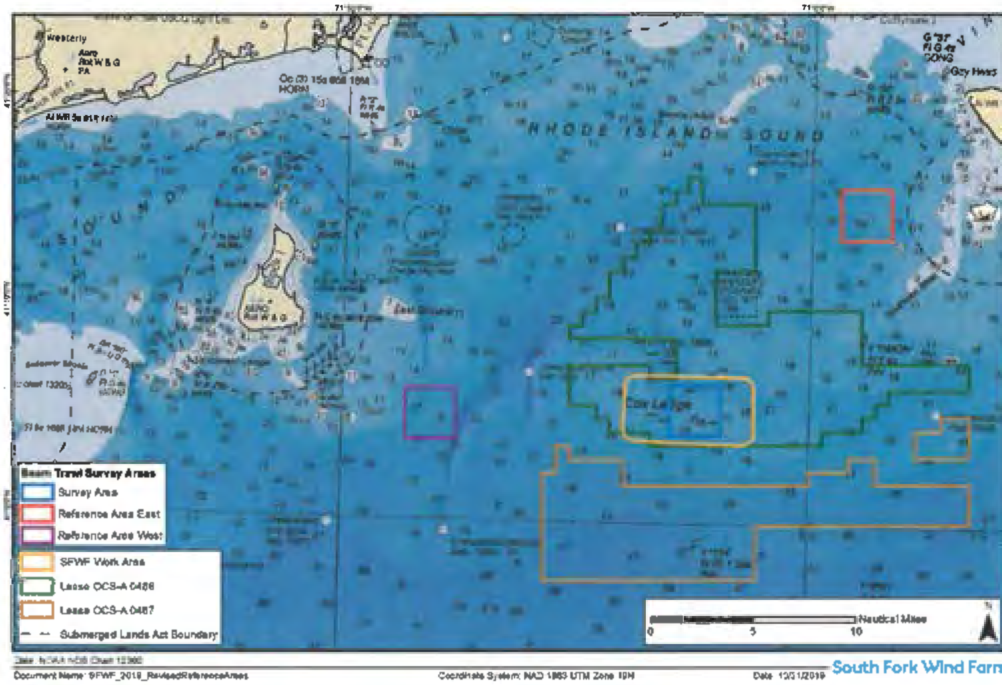


Figure 2. Proposed relocated control areas for SFWF research and monitoring plan.

Conclusion

Based on comments from the FAB and others, Orsted had a power analysis developed for the beam trawl survey as quickly as it was able to once it obtained the relevant data from a third party. Orsted also has developed a plan for an elevated level of sampling in the first year of the survey to collect data that can be used to inform a power analysis for a gillnet survey. In addition, Orsted has re-evaluated its control site areas, met with numerous stakeholders about these sites, and now presents them to the FAB for its comment. Orsted respectfully requests the FAB provide any comments on the control site areas by January 8, 2020. Thank you for your time and attention to this matter.

If you have any questions concerning the enclosed information, please do not hesitate to contact me.

Yours sincerely,

Melanie Gearon

Melanie Gearon
Manager, Permitting and Environmental Affairs
Ørsted: U.S. Wind Power
MELGE@orsted.com
Tel. +1 857 348 3261

cc: (via electronic email) Grover Fugate, James Boyd and David Beutel (CRMC)

EXHIBIT 5

Date	Organizations/Individuals Contacted[5]	Location/Form of Contact and Response	Purpose of Contact
5/11/20	BOEM, CT DEEP, MA DMF, NEFMC, NOAA/GARFO, NOAA/NMFS, NYS DEC, NYS DOS, NYSERDA, RI CRMC, RI DEM, RODA, ROSA, USACE	Emails from SFW and recipient responses are attached to Exhibit 5 to Appendix A	Distribution of Final Fisheries Management Plan

[5] BOEM – Bureau of Ocean Energy Management; CFCRI – Commercial Fisheries Center of Rhode Island; CFRF – Commercial Fisheries Research Foundation; CT DEEP – Connecticut Department of Energy and Environmental Protection; MA DMF- Massachusetts Division of Marine Fisheries; MA CZM – Massachusetts Center of Coastal Zone Management; MA FWG – Massachusetts Offshore Wind Fisheries Working Group; NEFMC – New England Fisheries Management Council; NOAA/GARFO - National Oceanic and Atmospheric Administration's Greater Atlantic Regional Fisheries Office; NOAA/NMFS – National Oceanic and Atmospheric Administration's National Marine Fisheries Service; NYS DEC – New York State Department of Environmental Conservation; NYS DOS – New York Department of State; NYS DPS – New York State Department of Public Service; NYSERDA – New York State Energy and Research Development Authority; RI CRMC – Rhode Island Coastal Resources Management Council; RI DEM – Rhode Island Department of Environmental Management; RISAA – Rhode Island Saltwater Angler's Association; RODA – Responsible Offshore Development Alliance; ROSA – Responsible Offshore science Alliance; USACE – United States Army Corps of Engineers

Brian Gervelis

From: Melanie Gearon <MELGE@orsted.com>
Sent: Monday, May 11, 2020 6:26 PM
To: 'Engler, Lisa (ENV)'; 'Boeri, Robert (ENV)'; Callaghan, Todd (EEA); Ford, Kathryn (FWE; Pol, Mike (FWE); annie@rodafisheries.org; lyndie@rosascience.org; andrew.lipsky@noaa.gov; 'Susan Tuxbury - NOAA Federal'; 'Sharon Benjamin - NOAA Affiliate'; 'Julie Crocker - NOAA Federal'; ursula.howson@boem.gov; 'Ryan Silva'; douglas.christel@noaa.gov; Nick Sisson - NOAA Affiliate; Christopher.Boelke@noaa.gov; wendy.gabriel@noaa.gov; Gregory.Lampman@nyserda.ny.gov; mbachman@nefmc.org; 'David Beutel'; 'Grover Fugate'; 'James Boyd'; Jeff Willis; 'McLean, Laura (DOS)'; 'Maraglio, Matthew (DOS)'; Gaidasz, Karen M (DEC); Maniscalco, John D (DEC); Davis, Andrew (DPS); McNamee, Jason (DEM; 'Julia Livermore'; 'Brian Hooker'; 'Boatman, Mary'; Stromberg, Jessica; Peter.Aarrestad@ct.gov; 'Handell, Naomi J CIV USARMY CENAN (US)'
Cc: Stephanie Wilson; Liz Gowell; Sophie Hartfield Lewis; John O'Keeffe; Rodney Avila; Ross Pearsall; Robert Soden; Robert Mastria; Main, Robin L.; Brian Gervelis; Drew Carey; Gregory DeCelles; Jennifer Garvey; Julia Prince; Berg, James; Mark Gardella, external user
Subject: SFW - 2020 Fisheries Monitoring Plan
Attachments: SFW01_Fisheries_Research_Monitoring_Plan_2020-05-11.pdf

Good Afternoon,

South Fork Wind is pleased to send you its Fisheries Research and Monitoring Plan, which will be implemented in 2020. As a result of the helpful and productive comments that South Fork Wind has received from agencies and stakeholders, this plan now includes: gillnet survey, beam trawl survey, ventless trap lobster survey, ventless fish pot survey, acoustic telemetry, and benthic survey.

On Friday May 22, 2020 from 10:00am to 12:00pm, the South Fork Wind team will host a webinar to walk you through the plan and describe our next steps. We will send an invite shortly and hope you can join us.

Thanks and stay safe!

Best regards,
Melanie Gearon
Project Manager
Permitting
Offshore

Ørsted

Learn more at orsted.com

56, Exchange Terrace, Suite300
RI-02903 Providence
Tel. +1 857 348 3261

melge@orsted.com
orsted.com

South Fork Wind
Fisheries Research and Monitoring Plan

May 2020

Prepared by:

South Fork Wind | Powered by Ørsted & Eversource

Deepwater Wind South Fork, LLC

and

INSPIRE Environmental

INSPIRE Environmental
513 Broadway, Suite 314
Newport, Rhode Island 02840

TABLE OF CONTENTS

Page

LIST OF FIGURES

LIST OF ACRONYMS

ACCOL	Anderson Cabot Center for Ocean Life
ASMFC	Atlantic States Marine Fisheries Commission
BACI	Before-After-Control-Impact
BAG	Before-After-Gradient
BIWF	Block Island Wind Farm
BOEM	Bureau of Ocean Energy Management
CMECS	Coastal and Marine Ecological Classification Standard
COP	Construction and Operation Plan
CPUE	Catch per unit effort
DSLR	Digital single-lens reflex
DWSF	Deepwater Wind South Fork, LLC
EFP	Exempted Fishing Permit
ESA	Endangered Species Act
FGDC	Federal Geographic Data Committee
GPS	Global Positioning System
HMS	Highly migratory species
INSPIRE	INSPIRE Environmental, LLC
LOA	Letter of Acknowledgement
LPIL	Lowest possible identification level
MADMF	Massachusetts Division of Marine Fisheries
MARACOOS	Mid-Atlantic Regional Association Coastal Ocean Observing System
MMPA	Marine Mammal Protection Act
NERACOOS	Northeastern Regional Association of Coastal Ocean Observing Systems
NEAMAP	Northeast Area Monitoring and Assessment Program
NEFSC	Northeast Fisheries Science Center
NOAA	National Oceanic and Atmospheric Administration
NYSERDA	The New York State Energy Research and Development Authority
OCS	Outer Continental Shelf
PV	Plan View
RICRM	Rhode Island Coastal Resources Management

RIDEM	Rhode Island Department of Environmental Management
SFEC	South Fork Export Cable
SFW	South Fork Wind
SMAST	School for Marine Science & Technology
SNECVTS	Southern New England Cooperative Ventless Trap Survey
SPI	Sediment Profile Imaging
WEA	Wind Energy Areas

1.0 Introduction

The Fisheries Research and Monitoring Plan (the plan) is for South Fork Wind (SFW or Project) is proposed to be located in Bureau of Ocean Energy Management (BOEM) Lease Area OCS A-0517, which is within the Rhode Island – Massachusetts Wind Energy Area (RI-MA WEA) (Figure 1)[1]. SFW includes up to 15 wind turbine generators (WTGs or turbines) with a nameplate capacity of 6 to 12 MW per turbine, submarine cables between the WTGs (Inter-array Cables), and an offshore substation (OSS), all of which will be located approximately 19 miles (30.6 kilometers [km], 16.6 nautical miles [nm]) southeast of Block Island, Rhode Island, and 35 miles (56.3 km, 30.4 nm) east of Montauk Point, New York.

This monitoring plan has been developed in accordance with recommendations made by both BOEM's "Guidelines for Providing Information on Fisheries for Renewable Energy Development on the Atlantic Outer Continental Shelf" (BOEM, 2013) and state agencies (RICRMC, 2010; NYSERDA, 2017; MADMF, 2018). This plan has been created using an iterative process, and details have been refined and updated based on feedback received from stakeholder groups. The Deepwater Wind South Fork (DWSF) team has spoken extensively with regional fishing organizations, working groups, and individual fisherman over the last three years as development of the monitoring plan has evolved. In addition, through the permitting and development process the DWSF team has consulted with several state (e.g., NY, CT, RI, and MA) and federal fisheries resource management agencies. The team has attended several public meetings with these groups to present the development and status of the plan and to solicit feedback directly from stakeholders. Webinars have been conducted with state and federal agencies and the plan has been distributed to these entities for multiple rounds of comment. The current plan was produced utilizing the feedback received through this extensive engagement process. As a result of these efforts, the monitoring plan includes the following, in order as they appear in this plan: gillnet survey, beam trawl survey, ventless trap lobster survey, ventless fish pot survey, acoustic telemetry, and benthic survey.

[1] Deepwater Wind South Fork, LLC (DWSF), now a wholly-owned indirect subsidiary of North East Offshore, LLC, a joint venture between Ørsted and Eversource , submitted the major federal permit application, The South Fork Wind Farm Construction and Operations Plan (COP), to BOEM in June, 2018 and submitted a revised COP to BOEM in May, 2019.
The full revised COP document can be found online at: https://www.boem.gov/South-Fork/

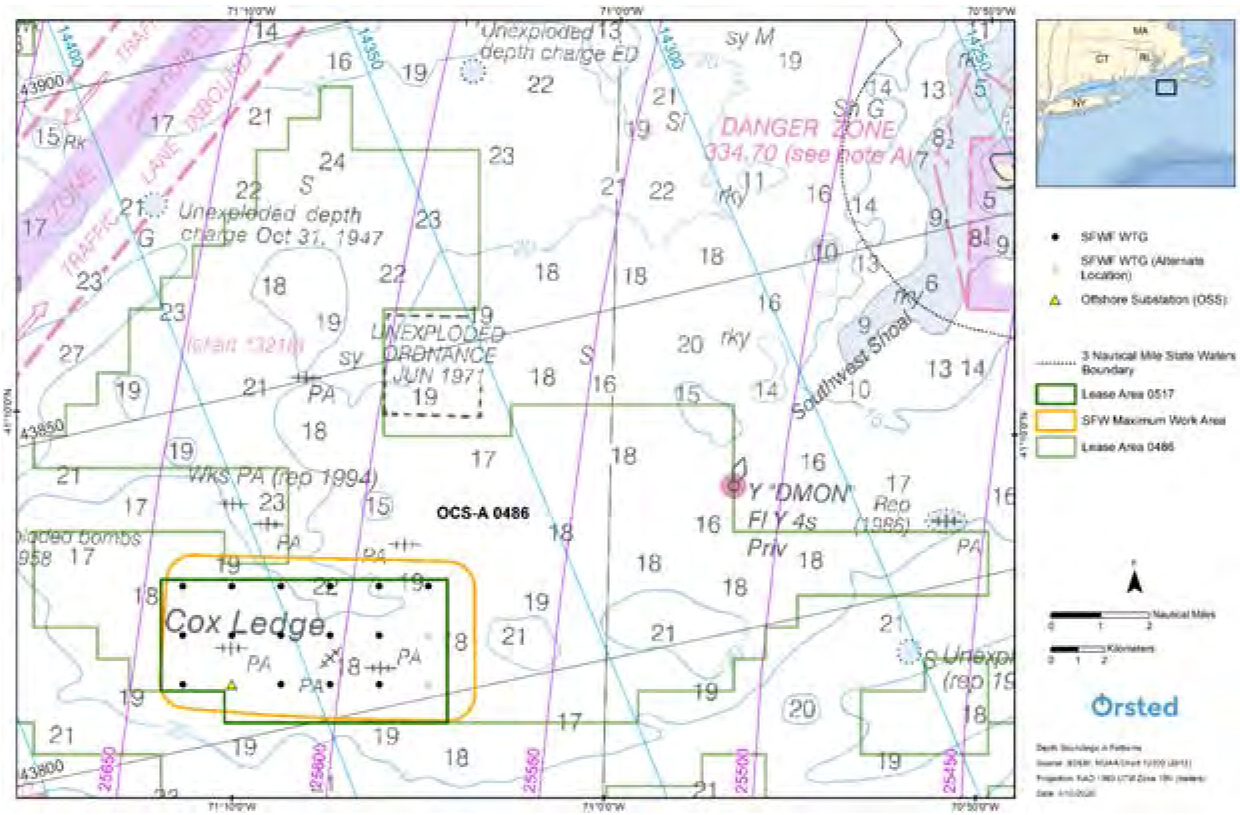


Figure 1. Location of South Fork Wind

DWSF is committed to conducting sound, credible science. Biological surveys, developed in coordination with the commercial fishing fleet and state agencies, were conducted at the Block Island Wind Farm (BIWF) from 2012 through 2019. The guiding scientific principles implemented beginning with the BIWF and continuing into the future include:

- Producing transparent, unbiased, and clear results from all research
- Working with commercial and recreational fishermen to identify areas important to them
- Collecting long-term data sets to determine trends and develop knowledge
- Promoting the smart growth of the American offshore wind industry
- Focusing on maintaining access and navigation in, and around, our wind farms for all ocean users
- Completing scientific research collaboratively with the fishing community
- Being accessible and available to the fishing industry
- Utilizing standardized monitoring protocols when possible and building on and supporting existing fisheries research
- Sharing data with all stakeholder groups
- Maintaining data confidentiality for sensitive fisheries dependent monitoring data

The SFW site is situated atop Cox Ledge, an area with complex bathymetry including extensive areas of boulders and mobile gear "hangs", making it difficult to safely operate large mobile gear (e.g., bottom trawl) in this area. Therefore, the SFW site is not sampled routinely by the Northeast Fisheries Science Center (NEFSC) bottom trawl survey. Feedback from commercial fishermen, and an analysis of vessel Monitoring System (VMS) data indicate there is little commercial trawl effort in the area. Details of the SFW fisheries data assessment and stakeholder feedback can be found in the SFW COP Appendix Y - *Commercial and Recreational Fisheries Technical Report*.[2]

The BOEM fishery guidelines recommend that trawl surveys be executed using a stratified random design. However, because of the complex bathymetry throughout the area, it is unlikely that a trawl survey can be safely conducted within the SFW site using a scientific design with random site selection. Therefore, DWSF has evaluated alternative survey designs and monitoring tools that can be used to collect pre-construction data for a wide range of taxa in the SFW site. Through extensive outreach efforts with the fishing community, feedback from state and federal agencies, and exploration of existing datasets, the DWSF team has developed survey designs using multiple sampling gears to acquire pre-construction data on the abundance, demographics, and composition of species that occur in and around the SFW site. In particular, the surveys have been designed to utilize sampling gear that can be fished effectively, and with limited impact, on the complex, rocky habitat within the SFW site(Thomsen et al., 2010; Malek, 2015).

Different gear types select for different fish and macro-invertebrate species, therefore, using multiple gear types to sample species assemblages is needed for assessing potential impacts from SFW (Walsh and Guida, 2017). Consistent survey methods and approaches will allow for data comparisons across studies, collaboration among developers and institutions, and an ability to address questions at appropriate spatial and temporal scales. Several gear types will be used to monitor a large portion of the species assemblage present in and around SFW. Some sampling will occur seasonally, while other sampling efforts will occur throughout the year (Figure 2). The proposed survey designs in this plan are not exhaustive but will form a basis for fisheries monitoring in the SFW site.

Figure 2. Generic survey timeline for SFW monitoring

[2] Appendix Y can be found online at: https://www.boem.gov/Appendix-Y/

These surveys will provide data that can be used to evaluate:

1. Commercially and recreationally important species that utilize the area in and around the SFW site.
2. The seasonal timing of the occurrence of these species.
3. Whether the taxonomic composition or relative abundance of fish and invertebrate assemblages change between the pre-construction and post-construction time periods.

The survey protocols have been designed to address requirements and guidelines outlined in the national register (30 CFR 585.626), BOEM fishery guidelines, and RICRMC policies (11.10.9 C).

DWSF issued a 'Request for Proposals' on May 5th, 2020 to local Universities and research institutions to execute elements of the monitoring plan. In some instances, the scientific researchers that are contracted to perform these surveys may work with DWSF to make slight modifications to the methodologies that are described below, provided such modifications are agreed by both parties. The proposals will be reviewed in late May and early June, and it is expected that contracts will be awarded shortly thereafter. It is envisioned that field work for these components of the pre-construction monitoring will begin in August or September 2020, but the actual start date will depend on several factors including state regulations regarding Covid-19.

Similar to the principles and practices executed for the Block Island Wind Farm, DWSF is committed to conducting scientific surveys and assessments that are collaborative with the fishing industry. The scientific contractors selected to perform the monitoring will identify for-hire fishing vessels from which these surveys will be conducted.

2.0 Demersal Fisheries Resources Survey - Gillnet

Gillnet selectivity depends mainly on fish size and shape and mesh size, but is also affected by the thickness, material, and color of net twine, hanging of net, and method of fishing (Hamley, 1975). Using specific gear placements and prescribed mesh sizes, gillnets may be designed to target specific species, or subgroupings of species, and life stages. Southern New England waters are host to an active gillnet fishery that primarily targets monkfish and winter skate. The proposed gillnet survey will focus on monitoring these two species, pre- and post-construction of SFW.

The survey will establish pre-construction data on the micro-scale distribution, abundance and composition of fish species in the area of potential affect. In particular, the study will use large-mesh gillnet gear, with a focus on monkfish and winter skate, and may be used to assess whether detectable shifts occur in the presence, relative abundance, and demographics of these species before and after construction.

2.1 Survey Design/Procedures

The survey will be conducted from commercial fishing vessel(s) with scientists onboard to process the catch. For-hire vessels will be selected based on criteria such as experience, safety record, knowledge of the area, and cost. The scientific contractor will apply for an Exempted Fishing Permit (EFP) from the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) in order to use the hired fishing vessel(s) as a scientific platform and conduct scientific sampling that is not subject to the Atlantic Coastal Fisheries Cooperative Management Act, Magnuson-Stevens Fishery Conservation and Management Act, and fishery regulations in 50 CFR parts 648 and 697. All survey activities will be subject to rules and regulations outlined under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA). Pingers will be used on all gillnet gear as required under regulation. All gear restrictions, closures, and other regulations set forth by take reduction plans (e.g., Harbor Porpoise Take Reduction Plan, Atlantic Large Whale Reduction Plan, etc.) will be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury.

2.2 Proposed Sampling Stations

An asymmetrical Before-After-Control-Impact (BACI) design is proposed with three sampling areas; an impact area within the SFW "Project Area" and two reference areas. The SFW "Project Area" is defined as the maximum work area required to install the SFW (yellow outline in Figure 3 below). This includes the maximum spatial extent where vessels or lift barges may anchor during construction around the wind turbines and foundations. Fishable gillnet lines will be determined through consultation with the participating fishermen. Up to five gillnet lines per area will be randomly selected for each survey, resulting in up to 15 gillnet strings conducted per survey. Final designation of survey areas and survey lines within each area will be based on detailed geophysical seafloor survey data as well as input from commercial gillnet fishermen regarding areas important to them. Location of gillnets may be subject to change due to seasonal location of other fixed fishing gear (e.g., lobster pots). If a survey line is found to have poor conditions for setting gillnets it may be moved based on the captain's professional judgement.

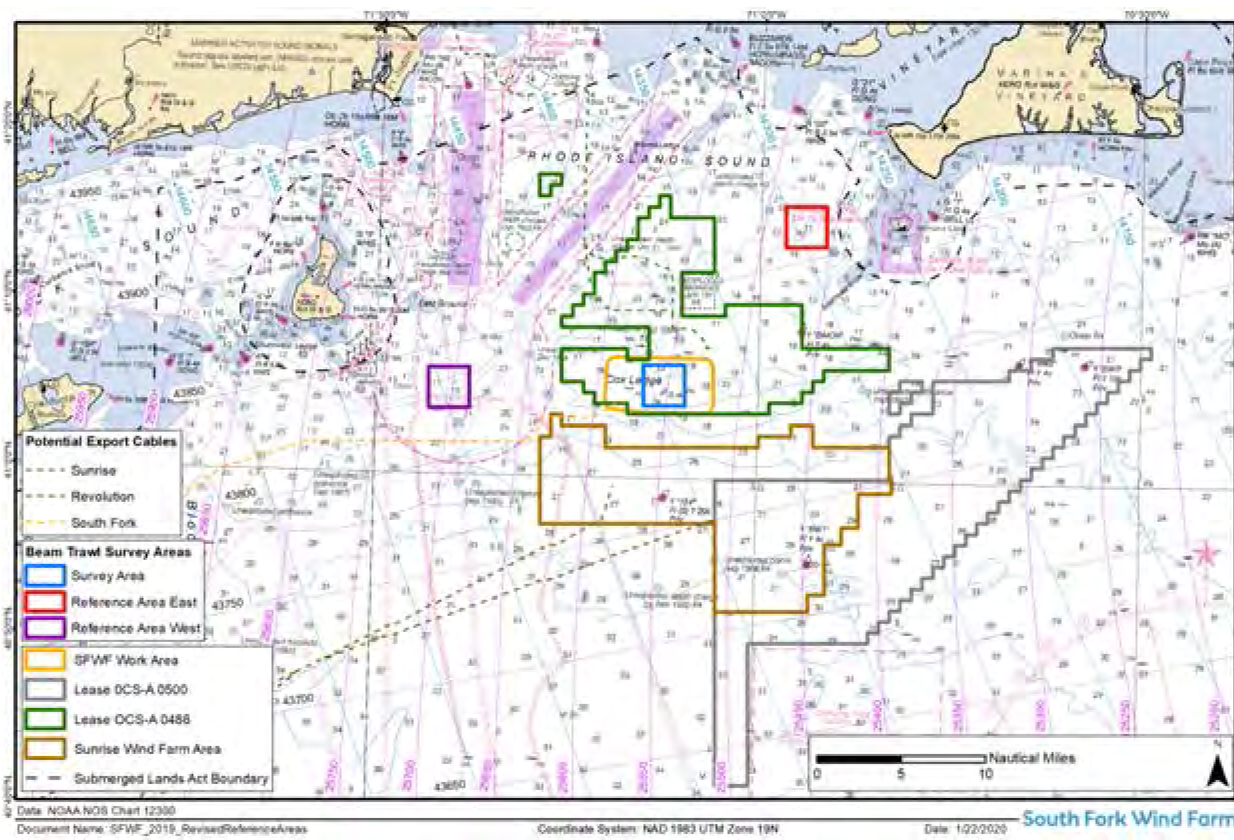


Figure 3. Northeast lease areas including the South Fork Wind Project Area with Proposed Gillnet and Beam Trawl Survey and Reference Areas

Data will be collected in the Project Area and two reference areas with similar habitat characteristics as the Project Area. The reference areas will serve as an index of demersal fish abundance in Rhode Island Sound in an area outside of the direct influence of SFW, and other future planned wind farm construction in the region. Concurrent sampling in the Project Area and the two reference areas will identify whether changes in the relative abundance and demographics of monkfish, winter skate, and other species observed within the Project Area are consistent with regional trends rather than representing a localized impact in the vicinity of SFW. The study will use an asymmetrical BACI experimental design, with statistical evaluation of the differences between control and impact areas contrasted in the before and after construction time periods (Underwood, 1994; Smith, 2002). A BACI design will allow for assessment of shifts in fish presence, absence, or abundance that correlate with proposed construction and operations at the SFW site.

The study design consists of sampling each of the treatment areas with a gillnet. The proposed sampling locations were selected in consultation with regional stakeholders to ensure that:

1. There is comparability among all sampling areas with respect to current, habitat and depth condition;
2. The reference areas are outside the area of influence from SFW but are still utilized by the same/similar fish populations;
3. Areas allow optimal operational execution of the survey (e.g., minimal travel times between sampling locations);
4. Space conflicts are minimized with other active uses.

2.3 Gillnet Methods

A gillnet is a wall of netting that hangs in the water column and is typically made of monofilament or multifilament nylon. Mesh sizes are designed to allow fish to get only their head through the netting, but not their body. The fish's gills then get caught in the mesh as the fish tries to back out of the net. Factors that can influence the catch rate of gillnets for target species include: fish density in the vicinity of gears, the behavior of the target species, the ability of fish to detect and locate the gillnet, and environmental factors such as water temperature, visibility, current direction, and velocity. This survey will use standardized fishing gear and sampling strategies across time and space to standardize catch rates to the extent possible. However, comparison of this gillnet survey data to other pre-construction fishery independent sampling efforts (e.g., nearby federal Northeast Area Monitoring and Assessment Program [NEAMAP]and NEFSC bottom trawl survey stations) may be limited due to the differences in the selectivity and catch rates of the disparate gear types.

The gillnet survey may be conducted using gillnets that are typical of the commercial fishery in Rhode Island and Massachusetts. Each gillnet string will consist of six, 300-ft net panels of 12-inch mesh with a hanging ratio of 1/2 (50%) and using net tie-downs. Following the guidance set forth by BOEM, sampling will occur each spring and fall. Sampling will take place twice per month from April-June and again from October-December. These months see the majority of commercial gillnet activity as monkfish and skates migrate through the area in spring and fall. Sampling in July-September will not occur in order to minimize interactions with protected species (e.g., large whales, sea turtles) and to reduce the likelihood of gear damage that can occur during the seasonal migration of spiny dogfish and larger shark species through the area. The standard soak time of approximately 48 hours is proposed after input from industry, to maximize catch and standardize catch rates, while also ensuring the gear fishes properly during the soak (i.e., not collapsed from saturation), to minimize depredation of catch, and to improve the logistics of the survey. Soak time will remain consistent throughout the duration of the survey, to the extent practicable. Each survey event will be managed by a team of qualified scientists including a lead scientist with experience performing fisheries research. The catch will be removed from the gillnets by the boat crew for processing. The lead scientist will be responsible for collection of data and data recording.

Fish collected in each gillnet will be identified, weighed, and enumerated consistent with the sampling approach of NEAMAP. Scientists will sort and identify fish, and weigh each species by the following protocol:

All organisms will be identified to species. Taxonomic guides include *NOAA's Guide to Some Trawl-Caught Marine Fishes* (Flescher, 1980), Kells and Carpenter's (2011) *Field Guide to Coastal Fishes from Maine to Texas*, and *Peterson's Field Guide to the Atlantic Seashore* (Gosner, 1999).

The following information will be collected for each gillnet string that is sampled; catch per unit effort, species diversity, and length frequency distributions for dominant and vulnerable species in the catch. The catch will be sorted by species, and size (if appropriate) until the lead scientist verifies that the sorting areas are clear of all specimens. All species that are captured will be documented for each string that is sampled.

Catch per unit effort will be calculated for each species sampled in each string with regards to abundance (number of animals captured) and biomass (weight in kg).

Length frequency distributions will be recorded for the dominant species in the catch, as well as for any vulnerable species that are encountered during sampling (e.g., Atlantic sturgeon). Notwithstanding sub-sampling procedures, up to 50 individuals of each species/size will be measured from each gillnet string that is sampled, and the rest counted. Individual lengths are recorded on the field data sheet. Fork length is recorded for all fishes with a forked tail. Total length is measured for all other fishes. Exceptions to these rules are the measurement of rays (disc width), sharks (straight-line fork length), dogfish (stretched total length), crabs (carapace width), lobsters (carapace length), and squids (mantle length). Total weight of all individuals of each respective species will be recorded. Stomach content analysis will be performed for commercially important species (monkfish, winter skate, gadids, black sea bass) to determine the prey composition for these species during the pre-construction period. Each fish sampled for stomach content analysis will be measured and weighed individually to assess relative condition before the stomach is removed. All prey items will be identified to the lowest possible identification level (LPIL), counted, and weighed. For all fishes and select invertebrates (i.e., squids, shrimps, crabs), individual length measurements will be recorded. Otoliths should be sampled and archived for all fish that are sacrificed for biological sampling. Atlantic cod are known to spawn on or near Cox Ledge (Zemeckis et al., 2014). In addition to stomach sampling, any Atlantic cod caught on the gillnet survey will be assessed for reproductive stage and spawning condition according to the protocols used for SFW Atlantic Cod Spawning Survey (adapted from Burnett et al. [1989] and O'Brien et al. [1993]) that occurred during the winters of 2018 and 2019.

2.4 Gillnet Methods

Hydrographic data will be collected using a YSI 6820 V2 multi parameter sonde coupled with a YSI 650 MDS display system (or similar). The sonde is lowered overboard and held in surface waters until the instrument equilibrates. Water temperature (degrees C), dissolved oxygen concentration (mg/l), and salinity (ppt) data are recorded for the near-surface waters. The sonde is then lowered to near-bottom and water temperature, dissolved oxygen, and salinity data are recorded. Measurements are recorded for each station at the end of each tow.

Sea state and weather conditions are recorded from visual observations. Air temperature may be downloaded from a local weather station if not available onboard.

2.5 Gillnet Station Data

The following data will be collected during each sampling effort:

- Station number
- Latitude and longitude
- Soak start and end time and date
- Water depth
- Wind speed
- Wind direction
- Wave height
- Air temperature
- Surface and bottom water temperature, salinity, and dissolved oxygen

2.6 Data Entry and Reporting

Data will be transcribed from hard copy datasheets into electronic worksheets. The data sheets will be reviewed for data entry errors prior to importing into a relational database. Quality control checks will be performed on database tables by running standardized, systematic queries to identify anomalous data values and input errors. Species names (common and scientific) are verified and tabulated for consistency. All data used in analysis will be exported from the relational database.

Annual reports containing catch data will be prepared after the conclusion of each year of sampling and shared with State and Federal resource agencies. One final report will also be produced synthesizing the findings of the pre- and post-construction evaluations.

2.7 Data Analysis

Prior to the Project being built, data analysis will focus on comparing the fish communities in the impact and the control areas to describe spatial differences in abundance, species occurrence, and size structure. Catch per unit effort (CPUE) and length frequency data will be quantitatively compared on a per species basis between the impact and the control areas. Similar analyses will occur using the post-construction data, however the focus will be on identifying changes in the fish community in the impact area between pre- and post- construction that did not also occur at the control areas that could be attributed to either construction or operation of the wind turbines. Confidence intervals for the size of the apparent effects of SFW will be the focus of the analyses, rather than simply Yes or No statements about the statistical significance of any observable effects. More detailed or appropriate analyses may be included as the Project progresses. Data analysis will be executed in accordance with the BOEM fishery guidelines.

An adaptive sampling strategy will be used. Upon completion of the first year of the survey, a power analysis will be conducted using the data collected in the first year, and any other available regional data, to determine if sampling levels need to be adjusted in subsequent years.

3.0 Demersal Fisheries Resources Survey – Beam Trawl

Experienced local fishermen report that sections of the Project Area allow for data collection via beam trawl, as beam trawls are smaller in size than traditional otter trawls and more maneuverable (R. Sykes, pers. comm.). Previous studies have used beam trawls to sample in the vicinity of the Project Area and have proven to be an effective gear for sampling demersal species, including juveniles (Malek, 2015; Walsh and Guida, 2017).

The beam trawl survey will establish pre-construction data on distribution, abundance and community composition, with a focus on demersal fish and macroinvertebrates species, and may be used to assess whether detectable shifts occur in fish presence, absence, or abundance before and after construction.

3.1 Survey Design/Procedures

The survey will be conducted from commercial fishing vessel(s) with scientists onboard to process the catch. For-hire vessels will be selected based on criteria such as experience using a beam trawl, safety record, knowledge of the area, and cost. The scientific contractor will apply for a Letter of Acknowledgement (LOA) from NOAA Fisheries in order to use the hired fishing vessel(s) as a scientific platform and conduct scientific sampling that is not subject to the Atlantic Coastal Fisheries Cooperative Management Act, Magnuson-Stevens Fishery Conservation and Management Act, and fishery regulations in 50 CFR parts 648 and 697. All survey activities will be subject to rules and regulations outlined under the MMPA and ESA. Efforts will be taken to reduce marine mammal, sea turtle, and seabird injuries and mortalities caused by incidental interactions with fishing gear. All gear restrictions, closures, and other regulations set forth by take reduction plans (e.g., Harbor Porpoise Take Reduction Plan, Atlantic Large Whale Reduction Plan, etc.) will be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury.

3.2 Proposed Sampling Stations

The SFW “Project Area” is defined as the maximum work area required to install SFW (yellow outline in Figure 3). This includes the maximum extent where vessels or lift barges may anchor during construction around the wind turbines and foundations. Three survey areas are proposed for sampling: one survey area within the SFW Project Area and two reference areas. Due to the complex bathymetry (e.g., hangs and boulders) present in the impact area and the reference areas, a beam trawl survey would be difficult to execute safely using a simple random design. Conversations with fishermen indicate that there is a limited amount of benthic habitat that can be sampled safely and effectively within each area using a beam trawl. Therefore, in lieu of a simple random design, the input of commercial fishermen with experience fishing in these area, and detailed geophysical seafloor survey data, will be used to generate a map of tow tracks that can be safely sampled with the impact area, and the two reference areas.

Sampling will occur monthly within the impact and control areas. During each survey event, three beam trawl lines will be randomly selected from the universe of possible sampling locations in each area, resulting in nine beam trawls conducted per monthly survey (Read, 2019). However, during any given sampling event, the location of beam trawl sampling stations may be subject to change due to seasonal location of other fixed fishing gear (e.g., lobster pots). If a survey line is found to have poor conditions for beam trawling it may be moved based on the captain's professional judgement. In this instance an alternate trawling location will be chosen at random from the universe of potential sampling locations within that area.

3.3 Beam Trawl Methods

Beam trawling will be conducted monthly by a commercial fishing vessel using a 3-m beam trawl, with a cod-end of double 4.75 inch mesh and a 1-inch (2.54-cm) knotless cod end liner (or similar; equivalent to NEAMAP cod end) to ensure retention of the smaller fish (Malek, 2015). Rock chains will also be fitted across the mouth of the beam trawl to prevent larger rocks from entering and damaging the catch or net. Once on station, the crew of the vessel lowers the net into the water fully and allows it to drag behind the boat. When the gear is fully deployed and the winch brakes are set, the timer is set for 20 minutes, and the start coordinates, start time, date, tow direction, water depth, and tow speed are recorded. Towing speed is maintained at approximately 4.0 knots (Malek, 2015). Upon completion of the tow, end time, and end coordinates are recorded.

Fish collected in each tow will be identified, weighed, and enumerated consistent with the sampling approach of NEAMAP. The following data elements will be recorded for each tow; total biomass and total number of organisms caught, number and biomass caught for each species, species diversity, and length frequency data for dominant and vulnerable species (e.g., Atlantic sturgeon, thorny skate).

Onboard scientists will sort and identify fish, and weigh each species by the following protocol:

All organisms will be identified to species including fish and mega-invertebrates such as sea scallops, squid, lobsters, *Cancer* spp. crabs, sand dollars, and urchins. Taxonomic guides include NOAA's *Guide to Some Trawl-Caught Marine Fishes* (Flescher, 1980), Kells and Carpenter's (2011) *Field Guide to Coastal Fishes from Maine to Texas* and *Peterson's Field Guide to the Atlantic Seashore* (Gosner, 1999).

The catch will be sorted by species. In the case of large catches with a range of size classes, the catch may be sorted by relative size categories within each species. The use of size categories is to ensure that all sizes are equally represented in the data if subsampling is used. The chief biologist will determine the categories and approximate length ranges to be used for each species.

All specimens, fishes and invertebrates, are sorted by species and size (if appropriate) into buckets or fish totes as needed. This process continues until all specimens are sorted, and the chief biologist verifies that the sorting areas are clear of all specimens.

Notwithstanding sub-sampling procedures, up to 50 individuals of each species (and size category) are measured and the rest counted. Individual lengths are recorded on the field data sheet. Fork length is recorded for all fishes with a forked tail. Total length is measured for all other fishes. Exceptions to these rules are the measurement of rays (disc width), sharks (straight-line fork length), dogfish (stretched total length), crabs (carapace width), lobsters (carapace length), sea scallops (shell height), and squids (mantle length). Miscellaneous invertebrates (e.g., worms, hermit crabs, snails) will be counted but not measured. Total weight of all individuals of each respective species will be recorded. Stomach content analysis will be performed for commercially important species (monkfish, winter skate, gadids, black sea bass) to determine the prey composition for these species during the pre-construction period. All prey items will be identified to the LPIL, counted, and weighed. For all fishes and select invertebrates (i.e., squids, shrimps, crabs), individual length measurements will be recorded. Each fish sampled will be sampled for length and weight individually to assess relative condition before the stomach is removed. Otoliths should be collected from fish that are sacrificed for biological sampling. In addition to stomach sampling, any Atlantic cod caught on the beam trawl survey will be assessed for reproductive stage and spawning condition according to the protocols used for SFW Atlantic Cod Spawning Survey (adapted from Burnett et al. (1989) and O'Brien et al. (1993)) that occurred during the winters of 2018 and 2019.

In the case of larger catches (e.g., >900 kg), one or multiple subsampling procedures may be used. Subsampling protocols for the beam trawl are adapted from the subsampling procedures of the NEAMAP survey (Bonzek et al., 2008). The decision of which subsampling protocol, or protocols, to use will be at the discretion of the chief biologist.

3.4 Hydrographic and Atmospheric Data

Hydrographic data will be collected using a YSI 6820 V2 multi parameter sonde coupled with a YSI 650 MDS display system (or similar). The sonde is lowered overboard and held in surface waters until the instrument equilibrates. Water temperature (degrees C), dissolved oxygen concentration (mg/l), and salinity (ppt) data are recorded for the near-surface waters. The sonde is then lowered to near-bottom and water temperature, dissolved oxygen, and salinity data are recorded. Measurements are recorded for each station at the end of each tow.

Sea state and weather conditions are recorded from visual observations. Air temperature may be downloaded from a local weather station if not available onboard.

3.5 Tow Station Data

The following data will be collected during each sampling effort:

- Station number
- Start latitude and longitude
- Start time and date
- Start water depth
- Tow direction
- Tow speed
- Tow duration
- End latitude and longitude
- End time and date
- Wind speed
- Wind direction
- Wave height
- Air temperature
- Surface and bottom water temperature, salinity, and dissolved oxygen

3.6 Data Entry and Reporting

Data will be transcribed from hard copy datasheets into electronic worksheets. The data sheets will be reviewed for data entry errors prior to importing into a relational database. Quality control checks will be performed on database tables by running standardized, systematic queries to identify anomalous data values and input errors. Species names (common and scientific) are verified and tabulated for consistency. All data used in analysis will be exported from the relational database.

Annual reports containing catch data will be prepared after the conclusion of each year of sampling and shared with State and Federal resource agencies. One final report will also be produced synthesizing the findings of the pre- and post-construction evaluations.

3.7 Data Analysis

The BACI survey design will allow for characterization of pre-construction demersal fish and invertebrate community structure. By continuing sampling during and after construction the survey will allow quantification of any substantial changes in species presence, absence, or abundance associated with proposed operations. The use of reference control sites will ensure that larger regional changes in demersal fish and invertebrate community structure will be captured and delineated from potential impacts of the proposed Project. The survey plan allows the catch of numerically dominant species to be compared between the before and after construction periods, using a BACI statistical model. Data analysis will be executed in accordance with the guidance provided by BOEM.

A power analysis was conducted using data from Malek (2015). These data provided approximate estimates of spatial variability in total abundance among independent tows, but the level of replication over time was insufficient to estimate temporal variability at the scale needed for the power analysis (Read, 2019). Therefore, an adaptive sampling strategy will be employed. Upon completion of the first year of the survey, a power analysis will be completed to determine if sampling levels need to be adjusted in subsequent years.

4.0 Demersal Fisheries Resources Survey – Ventless Trap, Lobster

A BACI ventless trap survey will be conducted to collect pre-construction data on lobster and crab resources in the proposed SFW site. The objective of this study is to evaluate the spatial and seasonal patterns of relative abundance of lobster and Jonah crab in the Project Area. In addition, the proposed study will classify the demographics of the lobster and Jonah crab resources, including size structure, sex ratios, reproductive status, and shell disease. Pre-construction data collected in this study may be used to assess whether detectable changes occur in the presence, relative abundance, or demographics of lobsters and crab resources during and after construction.

Based on recommendations from BOEM's renewable energy fishery guidelines (BOEM, 2013) and stakeholders, this survey will quantify pre-construction data for lobster in the SFW site (McCann, 2012; Petruny-Parker et al., 2015, MADMF, 2018) such that changes in the resource due to construction and operation of the wind farm can be evaluated.

4.1 Survey Design/Procedures

The sampling protocol proposed here is informed by the methods used by the Atlantic States Marine Fisheries Commission (ASMFC) and other regional groups to monitor lobster resources in the region (Wahle et al., 2004; O'Donnell et al., 2007; Geraldi et al., 2009; Collie and King, 2016). While the current survey is focused upon SFW, the sampling methods can be expanded to accommodate monitoring at nearby development sites that are much larger in scope. Further, the sampling methodologies proposed here are similar to sampling methods being used at the Vineyard Wind development site, as part of an effort to standardize monitoring amongst offshore wind developers. All sampling will occur on a commercial lobster vessel(s) that is chartered for the survey.

4.2 Sampling Stations

The study will be conducted using a BACI experimental design for direct effects, with quantitative comparisons made before and after construction and between control and impact area (Underwood, 1994). A control site (or multiple control sites) will be identified with similar bottom types, benthic habitat, and areal extent as the SFW site. The scientific contractor that is selected to execute the survey will with Ørsted to help to determine the final details of the survey design, including the number and location of control sites. Ideally, the control site(s) will be selected with direct input from the local lobster industry, along with consideration of the extant fishery dependent and fishery-independent data in the region. In addition, consideration will be given to the proximity of the control area(s) relative to offshore wind development that is planned in the future. Data collected at the control area(s) will serve as a regional index of lobster and Jonah crab abundance n an area well outside of the direct influence of the Project.

Following the protocols used during the Southern New England Cooperative Ventless Trap Survey (SNECVTS; Collie and King, 2016), the survey will be executed using a stratified random design. The impact area will be divided into a series of ten grid cells. Each grid cell will be further divided into aliquots (Figure 4). Similarly, the control area(s) will also be divided into grid cells and aliquots. Through consultation with local industry members, a subset of the aliquots within each grid cell will be identified as suitable sampling sites based on the location of known lobster fishing grounds, and the desire to minimize gear conflicts amongst fishermen in the area. At the beginning of each sampling season, an aliquot will be randomly selected for sampling within each grid cell. An alternative aliquot will also be selected within each grid cell, and the alternative aliquot will be sampled if needed based on local conditions (e.g., to avoid gear conflicts).

To achieve consistency with the ASMFC and SNECVTS protocols, the stations will be selected randomly at the start of each year of sampling, and the sampling locations will remain fixed for the remainder of the year. This sampling approach keeps the station occupied, reduces time that is spent moving traps between locations, and is generally similar to the routine operations of lobstermen in the region. To minimize gear interactions with other user groups in these areas, the lead scientist will work with the captain to ensure that the gear is set in accordance with local fishing practices.

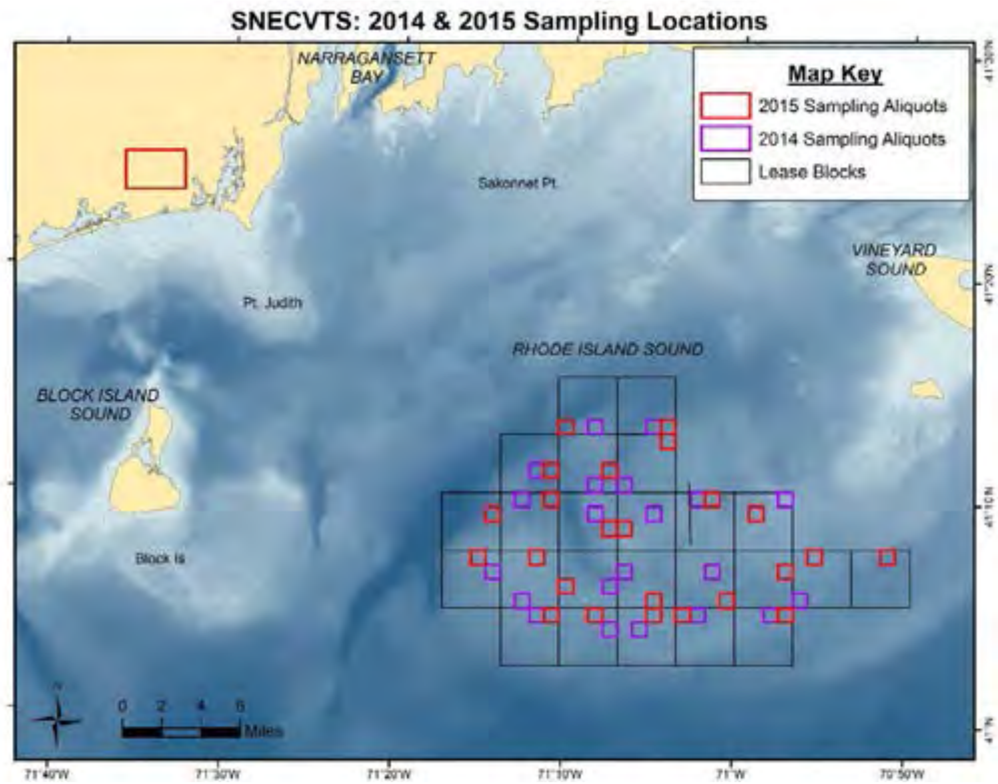


Figure 4. Example of the station selection method employed during the Southern New England Cooperative Ventless Trap Survey. The study area was stratified into 24 sampling grid cells, and each grid cell was further divided into aliquots. One aliquot from each grid was randomly selected for sampling in each year. Figure from Collie and King (2016).

4.3 Ventless Trap Trawl Methods

Lobster resources in SFW and the reference areas will be surveyed using a commercial fishing vessel with scientists onboard to process the catch. A local lobster vessel(s) will be contracted to conduct the sampling using a trap that is consistent with that used in the ASMFC and SNECVTS ventless trap surveys. This trap is a single parlor trap, 16 inches high, 40 inches long, and 21 inches wide with 5-inch entrance hoops and is constructed with 1-inch square rubber coated 12-gauge wire. The trap is constructed with a disabling door that can close off the entrance during periods between samples when the trap is on the bottom but not sampling. Trawls will be configured with 10 traps on each trawl, which is consistent with the gear configuration used in the SNECVTS (Collie and King, 2016). Local fishermen provided Input that fishing longer trawls (i.e., 10 pot vs., 6 pot) should reduce the likelihood of gear losses during the study. A combination of ventless and vented traps will be used to survey juvenile and adult lobster and crabs. Following the approach used in the SNECVTS, each trawl will be comprised of six ventless traps, and four standard vented traps. One trawl will be set in each grid cell in the control and impact area(s), with a target sampling intensity of ten trawls (100 traps) sampled in the impact area, and an equivalent level of sampling in the control area(s). A temperature logger (Onset TidBit or similar) will be attached to the first trap in each trawl to record water temperature continuously throughout the monitoring period.

Pre-construction sampling will occur twice per month from May through November. The sampling period of May through November was derived from a combination of feedback from commercial fishermen and to establish consistency with existing regional surveys (Rhode Island Department of

Environmental Management [RIDEM], Massachusetts Division of Marine Fisheries [MADMF], SNECTVS). The standard soak time will be five nights, which is consistent with local fishing practices to maximize catch, and the protocols used on the SNECVTS survey. Soak time will remain consistent throughout the duration of the survey. Traps will be baited with locally available bait. At the start of each monthly sampling event, the lobsterman will retrieve and bait the traps. After the five-day soak period, the traps will be hauled and the catch will be processed for sampling, and the traps will be rebaited for another five-night soak. Each survey event will be managed by a team of qualified scientists including a lead scientist with experience performing lobster research. The catch will be removed from the traps by the vessel crew for processing. The lead scientist will be responsible for collection and recording of all data.

The catch will be processed in a manner consistent with the ASMFC and SNECVTS ventless trap surveys. After sampling, all catch will be returned to the water as quickly as possible to minimize incidental mortality. The following data elements will be collected for each trawl sampled during the survey; total number and biomass of individuals sampled, number and biomass for each species, length frequency distribution of dominant species (lobster, and Jonah crab), and catch per unit effort at the species level. Data collected for individual lobsters will include:

- Carapace length: Measured to the nearest one tenth mm using calipers.
- Sex: Determined by examining the first pair of swimmerets.
- Eggs: Examine the underside of the carapace for the presence or absence of eggs.
- V-notch status: present or absent
- Cull status: Examine the claws for condition (claws missing, buds, or regenerated).
- Incidence of shell disease: absent, moderate, or severe
- Mortality: alive or dead

Up to 10 Jonah crabs will be measured from each trap, and subsampling may be used if catches exceed 10 individuals in a single trap. The sex of each Jonah crab that is measured will also be recorded. All black sea bass will be measured to the nearest centimeter.

4.4 Ventless Trap Station Data

The following data will be collected during each sampling effort:

- Station number
- Start latitude and longitude
- Start time and date
- Start water depth
- End latitude and longitude
- End time and date
- Wind speed
- Wind direction
- Wave height
- Air temperature
- Bottom water temperature

4.5 Data Management and Analysis

The ventless trap survey will supplement the available pre-construction data on lobster and crab resources in the proposed SFW site. The pre-construction monitoring data will be used to evaluate the spatial and seasonal patterns of relative abundance of lobster and Jonah crab in the Project and control area(s). Sampling during and after construction will allow for quantification of any changes in the relative abundance and demographics of the lobster and crab resources. The use of a reference control site(s) will ensure that regional changes in the abundance and demography of lobsters and crabs are accounted for when assessing the potential impacts of the proposed Project. Analysis of the pre-construction data will be performed in accordance with the BOEM fishery guidelines. The spatial distribution of the lobster and crab resources will be mapped for both years of pre-construction monitoring. Catch per unit effort statistics will be summarized for both lobster and Jonah crab, and length frequency distributions will be examined. Length frequency distributions will also be provided for black sea bass. A Generalized Linear Model (or similar) will be used to examine the influence of biotic and abiotic factors on the catch rates and distribution of lobster and Jonah crab. Spatial and temporal patterns in the biological data for lobsters (shell disease, sex ratios, reproductive status) will be summarized and reported.

5.0 Demersal Fisheries Resource Survey – Ventless Fish Pot

Black sea bass, scup, and tautog are important species in both the commercial and recreational fisheries in southern New England that are typically associated with complex bottom habitats and not often well represented in trawl survey catches. There is also a significant pot fishery for these species in the region. Therefore, a fish pot survey will be a suitable gear type for monitoring these species at SFW. The emphasis on sampling for black sea bass is justified given that this species has Essential Fish Habitat throughout the Project Area and is considerable to be vulnerable to potential habitat disturbance from offshore wind construction and operation activities (Guida et al., 2017).

Fish pots are a transportable, cage-like, stationary fishing gear, which typically use bait as an attractant for target species, along with retention devices to prevent the escape of caught individuals (Suuronen et al., 2012). Fish pots possess many characteristics that are desirable in a sampling gear: they can be highly selective for targeted species, and fish can generally be returned after sampling in healthy condition and with low rates of post-capture mortality (Bjordal, 2002; Pol and Walsh, 2005; ICES, 2006; Rotabakk et al., 2011). Fish pots also provide an alternative survey and harvest method for areas inaccessible to otter-trawling, such as reefs and other hard bottom habitats (ICES, 2009; Petruny-Parker et al., 2015). As static gears, pots exhibit low impact to habitats (Thomsen et al., 2010).

Fish pots, unlike towed nets, do not sample indiscriminately. Pots are often designed to target specific species, or subgroupings of species. This is accomplished through the structural design of the pot openings, the pot holding areas, and the bait selected to attract species. Due to these characteristics, pots do not provide a comprehensive assessment of fish and invertebrates in a study area. However, they do provide important additional sampling data in areas where bottom trawling is not an option.

The SFW fish pot survey will be conducted to determine the spatial scale of potential impacts on the abundance and distribution of demersal juvenile and adult fish, particularly black sea bass, scup, and tautog, within the proposed SFW site.

5.1 Survey Design/Procedures

A Before-After-Gradient (BAG) survey will be conducted at SFW using fish pots to assess the spatial scale and extent of wind farm effects on habitat preferred by structure associated species like black sea bass, scup, and tautog. The survey will be conducted from commercial fishing vessel(s) with scientists onboard to process the catch. For-hire vessels will be selected based on criteria such as experience, safety record, knowledge of the area, and cost. The scientific contractor will apply for a LOA from NOAA Fisheries in order to use the hired fishing vessel(s) as a scientific platform and conduct scientific sampling that is not subject to the Atlantic Coastal Fisheries Cooperative Management Act, Magnuson-Stevens Fishery Conservation and Management Act, and fishery regulations in 50 CFR parts 648 and 697. All survey activities will be subject to rules and regulations outlined under the MMPA and ESA. Efforts will be taken to reduce marine mammal, sea turtle, and seabird injuries and mortalities caused by incidental interactions with fishing gear. All gear restrictions, closures, and other regulations set forth by take reduction plans (e.g., Harbor Porpoise Take Reduction Plan, Atlantic Large Whale Reduction Plan, etc.) will be adhered to as with typical scientific fishing operations to reduce the potential for interaction or injury.

5.2 Sampling Stations

To accomplish the goals of this survey, data will be collected before, during construction, and after installation and operation of SFW using a BAG survey design. This RFP covers the pre-construction sampling. The study design will sample at increasing distances from turbine locations to examine the spatial scale and effects of construction and operation of a turbine on the surrounding habitat and associated fish species (Ellis and Schneider, 1997). A trawl of 25 fish pots will be placed starting approximately 50 meters from a proposed turbine location extending outward to approximately 1150 meters. Six turbine locations will be randomly selected for sampling each year, and those turbines and trawl positions will remain fixed for the duration of the survey. In order to minimize conflicts with other fishermen in the region, the location of trawl positions may be subject to seasonal location of fixed fishing gear (e.g., gill nets, other commercial fish pots). If based on the professional judgement of the captain a trawl position is found to have poor conditions for setting fish pots it may be moved to an alternative location that is selected at random.

The proposed survey design eliminates the need for a reference area as is typical in a BACI design. Sampling effort is focused on sampling sites along a spatial gradient within the work area, rather than using a control location that may not be truly representative of the conditions within the work area (Methratta, 2020). This design also allows for the examination of spatial variation and does not assume homogeneity across sampling sites (Methratta, 2020).

Each trawl line will be composed of 25 fish pots spaced ~45 meters apart. Each of the 6 turbines that are sampled will have one trawl extending the sampling distance (~1150 meters) with 150 total pots sampled per survey. To minimize gear interactions with other user groups in these areas, the lead scientist will work with the captain to ensure that the gear is set in accordance with local fishing practices. Exact locations of sampling within the Project Area will be further determined by using any additional substrate mapping as well as through consultation with the contracted fisherman to ensure that the areas can be sampled effectively and safely.

5.3 Fish Pot Methods

The fish pot survey will be conducted using typical rectangular fish pots commonly used in Rhode Island and Massachusetts fisheries and as used in other regional pot surveys (R. Balouskus, RIDEM, pers comm.). The ventless fish pots measure 43.5 inches long, 23 inches wide, and 16 inches high and are made from 1.5-inch coated wire mesh. Each pot will be baited with whole clam bellies and the entire trawl allowed to soak for 24 hours. Sampling will take place once per month from April through October for two years prior to the start of construction. The Contractor selected to carry out the survey will take efforts to ensure that the timing of sampling is approximately consistent within each month, to the extent practicable. Soak time will remain consistent throughout the duration of the survey. Each survey event will be managed by a team of qualified scientists including a lead Scientist with experience performing fisheries research. The catch will be removed from the pots by the boat crew for processing. The Lead scientist will be responsible for collection of data and data recording.

Fish collected in each pot will be identified, weighed, and enumerated. The following data elements will be recorded for each tow; total biomass and total number of organisms caught, number and biomass caught for each species, species diversity, and length frequency data for all species caught.

The catch will be sorted by species. All specimens, fishes and invertebrates, are sorted by species and size (if appropriate) into buckets or fish totes as needed. This process continues until all specimens are sorted, and the chief biologist verifies that the sorting areas are clear of all specimens. Notwithstanding sub-sampling procedures, up to 50 individuals of each species/size are measured and the rest counted. Fork length is recorded for all fishes with a forked tail. Total length is measured for all other fishes. Dominant invertebrate species will be measured as follows: crabs (carapace width) and lobsters (carapace length), and miscellaneous invertebrates (e.g., worms, hermit crabs, snails) will be counted but not measured.

5.4 Hydrographic and Atmospheric Data

Hydrographic data will be collected using a YSI 6820 V2 multi parameter sonde coupled with a YSI 650 MDS display system (or similar). The sonde is lowered overboard and held in surface waters until the instrument equilibrates. Water temperature (degrees C), dissolved oxygen concentration (mg/l), and salinity (ppt) data are recorded for the near-surface waters. The sonde is then lowered to near-bottom and water temperature, dissolved oxygen, and salinity data are recorded. Measurements are recorded for each station at the end of each haul. A temperature logger (Onset TidBit or similar) will be attached to the first trap in each trawl to record water temperature continuously throughout the monitoring period.

Sea state and weather conditions are recorded from visual observations. Air temperature may be downloaded from a local weather station if not available onboard.

5.5 Ventless Fish Pot Station Data

The following data will be collected during each sampling effort:

- Station number
- Start latitude and longitude
- Start time and date
- Start water depth
- End latitude and longitude
- End time and date
- Wind speed
- Wind direction
- Wave height
- Air temperature
- Surface and bottom water temperature, salinity, and dissolved oxygen

5.6 Data Entry and Reporting

Data will be transcribed from hard copy datasheets into electronic worksheets. The data sheets will be reviewed for data entry errors prior to importing into a relational database. Quality control checks will be performed on database tables by running standardized, systematic queries to identify anomalous data values and input errors. Species names (common and scientific) are verified and tabulated for consistency. All data used in analysis will be exported from the relational database.

Annual reports containing catch data will be prepared after the conclusion of each year of sampling and shared with State and Federal resource agencies. One final report will also be produced synthesizing the findings of the pre- and post-construction evaluations.

5.7 Data Analysis

The BAG survey design will allow for characterization of pre-construction community structure of fish species associated with complex bottom habitats. By continuing sampling during and after construction the survey will allow quantification of any substantial changes in species presence, absence, and abundance associated with installation and operation of wind turbines in the SFW site. The use of a BAG design with sampling at increasing distances from the turbine foundation will for the examination of the spatial scale of impacts on the surrounding habitat and associated fish species. The survey plan allows the comparison of the catch of structure-associated fish species between the before and after construction periods. Data analysis will be performed in accordance with the BOEM fishery guidelines.

An adaptive sampling strategy is being proposed as part of the monitoring plan. Upon completion of the first year of the survey, a power analysis will be conducted using the data collected in the first year, and any other available regional data, to determine if sampling levels need to be adjusted in subsequent years.

6.0 Acoustic Telemetry

Passive acoustic telemetry can monitor animal presence and movements across a range of spatial and temporal scales. For instance, each acoustic receiver provides information on the fine-scale (tens to hundreds of meters) residence and movement of marine organisms. Acoustic receivers also offer continuous monitoring, allowing for behavior, movements, and residence to be investigated at a fine temporal scale (e.g., diel, tidal, etc.). By leveraging observations collected across individual receivers, and receiver arrays, telemetry can also monitor animal presence and movement over a broad spatial and temporal extent. Therefore, passive acoustic telemetry is an ideal technology to not only collect pre-construction data on species presence within WEAs, but also to monitor and evaluate short and long-term impacts of wind energy projects on species presence, distribution, and persistence.

The use of passive acoustic telemetry has grown dramatically over the past decade and continues to grow each year (Hussey et al. 2015). As a result of this rapid growth, hundreds to thousands of acoustic receivers are deployed each year in the northwest Atlantic from the Gulf of St Lawrence to the Gulf of Mexico, each of which is capable of detecting the thousands of active transmitters that are currently deployed on at least 40 species including, among many others, sturgeon, striped bass, sea turtles, sharks, bluefin tuna, and black sea bass.

6.1 Ongoing and Planned Research

Ørsted will coordinate with, and contribute to, ongoing and planned acoustic telemetry projects that are being carried out in and around the SFW site. There is an ongoing BOEM-funded study that is using passive acoustic telemetry to monitor the seasonal distribution and spawning activity of Atlantic cod on and around Cox Ledge, which lies within the SFW work area (Figure 5). This Project includes scientists from the Massachusetts Division of Marine Fisheries, the UMass Dartmouth School for Marine Science and Technology, Rutgers University, the Nature Conservancy, Woods Hole Oceanographic Institute, and the NEFSC. To date, 33 adult cod have been tagged with Vemco V16-4H acoustic transmitters, and additional tagging trips are planned for the spring and summer of 2020 to deploy the remaining transmitters (n=67). All tagging trips have been conducted on local charter and party recreational fishing vessels.

The movements and residency patterns of tagged cod are being monitored using fixed-station passive acoustics receivers, as well as a receiver that is attached to an autonomous glider. Ten acoustic receivers were deployed from a commercial gillnet vessel in November 2019, and the receiver array will remain in the water until at least May 2021. The autonomous glider allows for tagged fish to be detected over a wider area than is possible using the fixed-station receivers. In addition, the glider also collects valuable environmental data including temperature, dissolved oxygen, and turbidity. In addition to the acoustic receiver and environmental sensors, the glider is also equipped with a Passive Acoustic Monitoring device, which is used to record and document the vocalizations of whale species that are present in the study area. Further, all of the glider data is available in near real-time on the web (http://dcs.whoi.edu/cox1219/cox1219_we16.shtml). The glider deployments were scheduled to coincide with the presumed peak spawning season for Atlantic cod in southern New England. The autonomous glider was deployed in December 2019 and remained in the water until March 20th, 2020. The glider will be deployed again during the next two winters (December 2020-March 2021, and December 2021-March 2022).

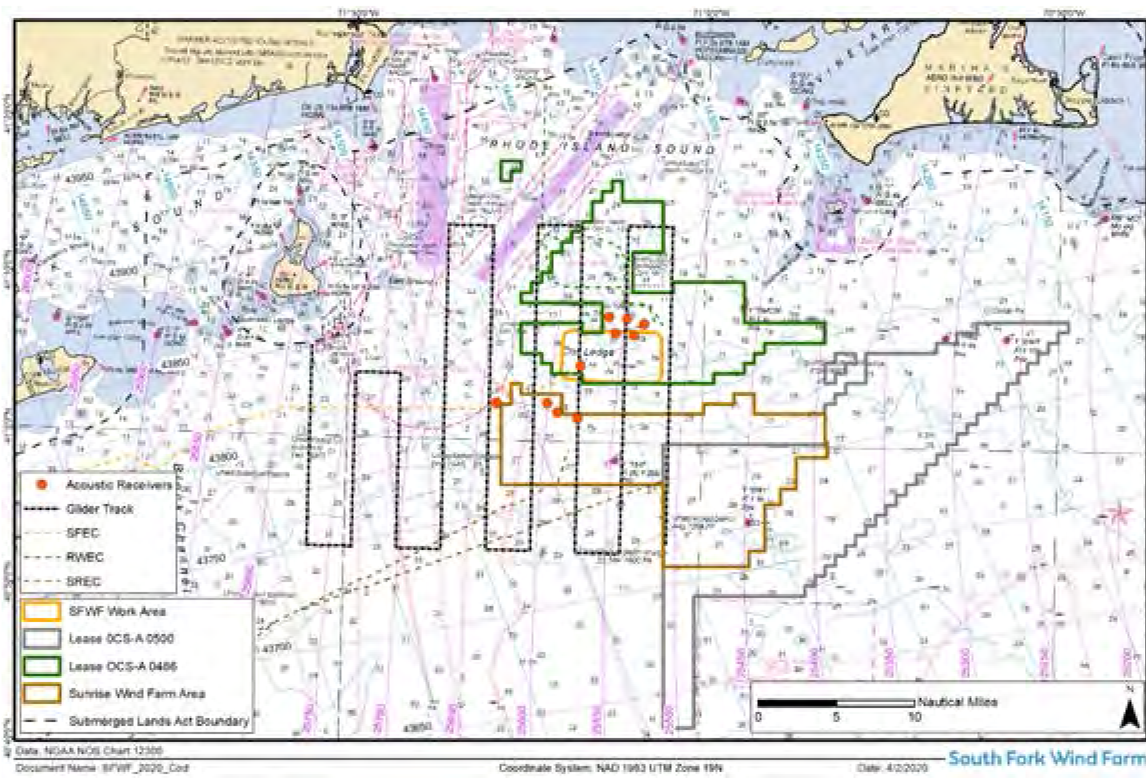


Figure 5. Study site for the Atlantic cod acoustic telemetry study, including the location of the fixed-station acoustic receivers. The general track of the autonomous glider is also shown.

A second acoustic telemetry study, beginning in the summer of 2020 and running through 2021, will examine the presence and persistence of highly migratory species (HMS) in popular recreational fishing grounds in the southern New England WEAs. INSPIRE Environmental has partnered with the Anderson Cabot Center for Ocean Life (ACCOL) at the New England Aquarium to use passive acoustic telemetry to monitor the pre-construction presence and persistence of bluefin tuna, blue sharks, and shortfin Mako sharks in the southern New England WEAs. These three species have been identified as three of the most commonly captured and targeted species by the offshore recreational community in southern New England (NOAA, 2019). This study will deploy 15 acoustic receivers at three popular recreational fishing sites within the WEAs identified through a previous recreational fishing survey carried out by the ACCOL (J. Kneebone, pers. comm.). The receivers will be deployed strategically, in conjunction with the Atlantic cod receiver array, to maximize detection coverage for both projects. For-hire tagging trips will be conducted collaboratively with the recreational fishing community to target and tag 20 individuals of each of the three HMS species listed above.

As part of the pre-construction monitoring, Ørsted is committed to using acoustic telemetry to collect high resolution information on the presence, distribution, and behavior of commercially and recreationally important species in and around SFW. These commitments will strengthen ongoing telemetry projects and contribute more broadly to regional telemetry research in the northwest Atlantic.

6.2 Acoustic Telemetry Methods

Ørsted will contribute to regional acoustic telemetry efforts by providing additional funding to support these active and planned studies. We have already reached out to principal investigators of the Atlantic cod project and the HMS telemetry studies and received confirmation of their willingness to work together to share detection data and design our receiver arrays to maximize the area that is monitored within SFW. This funding may include the purchase of acoustic transmitters to enhance ongoing tagging efforts for Atlantic cod and highly migratory species and would occur in coordination with these projects. Individuals would be tagged using a range of appropriate (species dependent) Vemco acoustic transmitters. Additional transmitters could be allocated to species that are of regional importance as identified by area researchers, industry stakeholders, and state and federal agencies. Where appropriate, funding may be provided to support additional vessel charters to deploy acoustic transmitters.

Further, Ørsted will provide support for the deployment and maintenance of additional acoustic receivers in SFW. Vemco VR2-AR 69kHz acoustic receivers (Vemco Division, InnovaSea Systems, Inc., Nova Scotia, Canada) will be deployed within SFW to monitor species outfitted with acoustic transmitters. In collaboration with the ongoing telemetry studies, additional receivers may be deployed strategically within SFW in order to increase the spatial extent of monitoring in and around the SFW area, while minimizing potential gear conflicts with local fishing effort. If deployed, the additional receivers will remain in the water year-round and one to two trips per year on board for-hire commercial fishing vessels will be made to maintain the receiver array and download collected data. As part of the ECO-PAM project, an acoustic receiver will also be deployed near SFW (41.06N 70.83W). Receivers will be rigged using standard procedures outlined by Vemco for benthic deployment (https://www.vemco.com/wp-content/uploads/2015/01/vr2ar-deploy-tips.pdf).

Vemco VR2-AR are the most suitable receiver models for passively monitoring species in an offshore environment and have been used previously in BOEM-funded telemetry projects in the mid-Atlantic (Haulsee et al., 2020). These receivers have several advantages that will maximize the likelihood of having a successful deployment. VR2-ARs have the unique ability to be remotely retrieved following extended deployment on the sea floor and are equipped with a system that allows researchers to communicate with the unit to monitor receiver status (e.g., health, tilt angle, temperature, battery life, remaining memory) and gather summary detection data (e.g., total number of detections, number of detections from specific transmitters) without bringing the receiver to the surface. This ability to deploy and monitor acoustic receivers without the need for surface retrieval systems (i.e., ropes and buoys) is advantageous for offshore work since receivers with surface mooring gear can sometimes be lost due to ship strikes or rough weather. In addition, the absence of surface mooring gear will eliminate the potential that large marine megafauna (i.e., whales and sea turtles) become entangled in the mooring line. Lastly, VR2-AR receivers are equipped with a V16-like transmitter that can be used to locate potentially lost units with a manual VR100 receiver and log temperature data throughout the entirety of their deployment.

Additional glider deployments may be funded to expand the spatial and temporal coverage of acoustic telemetry monitoring, collect detailed oceanographic data, and record spatially and temporally specific data on the presence of marine mammals in the area. Glider deployments are planned for the winter of 2021 and 2022 as part of the ongoing Atlantic cod telemetry project. Additional glider deployments in the summer and fall, when HMS species are most commonly observed in and around SFW would provide valuable information to supplement data collected by the fixed station receiver array. The glider deployments would also provide high resolution information on the presence and distribution of whale species in the Project Area, which would supplement ongoing monitoring studies (e.g., aerial surveys). Further, the glider would record vertical profiles of oceanographic data (e.g., temperature, turbidity, dissolved oxygen) during the months when the water column is stratified, which would be shared with oceanographic researchers (e.g., NERACOOS, MARACOOS) to help inform regional oceanographic models.

6.3 Data Analysis and Data Sharing

The resulting detection data downloaded from acoustic receivers will be analyzed with the overall goal of establishing pre-construction information on species presence and persistence in SFW. Short- and long-term presence, site fidelity (i.e., residency/persistence), fine- and broad-scale movement patterns, and inter-annual presence at SFW (i.e., whether individuals return to the receiver array each year) will be examined. Any detection data obtained through our participation in regional telemetry data sharing networks will be incorporated into this analysis, particularly to examine the distribution and movements of species beyond the confines of SFW. Deliverables resulting from the proposed study activities will include metadata of tagged individuals (e.g., species, sex, size, tagging location) as well as detailed detection history plots for each tagged individual that depict all detections logged for an animal over the course of a year. Summary tables and figures will be generated that describe: the number of times each fish was detected by receivers in SFW, the detection history for each fish, the total number of receivers it was detected on, movements, and monthly patterns in presence and persistence. In addition to the local-scale acoustic monitoring achieved by the proposed receiver array, broad-scale movement data will be accomplished through participation in regional telemetry data sharing programs, in an attempt to obtain detection data from our tagged animals wherever else they are detected in the greater Atlantic region.

All detection data recorded by the acoustic receivers in this Project will be distributed to researchers through participation in regional telemetry networks such as the Ocean Tracking Network, the Atlantic Cooperative Telemetry Network, the Florida Atlantic Coast Telemetry Network, and the Animal Tracking Network. This Project will capitalize on direct connections with researchers who are actively using passive acoustic telemetry to study marine organisms and will be able to determine the species that carries any transmitter that is detected by the receiver array. We will compile any detection data that we collect for transmitters that are not deployed as part of the proposed Project and disseminate that information to the tag owners (it is the policy of regional data sharing programs that the ‘owner’ of the data is the entity that purchased and deployed the transmitter, not the entity that detected it on their receiver). We will also approach each transmitter's owner to request the inclusion of their data (i.e., metadata on the species detected, number of detections, amount of time the animal was detected in our receiver array, etc.) in any analyses performed. We will also coordinate and cooperate with other researchers and developers who may deploy acoustic receivers elsewhere in the southern New England WEAs to further expand the spatial extent over which our tagged individuals are monitored in the WEAs. This collaboration will allow for a more holistic examination on the cumulative impacts of wind farm development on the distribution and migratory behaviors of marine taxa. Ultimately, participation in these large data sharing networks will increase both the spatial and temporal extent of monitoring for species tagged as part of this research effort and permit the collection of data on the presence and persistence of other marine species in around SFW at no additional cost.

7.0 Benthic Survey – Sediment Profile Imaging – Plan View and Video

The SFW benthic survey will be conducted not more than six months prior to construction and again after construction to determine the spatial scale of potential impacts on benthic habitats and biological communities within the proposed SFW site and along the South Fork Export Cable (SFEC), and to examine potential impacts on scallops along the SFEC.

Benthic assessments are necessary for both seafloor characterization as well as monitoring potential impacts on Essential Fish Habitat (EFH). Areas designated as EFH are important to a wide range of finfish and shellfish species for spawning, feeding, and refuge. Turbine foundations and scour mats provide area for the settlement of sessile invertebrates that can spread to the seafloor over time changing the surrounding habitat (Bishop et al., 2017). For instance, sediment grain size can change along with the densities of macrobenthic invertebrates (Coates et al., 2014). It is important to monitor these effects to understand and minimize the impacts on EFH in the project area.

A Sediment Profile and Plan View Imaging (SPI/PV) survey will be conducted within the project area and along proposed cable routes. This survey will characterize the geological (sediment size and type) and benthic (animal habitat) characteristics of the areas with potential effects from construction and operations. SPI and PV will be used to provide an integrated, multi-dimensional view of the benthic and geological condition of seafloor sediments and characterize benthic habitats as a baseline not more than six months before construction and not more than six months after operation has begun, providing neither period is during the winter. The SPI and PV cameras collect high-resolution imagery over several meters of the seafloor (plan view) as well as the sediment–water interface (profile) in the shallow seabed. SPI/PV surveys have been conducted within the SFW and along the SFEC to provide detailed assessment of benthic habitat for EFH consultation (Deepwater Wind South Fork 2020).

Most of the existing benthic data from the SFW area and the SFEC were collected in summer, when biomass and diversity of benthic organisms is greatest (Deepwater Wind South Fork 2020, Stokesbury, 2013, 2014; NYSERDA, 2017). In contrast to fish communities and harvestable benthic species, benthic habitats in the NE Atlantic are generally stable in the absence of physical disturbance or organic enrichment (Theroux and Wigley 1998, Reid et al. 1991). A single benthic survey conducted within six months of the construction activity can provide an accurate representation of benthic habitats prior to potential disturbance.

7.1 Survey Design/Procedures

A BAG survey will be conducted at SFW using fixed stations to assess the spatial scale and extent of wind farm effects on benthic habitat. The survey will be conducted from commercial research vessel(s) with scientists onboard to collect images utilizing a SPI/PV camera system. This system was utilized exclusively for ground-truth imagery to support mapping benthic habitat within SFW. Collecting seafloor imagery does not require disturbance of the seafloor or collection of physical samples. For-hire vessels will be selected based on criteria such as experience, safety record, knowledge of the area, and cost. All survey activities will be conducted with strict adherence to scientific health and safety protocols to reduce the potential for environmental damage or injury.

At least four SPI/PV replicates will be collected at each station. The three replicates with the best quality images from each station will be selected for analysis.

A V102 Hemisphere vector antenna will be deployed on the vessel to allow for accurate vessel heading as well as a differential position accuracy to within a meter. During mobilization the navigator will conduct a positional accuracy check on the antenna. This will be done by placing the antenna on a known GPS point and ensuring the antenna's position falls within a meter of the known coordinates.

During operations HYPACK Ultralite software will receive positional data from the antenna in order to direct the vessel to sampling stations. Once the vessel is within a 7.5-meter radius of the target location, the SPI/PV camera system will be deployed to the seafloor. As soon as the camera system has made contact with the seafloor the navigator will record the time and position of the camera electronically in HYPACK as well as the written field log. This process will be repeated for a minimum of four SPI/PV replicates per sampling station. After all stations have been surveyed the navigator will export all recorded positional data into an Excel sheet. The Excel sheet will include the station name, replicate number, date, time, depth, and position of every SPI/PV replicate.

7.2 Sampling Stations – Turbine Foundations

To accomplish the goals of this survey, data will be collected before and after installation and operation of SFW using a BAG survey design with statistical evaluation of the differences (Underwood, 1994; Methratta, 2020). The selection of a BAG design is based on an understanding of the complexities of habitat distribution at South Fork and an analysis of benthic data results from European wind farms and the Rodeo study at BIWF (Coates et al., 2014; Dannheim et al., 2019; Degraer et al., 2018; HDR, 2019; LeFaible et al., 2019; Lindeboom et al., 2011)

The study design will sample at increasing distances from turbine locations to examine the spatial scale and effects of construction and operation of a turbine on the surrounding benthic habitat (Ellis and Schneider, 1997). Four radial transects of SPI/PV stations will be established to the north, south, east, and west of five selected turbine locations. A current meter record collected for the RI Ocean Special Area Management Plan (Ocean SAMP) indicated that monthly mean currents near SFW are general easterly (to the west) (Ullman and Codiga, 2010). Pre-construction transects will begin at the center point of the planned foundation with two additional stations at equal intervals up to the maximum planned extent of the scour mat and then at intervals of 15, 25, 50, 100, 200, and 300 meters extending outward. Post-construction transects will begin at the edge of the scour mat and at intervals of 15, 25, 50, 100, 200, and 300 meters extending outward (Figure 6). Because current research indicates that effects of turbines on the benthic environment occurs on a local scale (e.g., Lindeboom et al., 2011; Coates et al., 2014; Degraer et al., 2018), sampling will be more intense closer to the turbine foundation. In the Belgian part of the North Sea, gradient sampling of benthic habitat within wind farms is conducted at close stations and far stations that are up to 500 m away from the turbine foundations (LeFaible et al., 2019). However, recent unpublished data from Belgium indicates some level of enrichment has been recorded between 200-250 m after eight years (personal comm. S. Degraer, 4/29/2020). Five turbine locations will be selected for sampling based on the habitat distribution adjacent to each foundation, and turbines that are part of the fish pot surveys will not be considered in order to avoid interaction between the two surveys (Figure 7). Habitat types mapped within SFW include glacial moraine, coarse sediment, sand and muddy sand, and a discrete area of mud and sandy mud at the northern boundary. The selected turbines and transect positions will remain fixed for the duration of the survey.

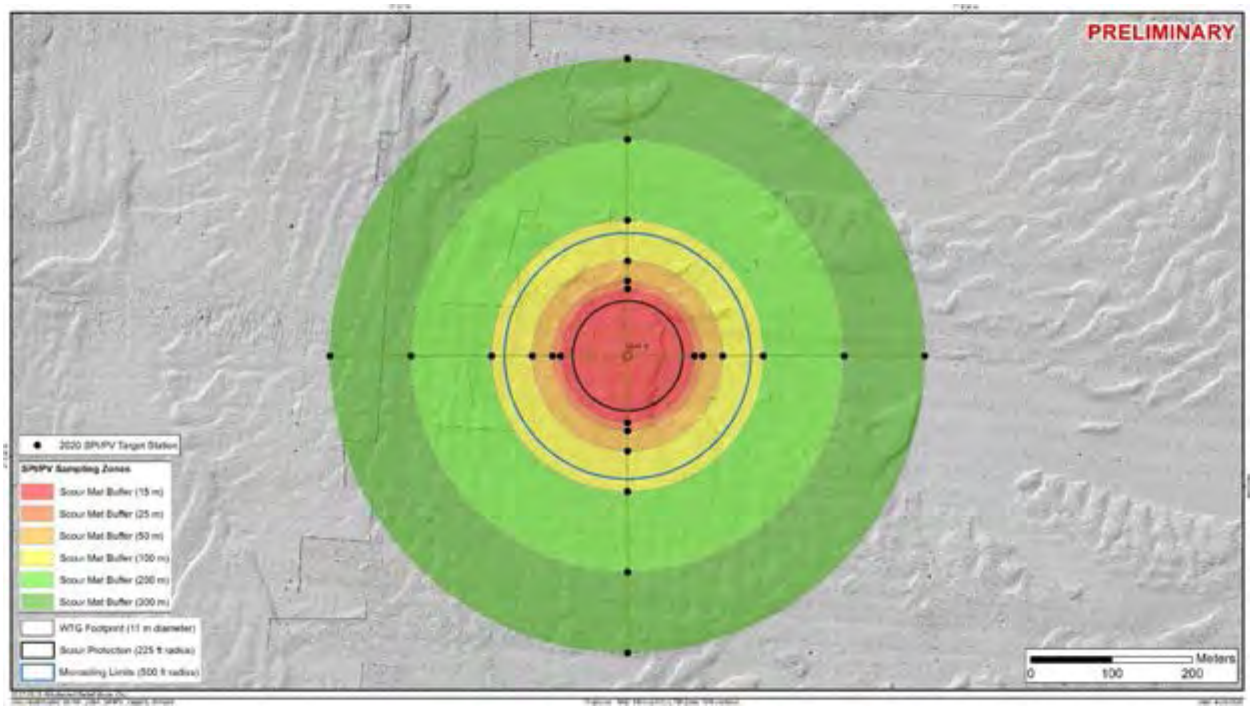


Figure 6. Proposed benthic survey sampling distances. The rings outside the scour mat protection (buffer) represent areas with temporary disturbance with no permanent structures.

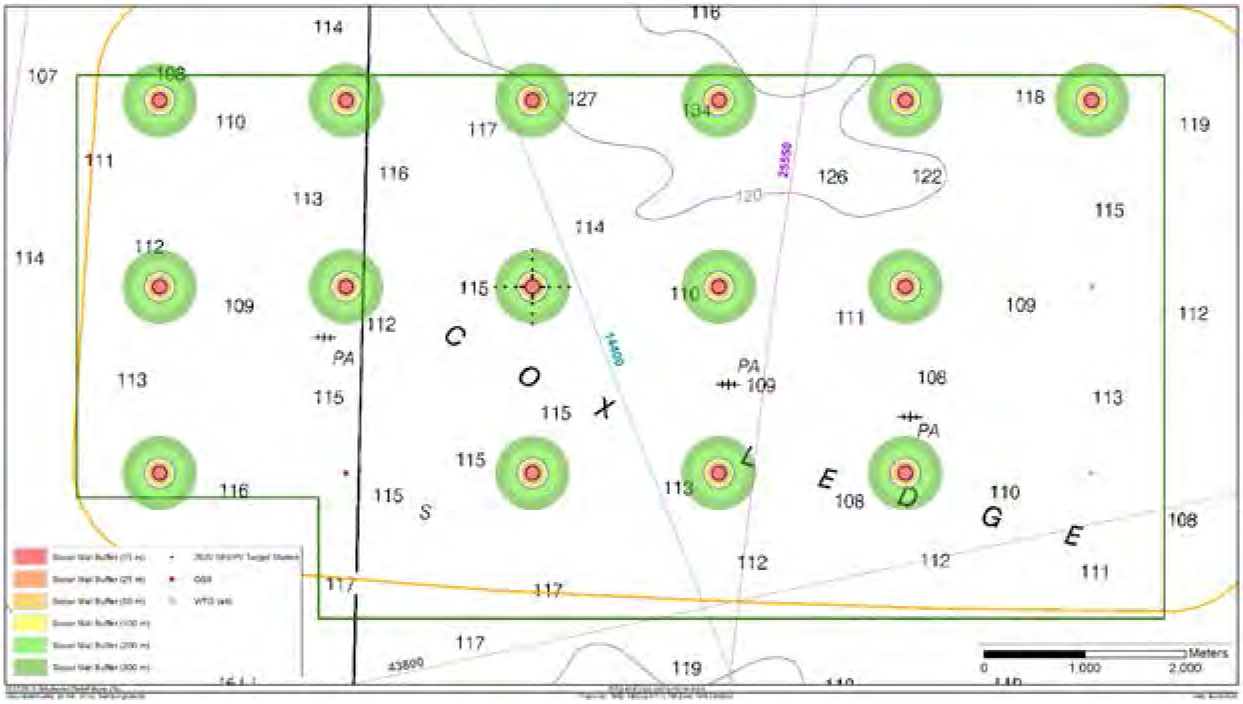


Figure 7. Proposed benthic survey sampling design. Five turbine foundations will be selected from this set, with consideration and coordination with fish pot survey planning. Note colored rings outside the scour protection represent areas with only temporary disturbance and no permanent structures.

The proposed BAG survey design eliminates the need for a reference area, which is a typical feature in a BACI design. In contrast, sampling effort in a BAG design is focused on sampling along a spatial gradient within the area of interest rather than using a control location that may not be truly representative of the conditions within the area of interest (Methratta, 2020). This design also allows for the examination of spatial variation and does not assume homogeneity across sampling sites (Methratta, 2020).

7.3 Sampling Stations – Export Cable (SFEC)

To accomplish the goals of this survey, data will be collected before and after installation and operation of the SFEC using a BACI experimental design for direct effects, with quantitative comparisons made before and after construction and between control and impact area (Underwood, 1994). A control site (or multiple control sites) will be identified with similar bottom types, benthic habitat, and water depth as the SFEC. A BACI design is appropriate for this survey component because the export cable is a linear feature with very similar habitat of primarily mobile sands with sections of mobile gravelly sands and a low density of boulders along the length of the corridor and the only gradient of potential disturbance associated with cable installation covers only a very short distance to either side of the cable (most impacts are anticipated within 100 m, maximum distance of potential impact is 340 m; Deepwater Wind South Fork, 2020). The study design includes sampling at fixed intervals along the SFEC comparable to the sampling interval used to collect baseline data (1.9 km) from the project site to the New York State (NYS) territorial waters (Figure 8). An additional survey will be conducted within NYS waters. The objectives of the study are to examine the effects of installation and operation of an export cable on the benthic habitat and scallop abundance (Ellis and Schneider, 1997). In areas where VTR data (2015-2016) indicate a high density of scallop dredging activity, sampling density will be doubled to one station per kilometer (Figure 9). Reference stations will be established 1 km from the cable route in two areas, one within the area of high scallop dredging activity and one within an area with low or no scallop dredging activity (Figure 9).

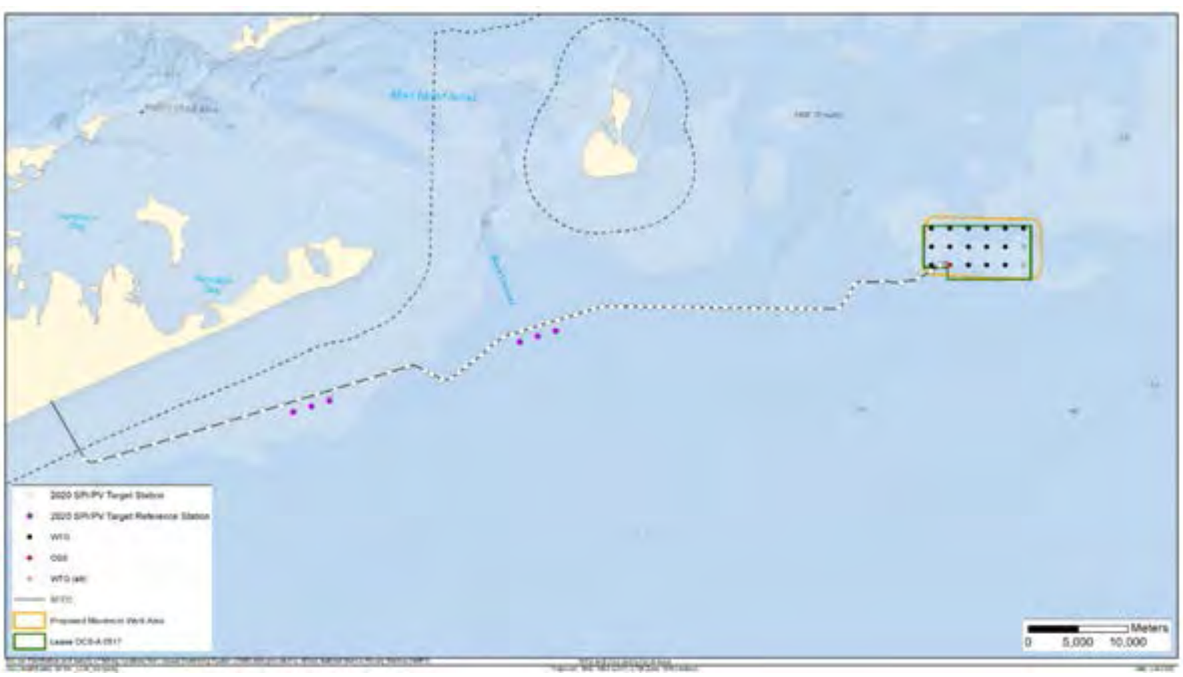


Figure 8. Proposed benthic survey sampling design along the SFEC with white dots indicating SPI/PV stations situated along the SFEC and purple dots indicating reference stations ~1km from the SFEC.

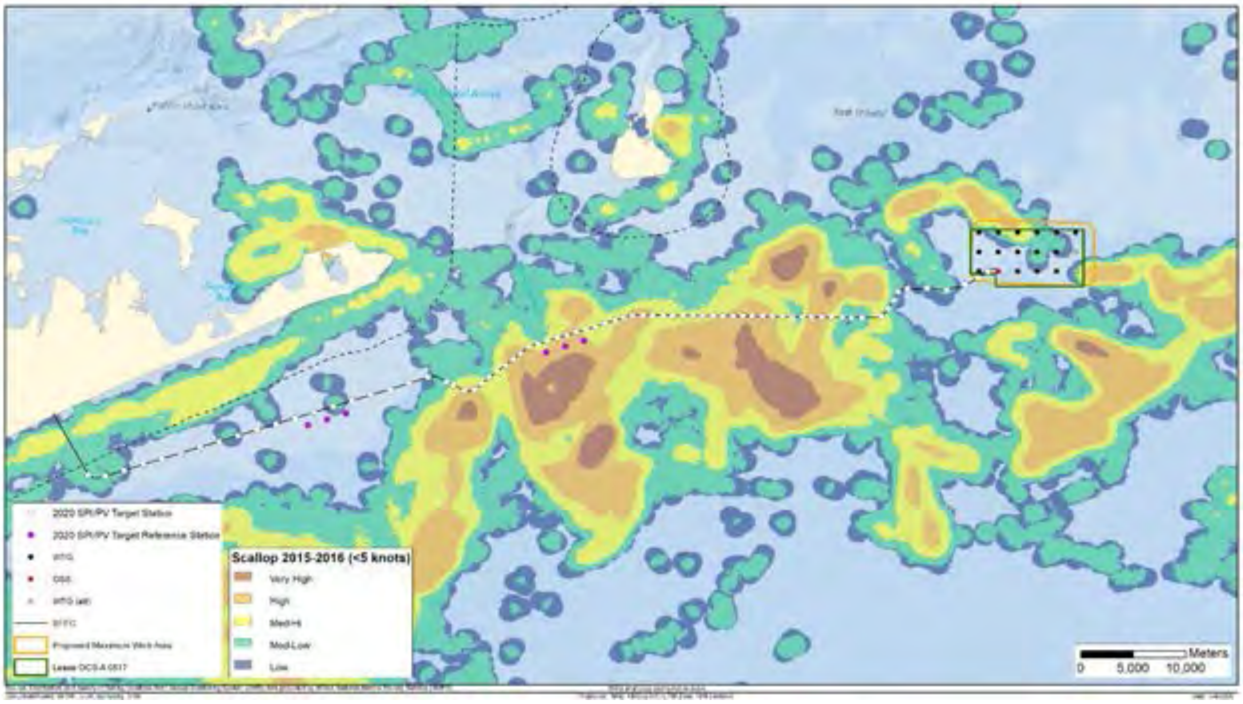


Figure 9. Proposed benthic survey sampling design along the SFEC

7.4 SPI/PV Methods

Acquisition and quality assurance/quality control of high-resolution SPI images will be accomplished using a Nikon D7100 digital single-lens reflex (DSLR) camera with a 24.1-megapixel image sensor mounted inside an Ocean Imaging Model 3731 pressure housing system. An Ocean Imaging Model DSC PV underwater camera system, using a Nikon D7100 DSLR, will be attached to the SPI camera frame and used to collect PV photographs of the seafloor surface at the location where the SPI images are collected. The PV camera housing will be outfitted with two Ocean Imaging Systems Model 400 37 scaling lasers. Co-located SPI and PV images will be collected during each “drop” of the system. The ability of the PV system to collect usable images is dependent on the clarity of the water column.

The Field Lead Scientist will ensure that samples are taken according to the established protocols and that all forms, checklists, field measurements, and instrument calibrations are recorded correctly during the field sampling.

7.5 Data Entry and Reporting

Following data entry, all spreadsheets will be proofread using the original handwritten field log. This review will be performed by someone other than the data entry specialist.

Computer-aided analysis of SPI/PV images will be conducted to provide a set of standard measurements to allow comparisons among different locations and surveys. Measured parameters for SPI and PV images will be recorded in Microsoft Excel© spreadsheets. These data will be subsequently checked by senior scientists as an independent quality assurance/quality control review before final interpretation is performed. Spatial distributions of SPI/PV parameters will be mapped using ArcGIS.

During field operations, daily progress reports will be reported through whatever means are available (email, text, phone). Upon completion of the survey all analyzed images as well as a data report with visualizations will be provided.

7.6 Data Analysis

SPI/PV provides an integrated, multi-dimensional view of the benthic and geological condition of seafloor sediments and will support achievement of project goals and objectives. The SPI and PV cameras are state-of-the-art monitoring tools that collect high-resolution imagery over several meters of the seafloor (plan view) and the typically unseen, sediment–water interface (profile) in the shallow seabed. PV images provide a much larger field-of-view than SPI images and provide valuable information about the landscape ecology and sediment topography in the area where the pinpoint "optical core" of the sediment profile is taken. Unusual surface sediment layers, textures, or structures detected in any of the sediment profile images can be interpreted considering the larger context of surface sediment features. The scale information provided by the underwater lasers allows accurate density counts or percent cover of attached epifaunal colonies, sediment burrow openings, or larger macrofauna or fish which may have been missed in the sediment profile cross section. A field of view is calculated for each PV image and measurements taken of parameters outlined in the survey workplan.

Seafloor geological and biogenic substrates will be described from SPI/PV using the Coastal and Marine Ecological Standard (CMECS; FGDC, 2012). The Substrate and Biotic components of CMECS will be used to characterize sediments and biota observed. The SPI/PV image analysis approach is superior to benthic infaunal sampling approaches because SPI/PV is more cost effective and more comprehensive. Analysis costs for benthic biological characterization using SPI/PV can be up to 75% lower than those of infaunal abundance counts derived from grab samples. Infaunal abundance assessments provide a limited view of benthic conditions whereas SPI/PV provides a more holistic assessment of the benthos that includes the relationship between infauna and sediments (Germano et al., 2011). Although infaunal abundance values are not generated from SPI/PV analysis, lists of infaunal and epifaunal species observed in SPI/PV images, the percent cover of attached biota visible in PV images, presence of sensitive and invasive species, and the infaunal successional stage (Pearson and Rosenberg, 1978; Rhoads and Germano, 1982; and Rhoads and Boyer, 1982) will be provided as part of the benthic biological assessment. Additionally, the benthic habitat types observed in the SPI/PV survey of the project area will be described. Differences in abiotic and biotic composition of habitats will be compared between pre- and post-construction surveys. In particular composition and total percent cover of attached fauna on the scour mat and changes in benthic community with distance from the scour mat will be evaluated.

7.7 Regional Comparable Datasets

SPI/PV surveys have been conducted for the Block Island, South Fork, Revolution, and Sunrise Wind Farms, and their respective cable routes. A SPI/PV survey was also conducted in Narragansett Bay near the proposed cable landing site for the Baystate Wind Farm. Vineyard Wind has a drop camera survey planned for both of their offshore wind leases. The drop camera survey will be conducted using the methods developed by the UMASS Dartmouth School for Marine Science & Technology (SMAST) as part of a regional sea scallop survey (Bethoney and Stokesbury, 2018). The method has been utilized for other image-based surveys and is appropriate for this use. A camera system is dropped to the seafloor and samples four quadrats at defined stations in an area and captures digital images analogous to the PV images outlined above.

8.0 References

Bethoney, N.D. and K.D.E. Stokesbury. 2018. Methods for Image-based Surveys of Benthic Macroinvertebrates and Their Habitat Exemplified by the Drop Camera Survey for the Atlantic Sea Scallop. J Vis Exp. 2018; (137): 57493.

Bishop, M.J., M. Mayer-Pinto, L. Airoldi, L.B. Firth, R.L. Morris, L.H.L. Loke, S.J. Hawkins, L.A. Naylor, and R.A. Coleman. 2017. Effects of ocean sprawl on ecological connectivity: impacts and solutions. Journal of Experimental Marine Biology and Ecology 492: 7-30.

Bjordal, Å. 2002. The Use of Technical Measures In Responsible Fisheries: Regulation of Fishing Gear in K. Cochrane (ed.), A Fishery Manager's Guidebook – Management Measures and Their Application. FAO Fisheries Technical Paper 424, Rome, Italy.

BOEM (Bureau of Ocean Energy Management). 2013. Guidelines for providing information on fisheries for renewable energy development on the Atlantic outer continental shelf pursuant to 30 CFR Part 585. Office of Renewable Energy Programs. August 13, 2013.

Bonzek, C. F., J. Gartland, D. J. Gauthier, and R. J. Latour. 2008. Northeast Area Monitoring and Assessment Program (NEAMAP) Data Report Fall 2007 – Fall 2012. Award Number Na12NMF4540017. 274 pp.

Burnett, J., L. O'Brien, R.K. Mayo, J. Darde, and M. Bohan. 1989. Finfish maturity sampling and classification schemes used during Northeast Fisheries Center bottom trawl surveys, 1963–1989. NOAA Tech. Mem. NMFS-F/NEC, vol. 76. 14 p.

Collie, J. and J. King. 2016. Spatial and temporal distributions of lobsters and crabs in the Rhode Island Massachusetts wind energy area. OCS Study BOEM 2016-073. 58pp.

Coates, D.A., Y. Deschutter, M. Vincx, and J. Vanaverbeke. 2014. Enrichment and shifts in macrobenthic assemblages in an offshore wind farm area in the Belgian part of the North Sea. Marine Environmental Research, 95: 1–12.

Dannheim, J., L. Bergström, S.N.R. Birchenough, R. Brzana, A.R. Boon, J.W.P. Coolen, J. Dauvin, I. De Mesel, J. Derweduwen, A.B. Gill, Z.L. Hutchison, A.C. Jackson, U. Janas, G. Martin, A. Raoux, J.Reubens, L. Rostin, J. Vanaverbeke, T.A. Wilding, D. Wilhelmsson, and S. Degraer. 2019. Benthic effects of offshore renewables: identification of knowledge gaps and urgently needed research. ICES Journal of Marine Science 77: 1092–1108.

Deepwater Wind South Fork. 2020. Construction and Operations Plan, South Fork Wind. Prepared by Jacobs Engineering Group Inc., Providence, RI. Submitted to the Bureau of Ocean Energy Management, Sterling, VA. Revision 3. February 2020.

Degraer, S., Brabant, R., Rumes, B., and Vigin, L. 2018. Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea: Assessing and Managing Effect Spheres of Influence. Royal

Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management, Brussels, Belgium. 136 pp.

Ellis, J. I., and Schneider, D. C. 1997. Evaluation of a gradient sampling design for environmental impact assessment. Environmental Monitoring and Assessment, 48: 157–172.

FGDC (Federal Geographic Data Committee). 2012. Coastal and Marine Ecological Classification Standard. FGDC-STD-018-2012. Marine and Coastal Spatial Data Subcommittee. June 2012. 343 pp. Reston, VA.

Flescher, D.D. 1980. Guide to Some Trawl Caught Marine Fishes from Maine to Cape Hatteras, North Carolina. NOAA Technical Report NMFS Circular 431. March 1980.

Geraldi, N.R., R.A. Wahle, and M.J. Dunnington. 2009. Habitat effects on American lobster catch and movement: Insights from geo-referenced trap arrays, seabed mapping, and tagging. Can. J. Fish. Aquat. Sci. 66: 460-470.

Germano, J.D., D.C. Rhoads, R.M. Valente, D. Carey, and M. Solan. 2011. The use of Sediment Profile Imaging (SPI) for environmental impact assessments and monitoring studies: Lessons learned from the past four decades. Oceanography and Marine Biology: An Annual Review 49: 247-310.

Gosner, K.L. 1999. A Field Guide to the Atlantic Seashore: From the Bay of Fundy to Cape Hatteras. Houghton Mifflin Harcourt, 329 p.

Guida, V., A. Drohan, H. Welch, J. McHenry, D. Johnson, V. Kentner, J. Brink, D. Timmons, E. Estela-Gomez. 2017. Habitat Mapping and Assessment of Northeast Wind Energy Areas. Sterling, VA: US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2017-088. 312 p.

Hamley, J.M. 1975. Review of gillnet selectivity. Journal of the Fisheries Board of Canada. 32(11): 1943-1969.

Haulsee DE, Fox DA, Oliver MJ. 2020. Occurrence of Commercially Important and Endangered Fishes in Delaware Wind Energy Areas Using Acoustic Telemetry. Lewes (DE): US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2020-020. 80 p.

HDR. 2019. Benthic Monitoring during Wind Turbine Installation and Operation at the Block Island Wind Farm, Rhode Island – Year 2. Final Report to the U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs. OCS Study BOEM 2019- 019. 318 pp.

Hussey, N.E., S.T.Kessel, K. Aarestrup, S.J. Cooke, P.D. Cowley, A.T. Fisk, R.G. Harcourt, K.N. Holland, S.J. Iverson, J.F. Kocik, and J.E.M. Flemming. 2015. Aquatic animal telemetry: a panoramic window into the underwater world. Science, 348(6240), p.1255642.

ICES. 2006. Report of the ICES-FAO Working Group on Fishing Technology and Fish Behaviour (WGFTFB), 3–7 April 2006, Izmir, Turkey. ICES CM 2006/FTC:06, Ref. ACFM. 180 pp.

ICES. 2009. Report of the Study Group on the Development of Fish Pots for Commercial Fisheries and Survey Purposes (SGPOT), 16–17 May 2009, Ancona, Italy. ICES CM 2009/FTC:10. 13 pp.

Kells, V. and K. Carpenter. 2011. A Field Guide to Coastal Fishes from Maine to Texas. Johns Hopkins University Press, 448 p.

LeFaible, N., L. Colson, U. Braeckman, and T. Moens. 2019. Evaluation of turbine-related impacts on macrobenthic communities within two offshore wind farms during the operational phase. In Degraer, S., Brabant, R., Rumes, B. & Vigin, L. (eds). 2019. Environmental Impacts of Offshore Wind Farms in the Belgian Part of the North Sea: Marking a Decade of Monitoring, Research and Innovation. Brussels: Royal Belgian Institute of Natural Sciences, OD Natural Environment, Marine Ecology and Management, 134 p.

Lindeboom, H.J., H.J. Kouwenhoven, M.J.N. Bergman, S. Bouma, S. Brasseur, R. Daan, R.C. Fijn, et al. 2011. Short-term ecological effects of an offshore wind farm in the Dutch coastal zone; a compilation. Environmental Research Letters, 6: 1-13.

MADMF (Massachusetts Division of Marine Fisheries). 2018. Recommended regional scale studies related to fisheries in the Massachusetts and Rhode Island-Massachusetts offshore Wind Energy Areas. 57pp.

Malek, A. 2015. An Investigation of the Fisheries Ecosystem Dynamics in Rhode Island's Nearshore Waters. Open Access Dissertations. Paper 352. https://digitalcommons.uri.edu/oa_diss/352

McCann, J. 2012. Developing Environmental Protocols and Modeling Tools to Support Ocean Renewable Energy and Stewardship. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA., OCS Study BOEM 2012-082, 626 pp.

Methratta, E. 2020. Monitoring fisheries resources at offshore wind farms: BACI vs. BAG designs. ICES J. Mar. Sci. doi:10.1093/icesjms/fsaa026.

NOAA (National Oceanic and Atmospheric Administration). 2019. 2018 Stock Assessment and Fishery Evaluation (SAFE) Report for Atlantic Highly Migratory Species. Highly Migratory Species Management Division. Silver Spring, MD. 250p.

NYSERDA (New York State Energy Research and Development Authority). 2017. New York State Offshore Wind Master Plan: Fish and Fisheries Study. NYSERDA Report 17-25j. 140 pp.

O'Brien, L., J. Burnett, and R. Mayo. 1993. Maturation of nineteen species of finfish off the northeast coast of the United States, 1985-1990. NOAA Technical Report NMFS-113. June 1993.

O'Donnell, K.P., R.A. Wahle, M.J. Dunnington, and M. Bell. 2007. Spatially referenced trap arrays detect sediment disposal impacts in a New England estuary. Mar. Ecol. Prog. Ser. 348: 249–260.

Pearson, T.H. and R. Rosenberg. 1978. Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. Oceanography and Marine Biology an Annual Review 16: 229–311.

Petruny-Parker, M., A. Malek, M. Long, D. Spencer, F. Mattera, E. Hasbrouck, J. Scotti, K. Gerbino, and J. Wilson. 2015. Identifying Information Needs and Approaches for Assessing Potential Impacts of Offshore Wind Farm Development on Fisheries Resources in the Northeast Region. US Dept. of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2015-037. 79 pp.

Pol, M. and P. Walsh. 2005. Cod Potting in Massachusetts. In: Pol, M. Fishermen Assisting Gear Technologists and Scientists. Final report submitted to the Northeast Consortium. www.northeastconsortium.com.

Read, L. 2019. Power analyses for the beam trawl survey at South Fork Wind. Technical Memorandum from Exa Data. December 12, 2019. 16 pp.

Reid, R.N., D.J. Radosh, A.B. Frame, and S.A. Fromm. 1991. Benthic macrofauna of the New York Bight, 1979-1989. NOAA Technical Report NMFS-103; 50 p.

Rhoads, D.C. and L.F. Boyer. 1982. The effects of marine benthos on physical properties of sediments. pp. 3-52. In: Animal-Sediment Relations. McCall, P.L. and M.J.S. Tevesz (eds). Plenum Press, New York, NY.

Rhoads, D.C. and J.D. Germano. 1982. Characterization of organism-sediment relations using sediment profile imaging: An efficient method of remote ecological monitoring of the seafloor (REMOTS System). Marine Ecology Progress Series 8:115–128.

RICRMC (Rhode Island Coastal Resources Management Council). 2010. Rhode Island Ocean Special Area Management Plan (Ocean SAMP) Volume I. Adopted October 19, 2010. 1021 p.

Rotabakk, B.T., D. Skipnes, L. Akse, and S. Birkeland. 2011. Quality assessment of Atlantic cod (*Gadus morhua*) caught by longlining and trawling at the same time and location. Fisheries Research 112: 44–51.

Smith, E.P. 2002. BACI Design. In: Encyclopedia of Envirometrics, Vol. 1, pp 141-148. Edited by: Abdel H. El-Shaarawi and Walter W. Piegorsch. John Wiley & Sons, Ltd, Chichester, 2002.

Stokesbury, K. D. E. 2013. MA Windfarm Survey, Final Report. School for Marine Science and Technology (SMAST), University of Massachusetts Dartmouth.

Stokesbury, K. D. E. 2014. MA Windfarm Survey, Final Report. School for Marine Science and Technology (SMAST), University of Massachusetts Dartmouth.

Suuronen P., F. Chopin, C. Glass, S. Løkkeborg, Y. Matsushita, D. Queirolo, and D. Rihan. 2012. Low impact and fuel efficient fishing-Looking beyond the horizon. Fisheries Research 119–120:135–146. doi: 10.1016/j.fishres.2011.12.009.

Theroux, RB and R.I. Wigley. 1998. Quantitative composition and distribution of macrobenthic invertebrate fauna of the continental shelf ecosystems of the Northeastern United States. NOAA Technical Report NMFS-140; 240 p

Thomsen B., O.B. Humborstad, and D.M. Furevik. 2010. Fish pots: fish behaviour, capture processes, and conservation issues. In Behaviour of Marine Fishes: Capture Processes and Conservation Challenges, pp. 143–158. Ed. by He P. John Wiley and Sons, Iowa. 392 pp.

Ullman, D.S. and Codiga, D.L. 2010. Characterizing the Physical Oceanography of Coastal Waters Off Rhode Island, Part 2: New Observations of Water Properties, Currents, and Waves. Prepared for the Rhode Island Ocean Special Area Management Plan 2010. University of Rhode Island, December 21, 2010

Underwood, A.J. 1994. On beyond BACI: sampling designs that might reliably detect environmental disturbances. Ecol Appl 4: 3–15.

Wahle, R.A., M. Dunnington, K. O'Donnell, and M. Bell. 2004. Impact of dredged sediment disposal on lobster and crab abundance and movements at the Rockland disposal site, Penobscot Bay, Maine. Disposal Area Monitoring System Contribution 154, US Army Corps of Engineers, New England District, Waltham, MA. DACW33–03-D-007 TO5 09000–351–260. Available at www.nae.usace.army.mil/damos/pdf/154.pdf

Walsh, H.J. and V.G. Guida. 2017. Spring occurrence of fish and macro-invertebrate assemblages near designated wind energy areas on the northeast U.S. continental shelf. Fishery Bulletin 115:437-450.

Zemeckis, D.R., M.J. Dean, and S.X. Cadrin. 2014. Spawning dynamics and associated management implications for Atlantic cod. North American Journal of Fisheries Management, 34: 424-442.

From:	Susan Tuxbury - NOAA Federal
To:	Melanie Gearon
Cc:	Engler, Lisa (ENV); Boeri, Robert (ENV); Callaghan, Todd (EEA); Ford, Kathryn (FWE; Pol, Mike (FWE); annie@rodafisheries.org; lyndie@rosascience.org; andrew.lipsky@noaa.gov; Sharon Benjamin - NOAA Affiliate; Julie Crocker - NOAA Federal; ursula.howson@boem.gov; Ryan Silva; douglas.christel@noaa.gov; Nick Sisson - NOAA Affiliate; Christopher.Boelke@noaa.gov; wendy.gabriel@noaa.gov; Gregory.Lampman@nyserda.ny.gov; mbachman@nefmc.org; David Beutel; Grover Fugate; James Boyd; Jeff Willis; McLean, Laura (DOS); Maraglio, Matthew (DOS); Gaidasz, Karen M (DEC); Maniscalco, John D (DEC); Davis, Andrew (DPS); McNamee, Jason (DEM; Julia Livermore; Brian Hooker; Boatman, Mary; Stromberg, Jessica; Peter.Aarrestad@ct.gov; Handell, Naomi J CIV USARMY CENAN (US); Stephanie Wilson; Liz Gowell; Sophie Hartfield Lewis; John O"Keeffe; Rodney Avila; Ross Pearsall; Robert Soden; Robert Mastria; Main, Robin L.; Brian Gervelis; Drew Carey; Gregory DeCelles; Jennifer Garvey; Julia Prince; Berg, James; Mark Gardella, external user; Elizabeth Methratta - NOAA Affiliate; Alison Verkade - NOAA Federal; Vincent Guida - NOAA Federal
Subject:	Re: SFW - 2020 Fisheries Monitoring Plan
Date:	Friday, June 12, 2020 2:54:31 PM
Attachments:	2020-06-12_NMFS_Comment Responses_SFWF.xlsx

Melanie,

Thank you for the opportunity to review the South Fork Fisheries Monitoring Plan. The plan has been reviewed by both our Science Center and Regional Office and comments are compiled in the attached spreadsheet. The spreadsheet includes a second tab with a comment response matrix of comments we submitted on previous monitoring plan drafts in December 2018 and July 2019.

While we appreciate the effort you have put into developing this plan, we still have significant overarching concerns with the monitoring plan as proposed. As stated in our previous comments, the plan should clearly state the research question being addressed and the hypotheses being tested, and provide justification for choice of study methodology and design elements. Specifically, justification should be provided for the frequency and duration of sampling, the selection of control sites, distance-based sampling intervals, and sample sizes. The justification should be based on a power analysis of existing data that indicates the target level of power and the detectable effect size given the sample size proposed. The study of cod reproductive stage and spawning condition proposed should be enhanced to provide a fuller picture of the importance of cod spawning on Cox's Ledge for the recently proposed Southern New England stock of Atlantic cod (McBride and Kent Smedbol, in review).

Another point we have raised in past comments is the importance of integrating findings at South Fork with those from other projects in the region. The monitoring plan should describe at minimum how these findings will be incorporated among multiple Orsted projects. A plan for sharing and disseminating the data collected and the study results should also be provided. We are encouraged by Orsted's participation in an emerging ROSA working group that is addressing challenges related to fisheries monitoring at offshore wind farms and is working toward developing standardized and regionally coordinated approaches for monitoring study design, implementation, analysis, and data management.

The effect that wind farm development will have on NMFS long term scientific assessments remains a major concern. It is anticipated that the methodologies used to conduct these assessments will not be operable inside of wind farms as currently designed. The inability to survey within the wind farm will reduce the accuracy and precision of the biological indices derived from these surveys which are essential for informing fisheries management decisions and ecosystem level assessments. Moreover, wind farms are expected to change the variance structure of important variables such that patterns in habitat, abundance, and distribution outside of wind farms will not be representative of that inside of wind farms. This compels a need to develop standardized methodologies across lease areas for sampling inside of wind farms that are comparable with the long term monitoring that occurs outside of wind farms.

As we have discussed, your proposed sampling protocols may pose risks to protected species. Your monitoring plan should include specific mitigation measures that will be taken to minimize protected species interactions for each gear type proposed. Details should also be provided for reporting any interactions with protected species.

We appreciate the opportunity to provide feedback in your development of a fisheries monitoring plan. Please feel free to reach out with any questions.

Thank you!

Sue

Sue Tuxbury
Fishery Biologist
Habitat Conservation Division
NOAA Fisheries
55 Great Republic Drive
Gloucester, MA 01930
978-281-9176 (phone)
978-281-9301 (fax)
susan.tuxbury@noaa.gov

On Mon, May 11, 2020 at 6:35 PM Melanie Gearon <MELGE@orsted.com> wrote:

> Good Afternoon,
>
> South Fork Wind is pleased to send you its Fisheries Research and Monitoring Plan, which will be implemented in 2020. As a result of the helpful and productive comments that South

Fork Wind has received from agencies and stakeholders, this plan now includes: gillnet survey, beam trawl survey, ventless trap lobster survey, ventless fish pot survey, acoustic telemetry, and benthic survey.

On Friday May 22, 2020 from 10:00am to 12:00pm, the South Fork Wind team will host a webinar to walk you through the plan and describe our next steps. We will send an invite shortly and hope you can join us.

Thanks and stay safe!

Best regards,
Melanie Gearon
Project Manager
Permitting
Offshore

[cid:image002.png@01D627C1.88768B50]

Learn more at orsted.com<http://orsted.com/>

56, Exchange Terrace, Suite300
RI-02903 Providence
Tel. +1 857 348 3261

melge@orsted.com<mailto:MELGE@orsted.com>
orsted.com<http://orsted.com/>

Monitoring Plan Date	Document Section	Comment Number	NMFS Comment
May 2020	General Comment	1	NMFS participated in a number of meetings with Orsted during the development of this monitoring proposal. We had requested that Orsted provide a written response to previous comments on how input had been used or not used in updated monitoring versions. Can Orsted please detail how previous NMFS and other commenters' input have been incorporated into the current plan. This would help address reviewers submitting the same comments through multiple iterations of the monitoring plan.
May 2020	General Comment	2	For the BACI studies (gill net, beam trawl, ventless trap), please describe how control sites will be selected and justified from a biological perspective. The choice of BACI or BAG should be directly related to the research question and hypothesis being examined and the assumptions being made about the spatial-temporal scales of the stressor under consideration. The location of control sites should account for these differences. For example, the spatial and temporal scales of noise impacts will differ from that of wind wakes. Therefore, testing the effects of each of these stressors on fish and habitat requires the use of appropriate spatial and temporal scales of study that match the stressor being investigated.
May 2020	General Comment	3	The monitoring plan should outline any anticipated overlap between the proposed sampling and ongoing G&G activities. Should overlap occur, the plans should discuss the potential impact on biological sampling and how this will be addressed in your studies.
May 2020	General Comment	4	The monitoring plan should provide a clear statement of the goals, hypotheses, assumptions, analyses, and products of these studies. Will any specific stressors such as the following be studied: noise impacts/distance effects; EMF and potential effects on behaviour changes or changes in migratory patterns; Potential effects of habitat change on distribution, abundance, or biological rates at the wind farm scale vs. turbine scale; Effects on pelagic habitat conditions (physical and chemical oceanography) due to wind wake effects on fisheries spatial dynamics (this would involve modeling where these effects may occur and then establishing biological monitoring based on those results).
May 2020	General Comment	5	Justification for the sample sizes proposed should be provided. Please describe any other regional data that could be examined to explore patterns of variance and sample sizes needed to detect changes. For available data sets that are small or limited in scope, consider using a prospective power analysis that uses resampling techniques (e.g., bootstrapping) to amplify the data set or perhaps consider a simulated power analysis. The plan to conduct retrospective power analyses are commendable and encouraged, but the baseline year(s) data are what all subsequent years will be compared to, so if it is possible to gain some insights from existing data to inform sample sizes in year 1, that would be ideal. With respect to the power analyses, please define what amount of change is targeted to be detectable. Note that power analysis is unique to each response variable (e.g., abundance, biomass) because each of these has a specific level of sensitivity to change. Therefore, more than one set of analyses may be needed depending on study design.
May 2020	General Comment	6	Please link each research question to specific statistical methods that are planned. Define the criteria by which you assess a change caused by the wind farm.
May 2020	General Comment	7	We strongly recommend coordination of sampling (e.g., paired sampling) with these different gears so that data can be made comparable among studies. Futhermore, more informative analysis would be possible if sampling is coincidental in time with regional trawl surveys or can be spatially compared with gear selectivity studies.
May 2020	General Comment	8	On a related note, there should be some way to synthesize the findings to all of these studies, particularly in the event that they have divergent outcomes.
May 2020	General Comment	9	For other wind farms that the developer is planning for the region or nearby regions, please describe the vision for how these studies will be made comparable to future studies at other wind farm developments.
May 2020	General Comment	10	Regional fisheries resource surveys will be excluded from the South Fork project areas and all neighboring wind lease areas over time. It is not clear how Orsted intends to address filling these future data gaps with this proposed monitoring plan. Please consider how information from these studies and future monitoring at SFWF and other developments might inform regional population assessments for managed species.
May 2020	General Comment	11	As we go forward and start dealing with larger projects in a regional context, we need to consider the unique South Fork footprint and its unique sampling challenges relative to integration with historical regional trawl surveys (because it is sited on Cox's Ledge), and avoid using it as a template for future monitoring. The SFWF monitoring as proposed is not sufficient to evaluate the resource implications of that project on a regional level. Our comments should be incorporated and the trawl integration problem addressed.

Monitoring Plan Date	Document Section	Comment Number	NMFS Comment
May 2020	General Comment	12	Please provide a clear plan for how these data will be stored, curated, and shared with resource agencies, commercial fishermen, or other stakeholders. Will raw data be accessible or will only reports be accessible.
May 2020	General Comment	13	Research and monitoring plans should also consider fisheries socio-economic and operations impacts. Monitoring fishing community impacts through survey research with fishermen before, during, and after construction (longitudinal study) within the Project area would provide valuable data on a number of socio-economic concerns, including fishing displacement and changes in fishing location and effort for local ports. Conducting these types of surveys could also provide insight on revenue impacts and/or increased conflict over other fishing grounds in support of existing data (e.g. VTR, VMS, landings). For more information on this longitudinal research strategy please follow up for examples. Fisheries operations impacts should also be considered and monitored. Using fine-scale fisheries dependent data from contracted vessels could also provide valuable data on these socio-economic concerns mentioned. We recommend Orsted collaborate with ROSA to develop a regional study to understand these socio-economic impacts across projects.
May 2020	General Comment	14	The monitoring plan should describe what specific measures for each sampling type will be taken to avoid protected species.
May 2020	General Comment	15	If an interaction with a protected species occurs, is there a plan to report interactions and what will be done with potential carcasses? This plan should be provided.
May 2020	General Comment	16	Please clarify how many years before and after construction each of these sampling/experiment types will be carried out.
May 2020	Section 1.0, p. 4, paragraph 1	17	"National register" needs to be changed to "Federal Register"
May 2020	Sections 2.4, 2.5, 3.4, 3.5, 4.4, 4.5, 5.4, 5.5,	18	Complete water column profiles via CTD would be much preferable to surface and bottom sonde readings, as they would provide data for stratification structure. Alterations in the depth of mixing and intensity of thermocline as a result of turbulence created by structures will not be available with the sort of sampling suggested. Surface & bottom only could not distinguish between a warm water column with a thin layer of cold water on the bottom and a cold water column with a thin layer of warm water on top, which are very different habitat conditions as regards many species of fish and crustacens at the least.
May 2020	Sections 2.7, 3.7, and 5.7 Data Analysis	19	For retrospective power analyses, please define your decision criteria for modifying the study. Also please describe the timeline over which these decisions will be made between sampling seasons and/or years.
May 2020	Sections 2.3 Gillnet Methods and 3.3 Beam Trawl Methods	20	Please provide a clear plan for analyzing diet and otolith data.
May 2020	Section 3.2	21	The eastern reference area is not entirely comparable with the survey and western reference areas. There is a large area of muddy sediments in or near the eastern reference area left by an ice-age glacial melt water lake. The last sentence of the first paragraph should address possible incompatibility of bottom types as well as tow track safety by adding that the survey will address both tow track safety and comparability.
May 2020	Section 3.3, paragraph 1	22	The beam trawl tow speed and length should be more flexible rather than depending on someone else's fixed parameters. Develop your own that suit the conditions based on preliminary experiences in the first year.
May 2020	Section 3.3, paragarph 4	23	Identification of juvenile fishes may prove difficult with a broad-area field guide to adult fishes. Suggest you find and bring along more sophisticated identification guides (e.g. Bigelow & Schroeder's Fishes of the Gulf of Maine)
May 2020	Section 4.2 Sampling Stations	24	Please define more clearly the stratification scheme for the ventless trap survey. Note that if the grid cells are the strata, then sampling one aliquot from each stratum will not allow for the calculation of variance attributes. If strata are the areas (reference, wind farm), then this is not a stratified design.
May 2020	Sections 3.4 and 5.4 Hydrographic and Atmospheric Data	25	For hydrographic data, could these data be collected along vertical transects rather than just surface and bottom? Temperature and depth loggers could be attached to fixed gears and provide bottom temp data during the entire duration of the fishing effort - providing more info on species mixing relative to temperature fluctuations.
May 2020	Sections 5.2 and 7.2 Sampling Stations	26	Please clarify how the distances chosen for the BAG studies (Ventless fish pot, SPI) were chosen. For ventless pot, the closest distance the study monitors is 50m. Collecting data closer to the turbines would be valuable because this is where previous studies from Europe suggest the effects on fish abundance are greatest.

Monitoring Plan Date	Document Section	Comment Number	NMFS Comment
May 2020	Section 6.0	27	The Atlantic cod stock structure working group (ACSSWG) is proposing a new biological stock structure for Atlantic cod. The stock structure proposed includes five offshore stocks, one of which is the Southern New England Stock which overlaps the SFWF project area. There is initial genetic evidence that suggests that the Southern New England stock may spawn on Cox's Ledge. Further examination of the importance of spawning in the area of Cox's Ledge for this stock could be accomplished through: 1) Genetic studies: collection of tissue samples from individuals collected in the area that are in spawning condition and/or new or existing archival samples of very early stage larvae; 2) Tagging: Tag more fish in this region in different seasons to get better information on seasonal movements. In particular, while these fish are not known to go east, they are likely to go west (in cool months) and return in summer, which is known from decades ago but confirming this will help allocate catch properly for fish landed off New York and further south (NAFO Division 6); and 3) Interviews with fishermen, particularly the recreational fishermen, for historical, local ecological knowledge. This was a research recommendation of the WG's synthesis and could help put this fishery in context. For more information on this topic, please refer to the current and ongoing work of the ACSSWG. The ACSSWG draft Tech Memo is located here: https://s3.amazonaws.com/nefmc.org/Interdisciplinary-Review-of-Atlantic-Cod-Stock-Structure_200505_090723.pdf Peer Review of this work is located here: https://s3.amazonaws.com/nefmc.org/ACSSWG-Peer-Review-Panel-Report-FINAL-052920.pdf he project can be followed here: https://www.nefmc.org/committees/meetings/scientific-and-statistical-committee
May 2020	Section 7 Habitat - General Comment	28	It is not clear what are the questions/hypotheses that will be tested and how the proposed collected data will be used to address them. While using SPI/PV technology is a good way to capture screenshots of the seafloor, they are limited in both the extent of seafloor that is visualized and the information that can be obtained from them. We would recommend that video transects also be incorporated into your sampling protocols to provide a broader view of the sample stations and that you also consider the use of benthic grab samples.
May 2020	Section 7 Habitat- General Comment	29	The ability of the fisheries monitoring plan to fully evaluate impacts to YOY and smaller juvenile fish is not clear. The abundance and distribution of demersal juvenile fish species may be substantially altered as a result of a different scale of changes to the benthos than larger fish (e.g. the loss of interstitial spaces within cobble habitats through conversion to larger stone scour protection it likely to have a different effect on YOY and smaller juvenile fish species that utilize those spaces as shelter than on larger juveniles and adults). How the proposed fisheries sampling protocols will allow for detections of changes to YOY and smaller juvenile fish species should be discussed and evaluated.
May 2020	Section 7.0	30	The proposed sampling frequency is inadequate. While benthic habitats in this region are generally stable over time, particularly at higher taxonomic group levels, inter-seasonal and inter-annual variations at finer taxonomic group level (e.g. genus and species) can be highly variable. A single sampling event prior to construction will not allow for such variations to be accounted for during analysis and will limit the ability to detect changes as a result of construction versus natural variability over time. Multiple replicates, sample sizes, and sampling over a time series will likely be needed to adequately assess any changes that are a result of wind turbine installation. Multiple studies have been completed looking at changes in benthic community structure that could be used to help inform the expected annual variability of benthic communities within the lease and cable areas. The existing, collected benthic data within the lease area and along the cable route should be used to help evaluate necessary sample sizes and the power to detect changes in benthic communities. The plan includes only one post-construction sampling event within six months of the completion of construction. While it would be expected that there will be an acute impact to benthic habitats from construction, the long term changes to benthic communities that will occur post-construction would not be captured. We recommend multiple post-construction sampling events over time.

Monitoring Plan Date	Document Section	Comment Number	NMFS Comment
May 2020	7.1 Survey Design	31	It is not clear what are being considered as stations, samples, and replicates or how they will be analyzed. For example, the four/three SPI/PV images proposed to be collected at a station location are referred to as replicates versus samples. This would suggest that each station would be considered individually (i.e. the three best SPI/PV images collected at station x would only be used for an assessment of changes at station X). More information should be provided on the proposed study design, including how the SPI/PV images collected at stations located at different wind turbines and along the gradient transects will be treated as samples and replicates. As previously mentioned, existing data should be used to evaluate what sample sizes are necessary to adequately detect changes resulting from the project and addressed in the proposed study design.
May 2020	Section 7.2 - WTG BAG stations	32	Post-construction locations do not include the scour protection area. We recommend that the scour protection area be included in the post construction sampling. While SPI may not be feasible within the scour protection area, still images would be able to be captured and analyzed to evaluate benthic community changes over time. While we appreciate that four transects are proposed along a north, east, south, west orientation at five different wind turbines which could help to capture differences in responses around the turbines, it is not clear what is intended to be captured with this configuration. Are the four transects intended to be used as replicates? We would expect there to be variation in the benthic response based on the location around the turbine, and that this variation could differ from turbine to turbine. We would recommend consideration of replicating stations along each transect (e.g. three stations, with four/three SPI/PV sample images each, at the 15, 24, 50,...meter stratums) to ensure adequate replication and prevent confounding of potential localized spatial effects that may differ between transects.
May 2020	Section 7.3 - Cable Route	33	A BACI design is proposed for the export cable route instead of the BAG design proposed for the lease area. It is understood that there would be issues related to determining a pre-construction sampling transect and re-locating the sample route after construction, due to the lack of physical markers of the pre-construction route. However we believe further consideration should be made to incorporate a BAG design (for example, video and still images could be collected along transect perpendicular to the proposed cable route and the location of the constructed cable corridor could be used to refine the transects post-construction). We appreciate that areas supporting high scallop resources will be targeted for sampling along the cable corridor, but sampling stations locations should also be selected (and analyzed) based on habitat type along the cable corridor. This will help ensure each habitat type is adequately sampled.
May 2020	Section 7.6 Data Analysis	34	The sampling design and proposed analyses are not clear. It is stated that “lists of infaunal and epifaunal species observed in SPI/PV images, the percent cover of attached biota visible in PV images, presence of sensitive and invasive species, and the infaunal successional stage will be provided as part of the benthic biological assessment,” but it is not clear what analyses would be completed nor what specific parameters/criteria will be collected from SPI and PV images. For example, what is intended by (and for analysis of) lists of infaunal and epifaunal species, and will the percent cover of attached biota be assessed for each individual species, taxonomic group, or for all taxa combined? More specificity on the intended data to be collected from the images and proposed analyses should be provided. Further, while the rationale for not estimating abundances from SPI is clear, evaluation of the relative abundance of species within PV images should be feasible. Incorporation of measures such as the abundance of individual taxa allow for the analysis of changes to the benthic communities. Presence/absence data provides valuable information, but has substantial limitations for detecting changes to benthic communities and assemblages. For example, a benthic community could experience a significant shift in its community structure while still retaining each individual taxa, which presence/absence data would not be able to capture. We recommend the data to be collected from images include criteria that will allow for evaluation of changes that may occur with benthic community assemblages.

	Addressed
	Partially addressed
	Not addressed

Monitoring Plan Date	Document Section	Order	NMFS Comment	How Comment is Addressed in May 2020 Monitoring Plan	Addressed (1=not or partially addressed; 0=addressed)
6/13/19	1.0 Introduction	1	The introduction is generally good; particularly like the inclusion of "guiding principals"	Addressed	0
6/13/19	1.0 Introduction	2	A beam trawl survey as the second method is a good compromise when weighing the need for representative demersal catches against the issue of difficult bottom topography for otter trawl nets.	Addressed	0
6/13/19	1.0 Introduction	3	Acknowledgement of strength of multiple sampling methods (last paragraph) is good, but even this combination has weaknesses that should be acknowledged. You won't catch much pelagic fauna: squids, butterfish, Atl. & round herring in the MA-RI Wind Energy area are numerically important, but easily escape large mess gill nets and slow-moving beam trawls. This should be ackowledged.	Not addressed. No discussion provided on pelagic species in Current version.	1
6/13/19	1.0 Introduction	4	#3 in list in 1st paragraph: the data being collected do not only address "taxonomic composition", but also numerical abundance and biomass; that should be stated	Partially addressed. Current version added "relative abundance" to this sentence but not "biomass".	1
6/13/19	1.0 Introduction	5	Paragraph 1: There needs to be a clear statement as to the purpose of this program: is it a once-and-done assessment or is it a program to monitor effects for some extended period? It is not clear from the rest of the document which it is.	Not addressed. The Current version indicates that sampling will occur before and after construction, but the number of pre and post years is not explictly stated. One exception is the Fish pot study for which it is stated that, "Sampling will take place once per month from April through October for two years prior to the start of construction."	1
6/13/19	1.0 Introduction	6	Paragraph 2: "national register" should be changed to "Federal Register" It would be helpful to include e-links to this and other documents mentioned here.	Not addressed. The term "national register" is used in the Current version.	1
6/13/19	1.0 Introduction	7	There needs to be a clarification on how sampling is going to be done in time and how that relates to analysis and reporting. How many times will sampling be conducted and at what intervals? BACI design assumes there will be before and after sampling and there is mention of during construction as well, but will there be any extended monitoring program to detect slow-developing effects? When will reports be made? A Gantt chart to suggest the conduct of the entire project would be useful. The Gantt chart provided (Fig. 2) is inadequate: it seems to indicate seasonal gill netting, but continuous beam trawling (year round) and does not address the issue of how many times over what period the entire project is planned.	Not addressed. The current version provides some detail on the number of months per gear type. However the number of years and how data will be analyzed are not clearly explained. Reporting periodictiy is provided for some gear types. In the Current Version this text appears for the Gillnet, Beam trawl, and Ventless pot studies: "Annual reports containing catch data will be prepared after the conclusion of each year of sampling and shared with State and Federal resource agencies. One final report will also be produced synthesizing the findings of the pre- and post-construction evaluations."	1

Monitoring Plan Date	Document Section	Order	NMFS Comment	How Comment is Addressed in May 2020 Monitoring Plan	Addressed (1=not or partially addressed; 0=addressed)
6/13/19	2.0 Demersal Fisheries Resources Survey - Gillnet AND 3.0 Demersal Fisheries Resources Survey – Beam Trawl	8	Gill net and beam trawl sites will be placed randomly for each survey…that's necessary for statistical validity…but with some concessions to commercial fishing activity, poor setting, and untrawlable conditions: understandable. Thus this is a randomized unstratified BACI sampling design. However, there is a problem with that in this case. While the limits of project area in human terms is set to encompass the placement patterns for the turbines plus a buffer to accommodate construction activity, we cannot assume that the biological effects will follow the same system of boundaries. Previous experience in Europe has indicated that there are measureable effects, but they are largely confined to a limited radius (300 m) from turbine foundations. Fifteen 300 m – radius circles within South Fork would occupy about 4 sq km, or ~6% of the area of the wind farm (est.72 sq km). Under these conditions, an unstratified random sampling pattern within South Fork would have only a 6% chance of encountering an effect, even a very large one. A sampling program utilizing only 3 samples (gill net sets or beam trawls) per treatment would have only a small chance of "hitting" a measurably affected area, even if the effects were very large within those small areas. If the small areas around the turbines would support 10X the number of black sea bass per unit area than the rest of the farm (not unreasonable), the output for the entire farm would increase by 1.5X, but that would remain undetected because the unstratified random sampling program would likely miss sampling it. In other words, this could be a sampling scheme guaranteed to find no effect.	Not addressed. In the Current version, there is no justification for the number of samples proposed, nor a discussion of statistical power to detect changes. For the Gillnet study and the Beam trawl study, distance from the turbines is not included in the design. Some of the additional gear types that were added (Fish pot and Benthic survey) propose a distance-gradient sampling design.	1
6/13/19	2.0 Demersal Fisheries Resources Survey - Gillnet AND 3.0 Demersal Fisheries Resources Survey – Beam Trawl	9	One possible solution might be to create a stratified random sampling program in which the strata are determined by distance from turbine foundations. The simplest case would be two strata: one stratum with sampling sites within 300 m or some other distance considered appropriate, and one with sites outside 300 m or another appropriate distance. This could preserve the BACI design, but have a better chance of capturing any highly measureable effects of limited areal extent. This would involve additional sampling to cover the strata.	Partially addressed. In Current version, a distance-gradient sampling design is proposed for the Fish pot and Benthic survey. However, the station selection for Gillnet will follow simple random; the Ventless trap will use stratified random,; the Beam trawl stations will be chosen systematically based on input from fishermen.	1
6/13/19	2.1.4 Hydrographic and Atmospheric Data	11	The Hydrographic/Atmospheric data collection programs are adequate, though they provide only snapshots of conditions during sampling excursions. The descriptions of data handling and analysis appear adequate.	Addressed.	0
6/13/19	3.0 Demersal Fisheries Resources Survey – Beam Trawl	12	Reference areas used to compare with the survey areas are located in an existing lease area that may be used to site other wind turbines. Therefore, they are not appropriate as controls for a BACI design.	Addressed. Figure 3 in Current version indicates both references sites are now located outside of the lease area.	0

Monitoring Plan Date	Document Section	Order	NMFS Comment	How Comment is Addressed in May 2020 Monitoring Plan	Addressed (1=not or partially addressed; 0=addressed)
6/13/19	2.0 Demersal Fisheries Resources Survey - Gillnet AND 3.0 Demersal Fisheries Resources Survey – Beam Trawl	13	The duration of sampling is not specified in this draft plan. We cannot determine if sufficient sampling will occur after construction has been completed to assess whether the sampling design is sufficient to conduct a BACI approach.	Not addressed. The number of years that sampling will occur after construction is not explicitly stated.	1
6/13/19	2.0 Demersal Fisheries Resources Survey - Gillnet AND 3.0 Demersal Fisheries Resources Survey – Beam Trawl	14	The plan notes that lobster traps are in the area, but does not include any ventless trap survey to assess impacts to lobsters and crabs. This should be included to monitor and fully evaluate potential impacts of this project.	Addressed. The Current version includes a ventless trap survey for lobster and crab.	0
6/13/19	2.0 Demersal Fisheries Resources Survey - Gillnet	15	The sample size needed to assess cod spawning condition is undefined and should be specified in this report. As written, an unlimited number of cod could be sampled.	Not addressed. In Current version, sample size to be used for cod spawning is not specified. Two citations are provided for methods: Burnett et al. (1989) and O'Brien et al. (1993).	1
6/13/19	2.0 Demersal Fisheries Resources Survey - Gillnet	16	It is not clear in the description of the proposed study design's location conditions (#2) how the "area of influence" will be determined and measured for establishing reference areas. It should be clarified how the area of influence is determined - whether it is by the extent of scour protection around turbine bases, or by the detection of sound/EMF in the water column. This is also confusing because the reference areas must also be comparible in terms of current, habitat and depth, which are addiitonal factors that complicate the selection of reference sites if the "area of influence" is not well defined.	Not addressed.	1
6/13/19	2.0 Demersal Fisheries Resources Survey - Gillnet AND 3.0 Demersal Fisheries Resources Survey – Beam Trawl	17	Both gillnets and trawl sampling methods pose risks to protected species, including critically endangered North Atlantic right whales. Additionally, right whales occur in the proposed sampling areas in the spring and fall periods identified for the gillnet gear. Effects to listed species (large whales, sea turtles, Atlantic sturgeon) should be considered before any sampling occurs and measures to avoid, minimize and monitor effects should be incorporated into study plans. South Fork should ensure that any necessary ESA and MMPA authorizations/consultations are completed before sampling occurs.	Not addressed.	1
6/13/19	N/A	18	The stated goal of the proposed plan is to assess commercially and recreationally important demersal fish species. However, as there are other resources that should be monitored. We would expect monitoring to include studies on changes and impacts to benthic species; benthic habitat; HAPC and EFH; pelagic species; and pelagic habitat.	Partially addressed. In Current version, there is now a benthic habitat component that includes Sediment Profile Imaging/Plan View and Video. Pelagic species and pelagic habitat are not addressed in Current version.	1
12/14/19	General Comment	1	First, we have questions on the gear type proposed and the target species identified for the survey. While gillnets may be optimized for capturing monkfish, they may not be effective for other important demersal species. The target species identified for the project focus on the New England fish complex and is not representative of all the species that are likely to occur in and around the project area.	Not addressed. The table of target species in the earlier draft is no longer in the monitoring plan. In the Current version, the Gillnet Survey is targeted toward monkfish and winter skate. Other gear types are proposed in the Current version that could potentially address this comment but regional associations of these fish species are not explicitly stated in the text.	1

Monitoring Plan Date	Document Section	Order	NMFS Comment	How Comment is Addressed in May 2020 Monitoring Plan	Addressed (1=not or partially addressed; 0=addressed)
12/14/19	General Comment	2	The duration of the survey (1 year pre- and 2 years post construction) is limited and may not provide enough data to quantify impacts of construction. The duration of the survey may depend on what the survey is attempting to quantify. For example, is it abundance in the specific area or overall impacts to demersal fish abundance from the wind farm? These are two different questions and the latter would require long-term monitoring surveys to answer the question. Furthermore, detecting spatial shifts or impacts on migratory pattern in species, and seasonal availability to local ports, will be difficult to answer at a small scale. It is important to design a study that can be calibrated with existing federal trawl surveys to allow for comparison with existing long-term data sets. We would encourage you to continue working with our agency as you finalize the designs for this survey.	Not addressed. In the Current version, the pre and post construction duration (i.e., number of years) of the studies is not explicitly stated. There is also no discussion about calibrating with existing federal trawl surveys.	1
12/14/19	1.1 Introduction	3	This section should include a statement of the reason for conducting this study, its goals, and the questions addressed. It is not clear to which organizations and agencies the first paragraph refers - the agencies should be listed.	Not addressed. Questions, hypotheses, and goals are not well defined. There are several stressors (e.g., EMF, sound, habitat modification, wind wakes, etc.) associated with OSW and none of these are being studied explicitly. Initial: "The Survey will help establish pre-construction baseline community composition and may be used to assess whether detectable shifts occur in fish presence, absence, or abundance during and after construction. " Current: "These surveys will provide data that can be used to evaluate: 1. Commercially and recreationally important species that utilize the area in and around the SFW site.; 2. The seasonal timing of the occurrence of these species.; 3. Whether the taxonomic composition or relative abundance of fish and invertebrate assemblages change between the pre-construction and post-construction time periods."; Also, the agencies are not listed as requested.	1
12/14/19	2.1 Demersal Fisheries Resources Survey	4	This section is quite vague and does not clarify the intent of this study. Everything proposed should flow from what the purpose, objectives, and questions this monitoring is focused on. In addition, this statement should include aspects beyond just presence, absence, and abundance, including fish condition and reproduction.	Not addressed. Questions, hypotheses, and goals are not well defined. There are several stressors (e.g., EMF, sound, habitat modification, wind wakes, etc.) associated with OSW and none of these are being studied explicitly. Initial: "The Survey will help establish pre-construction baseline community composition and may be used to assess whether detectable shifts occur in fish presence, absence, or abundance during and after construction. " Current: "These surveys will provide data that can be used to evaluate: 1. Commercially and recreationally important species that utilize the area in and around the SFW site.; 2. The seasonal timing of the occurrence of these species.; 3. Whether the taxonomic composition or relative abundance of fish and invertebrate assemblages change between the pre-construction and post-construction time periods."	1

Monitoring Plan Date	Document Section	Order	NMFS Comment	How Comment is Addressed in May 2020 Monitoring Plan	Addressed (1=not or partially addressed; 0=addressed)
12/14/19	2.2 Rationale	5	We concur that minimal trawl effort exists within this area, but what has been done should not be ignored as it provides background coverage in space and time that the proposed monitoring program cannot cover. The NEFSC has completed trawl surveys in this area, as illustrated by the figure below.	Not addressed. Although there is some indication that existing data were examined, it is not clear how this information informed the current design. This text appears in the Current version: "Through extensive outreach efforts with the fishing community, feedback from state and federal agencies, and exploration of existing datasets, the DWSF team has developed survey designs using multiple sampling gears to acquire pre-construction data on the abundance, demographics, and composition of species that occur in and around the SFW site. In particular, the surveys have been designed to utilize sampling gear that can be fished effectively, and with limited impact, on the complex, rocky habitat within the SFW site(Thomsen et al., 2010; Malek, 2015)." Also in the Current version: "However, comparison of this gillnet survey data to other pre-construction fishery independent sampling efforts (e.g., nearby federal Northeast Area Monitoring and Assessment Program [NEAMAP]and NEFSC bottom trawl survey stations) may be limited due to the differences in the selectivity and catch rates of the disparate gear types."	1
12/14/19	2.2 Rationale	6	It is not clear why only one gear type is being considered. While gill net fishing makes sense for the SFWF area in providing intensive data in an area where bottom trawling is difficult, it does have some downsides. Gillnets optimized for catching monkfish may not be effective on other demersal species. Gillnetting may or may not capture squid, crab and lobster resources or small juvenile cod and black sea bass that are specialized for utilizing certain rough-bottom habitats. It is not useful for assessing effects on bivalves, including sea scallops, which are known to be in the vicinity. Additional gear types for sampling should also be considered.	Addressed. Multiple gear types are proposed in the Current version.	0
12/14/19	2.2 Rationale	7	Since existing databases are largely populated with bottom trawl data, we recommend at a limited number of stations where gill net and trawl gear data are collected simultaneously, you make a comparison or calibrate gill net results. This will also make the results amenable to comparison with existing trawl data and across wind energy areas. Without any possibility of associating results in this study with the larger database, this becomes an isolated "black box" study where you can see the input (initial fishery abundance and wind farm installations) and output (resulting fishery abundance). It provides little extra data to begin to look for causes or connect it with a larger regional picture. We recommend these studies be designed to allow for comparison with existing survey data.	Not addressed. The Current version does not propose any simultaneous paired sampling.	1
12/14/19	2.3.1 Proposed Sampling Stations	8	It will be difficult, if not impossible to examine the choices for sampling areas without review of the high-resolution geophysical data collected for the project. We request that you provided us with the geophysical data so we can provide input into the proposed sampling stations.	Not addressed. In the Current version, there is no indication that the high resolution geophysical data will be shared.	1

Monitoring Plan Date	Document Section	Order	NMFS Comment	How Comment is Addressed in May 2020 Monitoring Plan	Addressed (1=not or partially addressed; 0=addressed)
12/14/19	2.3.1 Proposed Sampling Stations	9	Biological sampling should be consistent with 'regional' surveys so comparisons to regional trends are valid. Priority species should be sampled in the same manner (e.g. length, weight, sex, maturity, age sample) and protocol (i.e. numbers per cm size bins) to compare fish condition and spawning, or potential different habitat use by size/age.	Partially addressed, In the Current version, the biological sampling during the Gillnet and Beam Trawl studies will follow methods of NEAMAP; Ventless sampling will follow ASMFC and SNECVTS ventless trap surveys; and all reproductive sampling cites methods in Burnett et al. (1989) and O'Brien et al. (1993). Precision levels are not addressed.	1
12/14/19	2.3.2 Gillnet Methods	10	While the SFWF is well outside the NEAMAP coverage, this area is within the NEFSC trawl survey coverage. While comparison may be limited, it certainly needs to be done and, therefore, simultaneous sampling via gill net and trawl is recommended. This will also be effective in sampling multiple species at different life stages.	Not addressed. In the Current version, there is no plan for simulteneous paired sampling.	1
12/14/19	2.3.2 Gillnet Methods	11	Gillnet sampling should include an analysis of gillnet observations and characteristics of the soak duration, targets, and catches in order to be compared with the gill net catch data collected by fisheries observers. The design should provide sufficient observations to answer the pertinent questions. Part of this should include the description of the gillnet (as in, sink nets or floating nets, anchored or drift nets) and more detailed explanation of survey methods. For example, for the soak procedure, is the 16 hour standard soak time described starting regardless of time of day, or is it an overnight set? If the 16-hour soak time was determined in order to maximize catch and based on commercial catch, is fish condition a priority? Will the catch be retained by cooperating fishermen?	Partially addressed. Current version: "Each gillnet string will consist of six, 300-ft net panels of 12-inch mesh with a hanging ratio of 1/2 (50%) and using net tie-downs." Soak times changed from 16 hrs in the earlier version to 48 hrs in the Current version. In the Current version: "The standard soak time of approximately 48 hours is proposed after input from industry, to maximize catch and standardize catch rates, while also ensuring the gear fishes properly during the soak (i.e., not collapsed from saturation), to minimize depredation of catch, and to improve the logistics of the survey." It is not stated whether catch will be retained by cooperating fishermen.	1
12/14/19	2.3.2 Gillnet Methods	12	The mesh size protocol as described may not adequately capture effects on species that are affected, but are not caught (as in smaller than the 5" mesh will catch).	Not addressed. In the Current version, a single mesh size of 12" inches is proposed.	1
12/14/19	2.3.2 Gillnet Methods	13	The number of samples proposed (for three fixed habitat stations, within two areas within the lease site and one outside control, a total of nine stations, once per season (assuming four seasons) would total 36 observations. In comparison many gear studies use paired trawls or paired gillnets, and we suggest the survey designers conduct an appropriate power analysis to determine the number of samples and soak times necessary to observe an affect. Spatial scale is simply not appropriate given the size of the lease sites and cumulative impacts. An immediate evaluation of soak times might help inform soak duration decisions. Similar analyses were conducted relative to the design of the ventless trap survey for scup and seabass that was an earlier cooperative research activity under Mid-Atlantic Research Set Asides (RSA) and Northeast Cooperative Research Program (NCRP) funding.	Partially addressed. There is text in the Current version that indicates that a power analysis was done with existing data, however no details of this analysis or its findings are shared. In Current version: "A power analysis was conducted using data from Malek (2015). These data provided approximate estimates of spatial variability in total abundance among independent tows, but the level of replication over time was insufficient to estimate temporal variability at the scale needed for the power analysis (Read, 2019)." There is no justification of spatial scale selected. Soak times appear to have been informed by fishermen: ""The standard soak time of approximately 48 hours is proposed after input from industry, to maximize catch and standardize catch rates, while also ensuring the gear fishes properly during the soak (i.e., not collapsed from saturation), to minimize depredation of catch, and to improve the logistics of the survey." It is not stated whether catch will be retained by cooperating fishermen.	1

Monitoring Plan Date	Document Section	Order	NMFS Comment	How Comment is Addressed in May 2020 Monitoring Plan	Addressed (1=not or partially addressed; 0=addressed)
12/14/19	2.3.2 Gillnet Methods	14	Justification for the timeline and schedule should be included, and clarification if “seasonal” means four times each year, three months apart. In addition, with only one year of data prior to construction, there is no way to control for inter-annual variability unrelated to the construction activity. This is an additional reason to plan protocol to make surveys comparable to existing datasets.	Partially addressed. Current version: ""Sampling will take place twice per month from April-June and again from October-December. These months see the majority of commercial gillnet activity as monkfish and skates migrate through the area in spring and fall. Sampling in July-September will not occur in order to minimize interactions with protected species (e.g., large whales, sea turtles) and to reduce the likelihood of gear damage that can occur during the seasonal migration of spiny dogfish and larger shark species through the area." In the Current version, there is no explanation or justification for the number of years of pre or post construction sampling.	1
12/14/19	2.3.2 Gillnet Methods	15	The last paragraph in this section refers to sub-sampling procedures - these should be described or referenced.	Not addressed for Gillnet study. In the Current version, the potential for subsampling mentioned for Gillnet, Ventless Trap, and Fish Pot Studies but no protocols defined. Some citations are provided on subsampling in the Beam Trawl study in current version: "In the case of larger catches (e.g., >900 kg), one or multiple subsampling procedures may be used. Subsampling protocols for the beam trawl are adapted from the subsampling procedures of the NEAMAP survey (Bonzek et al., 2008). The decision of which subsampling protocol, or protocols, to use will be at the discretion of the chief biologist."	1
12/14/19	2.3.2 Gillnet Methods	16	Recommend the sampling approach follow the NOAA trawl surveys since this project area overlaps with NOAA survey strata. Match the sampling protocols to those used for NEAMAP and NEFSC Bottom Trawl Survey, so that relevant comparisons are possible. Specifically, recording individual lengths, weights, sex, maturity, and potentially ages. Individual weights will be necessary to evaluate relative condition, which may be sex and maturity stage dependent (thus the need to determine those as well). Aim for individual weights at the 0.5-1 g resolution, as done on surveys with motion compensated balances.	Partially addressed. In Current version, the biological sampling during the Gillnet and Beam Trawl studies will follow methods of NEAMAP; Ventless sampling will follow ASMFC and SNECVTS ventless trap surveys; and all reproductive sampling cites methods in Burnett et al. (1989) and O’Brien et al. (1993). Precision levels are not addressed. There is no indication in the Current version that sampling will follow the NOAA trawl surveys.	1
12/14/19	2.3.2 Gillnet Methods	17	Regarding measurements of sharks and rays, the NEFSC measures total length (TL) for skates, and disc width for rays. VIMS (and now NEAMAP) have a history of measuring pre-caudal lengths. The NEFSC shark longline survey measures over the body fork length as well as straightline for comparison to other studies. The longline survey also measures TL in natural position, the same two ways. In a dogfish reproduction study, NEFSC measured FL, natural and stretched TL. For skates and rays, suggest measuring both disc width and total length. If you must pick a single measurement pre-caudal is not appropriate. Thus to correspond to most studies and enforcement you should take straightline FL. For dogfish take stretched straightline TL for comparison to the NEFSC trawl survey. In general, we recommend working with the Apex Predators group at Narragansett Lab for guidance on protocols from their surveys.	Addressed. Current verison of the Gillnet study and Beam trawl study: Fork length is recorded for all fishes with a forked tail. Total length is measured for all other fishes. Exceptions: Total length will be measured for skates; disc width will be measured for rays; stretched total length for dogfish; straight-line fork length for sharks. No indication that the Apex group at the Narragansett Lab was contacted.	0

Monitoring Plan Date	Document Section	Order	NMFS Comment	How Comment is Addressed in May 2020 Monitoring Plan	Addressed (1=not or partially addressed; 0=addressed)
12/14/19	2.3.2 Gillnet Methods	18	This section should also provide protocols for lobsters, crabs, squid and scallops if there is anticipation of catching these species.	Addressed. Current version: "...crabs (carapace width), lobsters (carapace length), and squids (mantle length)". No mention of scallop protocols for Gillnet survey. Protocols also provided for lobster, crab, squid, and scallop when caught in beam trawl; and for lobster and crab caught in ventless trap survey.	0
12/14/19	2.3.3 Atlantic cod reproductive stage	19	More details should be provided on cod maturity portion of the proposed study plan. The purpose and objective of this section is not clear (e.g. Is this an attempt to document cod spawning in the area or determine if the wind farm impacts cod maturity?). More information should be provided so we can provide better feedback on this aspect of the study.	Not addressed. The Current version does not provide a clear purpose and objective for the cod maturity study.	1
12/14/19	2.3.3 Atlantic cod reproductive stage	20	Measurements should include length (+/- 0.5 cm) and weight (+/- 0.5 g); the weight of dissected gonads should be record to 0.5 g precision as well.	Not addressed.	1
12/14/19	2.3.3 Atlantic cod reproductive stage	21	A major problem with macroscopic maturity classification is the lack of a physical sample to revisit later (unlike age samples). Photos can help somewhat, but it is very easy to take a lot of terrible and useless photos at sea. If samples are taken from gonads, preserved, and processed for histology, these can serve as definitive diagnosis of reproductive condition, and also serve as an archive-able sample to be revisited as needed, shared with experts for agreement/confirmation, etc. Histology adds costs, but given expected low occurrence of cod in the area, this wouldn't be too large of a burden, and would provide the most accurate diagnosis.	Not addressed. In the Current version, there is no explicit statement indicating that physical samples of gonads will be collected and preserved.	1
12/14/19	2.4 Potential Demersal Species Catch	22	The list in Table 2 seems to "target" species that are commercially and recreationally caught in the SFWF area and certain important permitted fisheries. Based on NEFSC trawl survey data, the most abundant catch species within the RI WEA between 2003 and 2006 were longfin squid, scup, butterfish, and round herring (#1-4 in Fall), and Atlantic herring (#1 in Spring). None of these appear in this list. Only Northeast and Small-Mesh Multispecies, Monkfish, and Spiny Dogfish, and skate FMPs are mentioned. It is not clear why some species on the list have “NA” under the FMP/Permit column. Black sea bass is actually under the MAFMC Summer Flounder, Scup & Black Seabass FMP, tautog and American lobster are managed by the ASMFC via the states. It is not clear how these target species were selected, but this list appears very slanted toward certain New England fisheries and ignores others that could be important, particularly outside or adjacent to the project boundary. If this study only focuses on species fished within the SFWF project boundary, it could mask the true impact of this wind farm on the larger ecosystem by regarding only those species of commercial value within the project boundary.	Not addressed. The table of species that this comment refered to is no longer in the monitoring plan. In the Current version, the Gillnet Survey is targeted toward monkfish and winter skate. Other gear types are proposed in the Current version that could potentially address this comment but regional associations of these fish species are not explicitly stated in the text.	1

31	# of Comments Remaining to be addressed in part or in whole	79%
39	Total Number of Comments	

Brian Gervelis

From:	Ford, Kathryn (FWE) <kathryn.ford@state.ma.us>
Sent:	Wednesday, June 24, 2020 7:50 AM
To:	Susan Tuxbury - NOAA Federal; Melanie Gearon
Cc:	Engler, Lisa (ENV); Boeri, Robert (ENV); Callaghan, Todd (ENV); Pol, Mike (FWE); annie@rodafisheries.org; lyndie@rosascience.org; andrew.lipsky@noaa.gov; Sharon Benjamin - NOAA Affiliate; Julie Crocker - NOAA Federal; ursula.howson@boem.gov; Ryan Silva; douglas.christel@noaa.gov; Nick Sisson - NOAA Affiliate; Christopher.Boelke@noaa.gov; wendy.gabriel@noaa.gov; Gregory.Lampman@nyserda.ny.gov; mbachman@nefmc.org; David Beutel; Grover Fugate; James Boyd; Jeff Willis; McLean, Laura (DOS); Maraglio, Matthew (DOS); Gaidasz, Karen M (DEC); Maniscalco, John D (DEC); Davis, Andrew (DPS); McNamee, Jason (DEM; Julia Livermore; Brian Hooker; Boatman, Mary; Stromberg, Jessica; Peter.Aarrestad@ct.gov; Handell, Naomi J CIV USARMY CENAN (US); Stephanie Wilson; Liz Gowell; Sophie Hartfield Lewis; John O'Keeffe; Rodney Avila; Ross Pearsall; Robert Soden; Robert Mastria; Main, Robin L.; Brian Gervelis; Drew Carey; Gregory DeCelles; Jennifer Garvey; Julia Prince; Berg, James; Mark Gardella, external user; Elizabeth Methratta - NOAA Affiliate; Alison Verkade - NOAA Federal; Vincent Guida - NOAA Federal; Logan, John (FWE); Pol, Mike (FWE); Pugh, Tracy (FWE); Burke, Erin (FWE); Whitmore, Kelly (FWE); Griffin, Melanie (FWE); McKiernan, Dan (FWE); Bruce Carlisle; Brunbauer, Morgan A (NYSERDA)
Subject:	RE: SFW - 2020 Fisheries Monitoring Plan
Attachments:	DMF to SFW fisheries survey 6-24-20 with attachment.pdf

Melanie,

Thank you for the opportunity to review the South Fork Wind Fisheries Research and Monitoring Plan. Attached are Mass DMF's comments. Regards, Kathryn Ford

On Mon, May 11, 2020 at 6:35 PM Melanie Gearon <MELGE@orsted.com> wrote:

> Good Afternoon,
>
> South Fork Wind is pleased to send you its Fisheries Research and Monitoring Plan, which will be implemented in 2020. As a result of the helpful and productive comments that South Fork Wind has received from agencies and stakeholders, this plan now includes: gillnet survey, beam trawl survey, ventless trap lobster survey, ventless fish pot survey, acoustic telemetry, and benthic survey.
>
> On Friday May 22, 2020 from 10:00am to 12:00pm, the South Fork Wind team will host a webinar to walk you through the plan and describe our next steps. We will send an invite shortly and hope you can join us.
>
> Thanks and stay safe!
>
> Best regards,
> Melanie Gearon
> Project Manager
> Permitting
> Offshore

[cid:image002.png@01D627C1.88768B50]

Learn more at orsted.com<http://orsted.com/>

56, Exchange Terrace, Suite300
RI-02903 Providence
Tel. +1 857 348 3261

melge@orsted.com<mailto:MELGE@orsted.com>
orsted.com<http://orsted.com/>

The Commonwealth of Massachusetts
Division of Marine Fisheries
251 Causeway Street, Suite 400, Boston, MA 02114
p: (617) 626-1520 | f: (617) 626-1509
www.mass.gov/marinefisheries

Ms. Melanie Gearon
Manager, Permitting and Environmental Affairs
South Fork Wind Farm
56 Exchange Terrace
Providence, RI 02903

June 24, 2020

Dear Ms. Gearon,
The Massachusetts Division of Marine Fisheries (MA DMF) has reviewed the document "South Fork Wind Fisheries Research and Monitoring Plan May 2020." This document is the third draft of the SFW fisheries studies. In addition to detailed comments for the previous two drafts, we also met with SFW in November 2019 and May 2020 to discuss the plan.

The purpose of the fisheries survey is "to acquire pre-construction data on the abundance, demographics, and composition of species that occur in and around the SFW site" (page 3). The survey data are also being collected to evaluate "timing of species occurrence" and whether the "composition or relative abundance of fish and invertebrate assemblages change between the pre-construction and post-construction time periods" (page 4). "The proposed survey designs in this plan are not exhaustive but will form a basis for fisheries monitoring in the SFW site" (page 3).

DMF strongly recommends reorienting your monitoring plan around the questions being asked. DMF has requested that SFW be clear in the purpose and objective of each study. There has been some attempt at that, but the effort still falls short of making it clear what questions are being asked and how the proposed studies will answer those questions. The only question that weaves its way through each methodological section presented in this plan is comparison of results before and after construction. Instead of asking a question, and then identifying the method(s) with which to answer that question, this fisheries monitoring plan provides a list of methodologies that will be deployed. This approach could result in data-rich-information-poor studies that European colleagues have warned of (Wilding et al. 2017).

- ➔ For example, if "timing of species occurrence" is a question, is it timing of all species or are there target species? Why are they being targeted? If so, some sampling frequencies may not be sufficient to address the question.

- ➔ What data sets will be used to identify areas within the project site that should be avoided or otherwise protected from development?
- ➔ The primary objectives in each specific section focus heavily on pre, during, and post-construction monitoring, which pose different questions than site characterization and therefore may require different methods to answer those questions.

Attached to this letter is a Draft example of how a fishery monitoring plan could better address DMF's concerns.

The SFW site is on a hard bottom region known as Cox Ledge, which is a geomporphic feature unique on the eastern seaboard. Therefore, there are specific questions unique to this site that need to be identified and addressed. Below are listed a few potential questions.

- ➔ Site characterization and pre-construction studies should focus on identifying important resources, unique or vulnerable resources, and areas to be avoided
    - o Cod spawning timing, location, and sensitivity to sound
    - o Cod abundance
    - o Monkfish, lobster, crab migration/spatial distribution through the area
    - o Number and types of fishing trips in the area
    - o Hard bottom areas with epiphtyic growth including denser stands of algae, presence of coral
- ➔ Impact assessment studies should focus on the extent and duration of foreseeable, anticipated, or potential impacts. Measured impacts can then lead to impact minimization through adaptive management and mitigation.
    - o What are sound, turbidity, or vibration impacts of construction
    - o Impact extents – how far away is effect seen in benthos, fish community
    - o Do monkfish/skates start eating different things?
    - o Black sea bass/reef effect – do you see an increase in BSB
    - o Change in number of juveniles associated with artificial vs natural hard bottoms
    - o Invasive species on turbines
    - o Shellfish on turbines
    - o Testing habitat value of different scour protection types
    - o Change in number and/or types of fishing trips in the wind farm area

The proposed plan does not address economic valuation or impact assessment to commercial fishermen. The site characterization of the project area would benefit from descriptions of fishing activities and relevant fisheries management, such as spatial regulations, in the area.

DMF recommends an annual report period to summarize activities and findings instead of separate report periods based on the methodology. In the annual report, raw and processed data products should be included. Ørsted should continue to communicate with fisheries stakeholders to provide relevant information as data needs are identified and become more standardized over time. The annual report period should include outreach with stakeholders, which may be useful to define now (e.g. annual presentation to RI FAB and MA FWG).

Specific comments on the methodological sections are listed in order of how they were presented in the plan. Generally speaking, DMF has concerns about the number of samples for all proposed studies, and whether the sampling designs are sufficient to measure change. It is fairly common for projects in information-poor areas to "oversample" in the first year or two, in order to better understand the variability of the data being collected and determine the amount of change that can be detected with various sampling designs. As proposed, the first sampling year would function more as a pilot study in which sample size adequacy would be determined post-sampling. If initial sampling effort was determined to be inadequate, the initial sampling year would be of limited use. We recommend an oversampling approach be taken here. The greater investment in year 1 sampling will help ensure that the overall design and sampling effort provides sufficient data to detect changes post-construction. Also, every study should indicate the number of sampling years anticipated, before, during, and after construction.

MA DMF is also concerned about reference site selection across all proposed BACI studies. The draft monitoring plan describes consultation with regional stakeholders to ensure that reference sites "are still utilized by the same/similar fish populations" (page 6) but does not provide any quantitative data (e.g., pilot sampling, previous biological surveys of the region) to support the use of the proposed reference regions. In addition to sharing similar abiotic characteristics, the reference sites should have similar species composition and abundance to the wind energy area to provide appropriate comparisons.

Comments on the individual sections are provided below.

Gillnet study

Less detail in gillnet section regarding data elements. Better level of detail in beam trawl/ventless studies. Please be more consistent.

Beam trawl

Differences in detail between gillnet and beam trawl studies with respect to data elements. Please be more consistent.

Ventless Trap Survey

The ventless trap survey is clear on what demographic measures are being collected. The survey section states that it "may" be used to assess post-construction impacts. Then it goes on to say "this survey will quantify pre-construction data for lobster in the SFW site such that changes in the resource due to construction and operation of the wind farm can be evaluated" (page 12). Similar to the fish species being targeted by the fish pot survey (black sea bass, scup, and tautog), lobsters and Jonah crab distribution and abundance will also likely be impacted by the turbines and surrounding scour protection habitat. The ventless trap survey design should anticipate this post-construction impact by considering lobster and Jonah crab abundance in relation to turbine proximity. This could potentially be accomplished using the same Before-

After-Gradient (BAG) design proposed for the fish pot survey, preferably with accompanying benthic habitat data.

Fish Pot Survey

Is this survey selecting 6 turbines randomly, and then sampling those 6 for multiple years, or is it selecting 6 new turbines every year?

How vulnerable is this survey to changes in where the turbines end up? The strings are proposed to radiate out approximately 1,150 m (~ 0.7 miles) from each turbine. The rationale for the proposed length should be described in more detail. The area nearest the turbines will likely have increased abundance of the structure-seeking demersal species post-construction, but it is important to understand if the overall abundance of these species increases in the wind area or whether existing fish instead just aggregate near the structures. To assess this difference, adequate sampling of areas representative of the remaining, undeveloped regions of the wind area are needed for comparison. The strings should cover a sufficient distance from the turbines to represent the broader, unaltered habitat within the wind area. Relatedly, surveying only six turbines may be inadequate for characterizing the full wind area, particularly if there is variability in depth and/or natural sediment characteristics across turbines.

Acoustic survey

This section proposes to provide additional funding for ongoing studies. Very little detail is provided and several times it was stated that the work "may" be done. We strongly recommend more concretely describing acoustic telemetry work and how it may benefit or be combined with other sampling activities. Will receivers be out full time in the wind farm post-construction? Will they be directly attached to the turbines? Will shadowing be a problem?

Glider deployments

"Glider deployments are planned for the winter of 2021 and 2022 as part of the ongoing Atlantic cod telemetry project. Additional glider deployments in the summer and fall, when HMS species are most commonly observed in and around SFW would provide valuable information to supplement data collected by the fixed station receiver array" (page 22). It is unclear if this work is being funded or not.

Benthic survey

MA DMF is pleased to see benthic surveys incorporated in the fisheries monitoring plan. However, the proposed survey only uses SPI/PV which may not be sufficient for specific questions about long-term habitat quality in and around turbines but is likely sufficient for site characterization work. Grab sampling is being done in US Wind and Vineyard Wind lease areas with 500 µm mesh.

Fish pot and benthic surveys are purposefully proposed to be conducted at different turbines to minimize interaction effects. If these two studies could be carried out at the same turbines, they would provide complementary information that would potentially improve understanding of the underlying habitat characteristics driving observed patterns in abundance rather than simply correlating abundance with distance from turbine structures. Might be better to overlap them particularly if pot trawls and benthic stations can be kept on separate lines.

Export cable

Stated objectives of the study are to "examine the effects of installation and operation of an export cable on the benthic habitat and scallop abundance" (page 27).

The export cable survey was confusing. Why are different treatments proposed based on the amount of scalloping?

An important question for export cables is how well they are staying covered. This question should be addressed. How is cable cover being monitored?

Questions pertaining to this review can be directed to John Logan (john.logan@mass.gov) or Kathryn Ford (kathryn.ford@mass.gov).

Sincerely,

Kathryn Ford, Ph.D.
Habitat Program Leader

cc: McKiernan, Logan, Pol, Pugh, Burke, Whitmore, Griffin, MA DMF
Callaghan, MA CZM
Carlisle, MA CEC
Tuxbury, Verkade, NOAA-NMFS
Livermore, RIDEM; Beutel, RI CRMC
Brunbauer, NYSERDA
Bachman, NEFMC
Hooker, BOEM

References

Wilding, T. A., Gill, A. B., Boon, A., Sheehan, E., Dauvin, J., Pezy, J.-P., O'Beirn, F., Janas, U., Rostin, L., & De Mesel, I. (2017). Turning off the DRIP ('Data-rich, information-poor') – rationalising monitoring with a focus on marine renewable energy developments and the benthos. Renewable and Sustainable Energy Reviews, 74, 848–859. https://doi.org/10.1016/j.rser.2017.03.013

Attachment to DMF Comment Letter to "South Fork Wind Fisheries Research and Monitoring Plan May 2020."

<u>Recommendations for what to include in a Fisheries Monitoring Plan</u>

<u>Mass DMF, June 2020</u>

Disclaimer: what follows below is a draft example of how a fishery monitoring plan could be organized to better address DMF's concerns of fish resource, habitat, and fisheries impacts from offshore wind developments. It is not meant to be prescriptive, nor is it final guidance for regulatory purposes. Instead, it is intended to start a conversation about how to improve the plans being developed in order to ensure critical site characterization and impact assessment questions are adequately being identified and addressed by offshore wind developers. Furthermore, this document does not identify all questions a developer could potentially address. It relies on DMF's experience authoring research priorities documents but is not intended to replace those documents or determine which questions are most relevant for any individual project.

The monitoring plans should **identify the questions being asked** for any purpose – to satisfy regulatory requirements such as the EIS and CZM requirements or questions related to construction and operations. Then for each question **describe the method and anticipated effect size** for measurement.

Monitoring plans should be clear when methods are relying on existing studies and results, existing data that will be analyzed by the developer for new purposes, or developer-sponsored studies. Studies should identify the spatial and temporal extent and utilize standardized monitoring protocols when appropriate. Leveraging existing regional monitoring programs, procedures, protocols, and time series is encouraged.

1. **Site characterization** –
   - 1.1. Fishing Industries
     - 1.1.1. What fisheries occur in the wind farm and cable route and when. What gear types are used? What is the catch composition and seasonality? Describe methods to address this question.
     - 1.1.2. What ports do those fisheries come from? What is port infrastructure that fishery supports? Describe methods to address this question.
     - 1.1.3. What is the current economic value of the area by state and port? Describe methods to address this question.
   - 1.2. Fish Resources and Habitat
     - 1.2.1. What are the species/communities of concern, where do they exist in the project site, and when? Describe resident species and seasonal migrations (what species are moving through and when). If existing information is not sufficient, what additional studies will be done?
     - 1.2.2. What are the benthic habitats in the area, how do they connect to EFH? What are the pelagic environments (upwelling, fronts), what are key patterns? Describe methods to address these questions.
   - 1.3. Fisheries Management

1.3.1. What are existing fisheries regulations in the area and how does that affect interpretation of important resources? Describe methods to address this question.

2. **Impact monitoring** -- For each stressor, address which variables in your area are affected and how the impact will be measured. What are the monitoring and mitigation approaches? What LOAs will be needed? What are fish collection restrictions that need to be adhered to? What are the endpoints being tested? Need to identify effect sizes.

2.1. Fishing Industries

2.1.1. Spacing -- Does array design adversely affect fishing? What is the amount of displacement, and where does that displaced effort go? Describe methods to address these questions.

2.1.2. Seafloor disturbance -- Do cables and/or cable mattressing adversely affect those gear types? Describe methods to address these questions.

2.1.3. Changes in dominant gear type (i.e. trawl gear being outcompeted by fixed gear) or changes in fishing or transit patterns -- How does economic value of the area change by state and port? Describe methods to address these questions.

2.2. Fish Resources and Habitat (stressor-response approach: for each section (stressor) below, describe how the response will be measured; the stressors are the same as those defined by the OES State of the Science Report)

2.2.1. Collision

2.2.2. Noise – BOEM has fish guidelines, NOAA has marine mammal guidelines

2.2.2.1. Pile driving

2.2.2.2. Operational

2.2.3. EMF – what species in the project area are sensitive to EMF? How are cables expected to impact EMF? What are existing EMF fields?

2.2.3.1. Lab and field studies have been done, how do methods compare to methods being used in this plan?

2.2.3.2. How will burial be monitored?

2.2.4. Habitat changes

2.2.4.1. Benthic: How are vulnerable habitats being identified and avoided?

2.2.4.1.1. Mattress options and consideration to fishability, habitat value, size of seafloor impact

2.2.4.1.2. Sediment transport impacts/scour protection options

2.2.4.2. Pelagic: Will the array change pelagic patterns/hydrodynamics? Will the reefing effect increase predation from marine mammals or change distribution of HMS species?

2.2.4.2.1. Plankton

2.2.4.2.2. Biofouling

2.2.4.2.3. Stomach contents/isotopes

2.2.4.2.4. Water quality (stratification, DO)

2.2.4.2.5. Fish abundance and species composition: does fish abundance, species composition, or spatial distribution change after construction – do the black sea bass move in and take over? Distribution of scallops/surf clams/ocean quahogs

2.2.4.3. Seasonal migrations: how will project monitor migrations?

2.2.4.4. Assessing regional scale changes – how will monitoring efforts for the individual site be nested within regional assessments?

2.3. Fisheries Management

2.3.1. Spacing -- what long term monitoring is currently underway in the area and how will it be impacted by the wind farm layout?

2.3.2. Displacement – if fisheries change, are there impacts to existing fisheries regulations that can be anticipated

3. **Adaptive Management** –How will company interact with regulatory community and fisheries stakeholders to address concerns? What is the adaptive management process?

3.1. Data management and reports

3.2. Interactions with BOEM Task Forces, Councils, ASMFC, ROSA, RODA, and state fisheries working groups.

3.3. Fisheries Communication Plan

3.4. Management – if certain events occur or thresholds are reached, what actions are taken

3.4.1. Collision

3.4.2. Noise

3.4.3. EMF/cable exposure

3.4.4. Habitat impact

3.4.4.1. Assessment of better/worse mattress and scour protection options

3.4.5. Existing surveys

3.4.6. Existing fisheries

Other notes:

- OES has no standard monitoring requirements/recommendations yet. Some projects are trying to work on techniques but some level of flexibility will be needed so different regulators can develop requirements that meet their regulatory needs.
- Environmental monitoring should focus on good, comprehensive, representative ecosystem endpoints, potentially based on an understanding of where the "bottlenecks" for biological populations or ecosystem function occur. (https://www.hydro.org/wp-content/uploads/2017/08/EMTSSummit4.pdf)
- "Current monitoring programmes are extensive and costly yet provide little useful data in relation to ecosystem-scale-related changes, a situation called 'data-rich, information-poor' (DRIP). MRED – benthic interactions may cause changes that are of a sufficient scale to change ecosystem services provision, particularly in terms of fisheries and biodiversity and, via trophic linkages, change the distribution of fish, birds and mammals. The production of DRIPy data should be eliminated and the resources used instead to address relevant questions that are logically bounded in time and space. Efforts should target identifying metrics of change that can be linked to ecosystem function or

service provision, particularly where those metrics show strongly non-linear effects in relation to the stressor" (Wilding et al 2017).

From: Bauer, Cassandra L (DEC)
To: Melanie Gearon
Cc: "Engler, Lisa " (ENV); "Boeri, Robert " (ENV); Callaghan, Todd (EEA); Pol, Mike (FWE); annie@rodafisheries.org; lyndie@rosascience.org; andrew.lipsky@noaa.gov; "Susan Tuxbury - NOAA Federal"; "Sharon Benjamin - NOAA Affiliate"; "Julie Crocker - NOAA Federal"; ursula.howson@boem.gov; "Ryan Silva"; douglas.christel@noaa.gov; nick.sisson@noaa.gov; Christopher.Boelke@noaa.gov; wendy.gabriel@noaa.gov; Lampman, Gregory G (NYSERDA); mbachman@nefmc.org; "David Beutel"; gfugate@crmc.ri.gov; "James Boyd"; Jeff Willis; McLean, Laura (DOS); Maraglio, Matthew (DOS); Gaidasz, Karen M (DEC); Maniscalco, John D (DEC); Davis, Andrew (DPS); jason.mcnamee@dem.ri.gov; Livermore, Julia (DEM); "Brian Hooker"; "Boatman, Mary"; Stromberg, Jessica; Peter.Aarrestad@ct.gov; "Handell, Naomi J CIV USARMY CENAN " (US); Stephanie Wilson; Liz Gowell; Sophie Hartfield Lewis; John O"Keeffe; Rodney Avila; Ross Pearsall; Robert Soden; Robert Mastria; Main, Robin L.; Brian Gervelis; Drew Carey; Gregory DeCelles; Jennifer Garvey; Julia Prince; Berg, James; Mark Gardella, external user; Ford, Kathryn (FWE); Matthew.Gates@ct.gov; Colleen.Brust@dep.nj.gov; Bozzi, Rhianna A (DEC); McKown, Kim (DEC); Covert, Lisa A (DEC); Brunbauer, Morgan A (NYSERDA)
Subject: SFW - 2020 Fisheries Monitoring Plan
Date: Monday, July 13, 2020 10:15:39 AM
Attachments: image001.gif
image002.gif
NYSDEC DMR comments on SFW Fisheries Survey_7.13.20.pdf

Melanie,

Thank you for the opportunity to provide feedback on the South Fork Wind Fisheries Research and Monitoring Plan. Attached, please find NYSDEC's comments.

Regards,
Cassie

--
Cassie Bauer
Marine Habitat Management Unit Leader, Division of Marine Resources

New York State Department of Environmental Conservation
205 N Belle Mead Road, Suite 1 East Setauket, NY 11733
P: 631-444-0474 | cassandra.bauer@dec.ny.gov

www.dec.ny.gov | |

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Marine Resources
205 North Belle Mead Road, Suite 1, East Setauket, NY 11733
P: (631) 444-0430 | F: (631) 444-0434 | FW.Marine@dec.ny.gov
www.dec.ny.gov

July 13, 2020

VIA EMAIL

Ms. Melanie Gearon
Manager, Permitting and Environmental Affairs South Fork Wind Farm
56 Exchange Terrace
Providence, RI 02903

RE: **NYSDEC Marine Resources Comments**
South Fork Wind Farm
Fisheries Research and Monitoring Plan

Dear Ms. Gearon,

Thank you for hosting the webinar on May 22nd, 2020 providing federal and state agencies with an overview of the revised South Fork Wind (SFW) Fisheries Research and Monitoring Plan. The New York State Department of Environmental Conservation's (NYSDEC) Division of Marine Resources has reviewed the revised plan and has the following comments:

General Comments

1. It is unclear how similar the species assemblages are in the impact and reference areas. Large differences in pre-construction communities will make it very difficult to detect a post-construction impact. A gradient design will help to alleviate the uncertainty associated with selecting appropriate reference areas.
2. Construction of a turbine field on the SFW site could potentially impact the species composition of the project area through a number of mechanisms (boat traffic, vibration, habitat change, electromagnetic fields (EMF), mobile gear exclusion, recreational fishing attractant) on different spatial and temporal scales. This plan proposes to collect data in a varied manner but may have difficulty addressing questions regarding specific impacts.
3. Cox Ledge has an abundance of natural hard bottom, some of which may be disturbed by installation of turbines, cables, scour protection, concrete mattresses, and anchoring. The encrusting organisms that develop on disturbed hard bottom may change over a 5-10 year (or more) period resulting in changes in benthic communities and dependent fish/invertebrates that will occur well into the operational life span of this project. More years of post-construction monitoring is recommended.
4. Raw data from each survey should be available in addition to summaries in written reports. Also, the reports should be released on an annual basis rather

than piecemeal depending on the timing of each survey. This will aid in the comparison of data collected from each study and help give a better overall picture of fisheries being studied.

5. It is unclear how this plan will fit into other fisheries monitoring plans that will be conducted in the region by Orsted or other project developers. It is also unclear how this study will work to fill gaps in regional studies that are being disrupted by the construction or operation of the wind farm. This data is more valuable if it is comparable to other studies in the area.
6. It is unclear how the effects on commercial, recreational, and for-hire fisheries will be addressed (i.e. shifts in species assemblages, shifts in gear used in project area, shifts in fishing locations, effects on popular fishing ports). Surveys should be conducted within the fishing community to get a broader understanding of fishing activity in the Cox Ledge area as well as an analysis of Vessel Trip Reports (VTR), Vessel Monitoring System (VMS), and Observer data to quantify fishing effort. This should be done in collaboration with a regional fishing body such as the Responsible Offshore Development Alliance or the Responsible Offshore Science Alliance.
7. Studies should be made comparable across gear types potentially by using paired gears. Timing should also coincide with historical surveys in the area to make data more valuable.
8. It is unclear how the surveys will address the presence of juvenile and young-of-year stock specifically. These fish will most likely be affected differently than their adult counterparts by the presence of structures and benthic disturbances.
9. Studies should also be expanded to include fisheries monitoring around the cable corridor in addition to the benthic survey. The cable also poses the risk of creating a change in fisheries presence (i.e., due to EMF, heat, etc.).
10. It is unclear what actions will be taken to mitigate any impacts to fisheries resources due to the project.
11. Temperature should be measured throughout the water column not just at the surface and bottom to account for mixing. If temperature probes could be attached to the survey gear itself, that would provide a more accurate depiction of temperature.
12. The sex should be recorded for all lobsters and for the subsample of crabs, horseshoe crabs, sharks and skates that are measured.
13. Any overlap with ongoing geological and geophysical studies in the area should be discussed in terms of effects these studies may have on fisheries monitoring activities and what actions will be taken to mitigate these effects.

Gillnet Survey

1. It is unclear what the sampling effort will actually be (number of gillnet lines/strings per survey).
2. The power analysis on the first year's data could lead to unusable data if the sampling effort is too low in the first year, unless the first year sampling is being

treated as a pilot and additional years of pre-construction sampling will be conducted to adequately establish a baseline.
    a. If additional pre-construction monitoring cannot be done, NYSDEC recommends oversampling the pre-construction year to ensure adequate power to detect changes.
3. It is unclear how many years of pre-and post-construction sampling are proposed.
4. A 12-inch mesh size will eliminate the ability to study other important fish species in the area that may be missed by trawl or pot studies (i.e., adult and juvenile cod). Creating a more diverse gillnet survey would allow for better capture of fisheries data.

Beam Trawl

1. Survey design implies multiple vessels could be involved adding another variable to account for when trying to detect project impacts.
2. The power analysis on the first year's data could lead to unusable data if the sampling effort is too low in the first year, unless the first year sampling is being treated as a pilot and additional years of pre-construction sampling will be conducted to adequately establish a baseline.
    a. If additional pre-construction monitoring cannot be done, NYSDEC recommends oversampling the pre-construction year to ensure adequate power to detect changes.
3. It is unclear how many years of pre-and post-construction sampling are proposed.

Ventless Trap- Lobster

1. Current survey design, while intending to minimize gear conflict, could be biasing survey by excluding areas from sampling.
2. It is unclear how the survey area is being stratified. The Atlantic States Marine Fisheries Commission coastwide survey that Rhode Island and Massachusetts participate in are stratified by depth. It is also unclear how the target sample size will be determined. A power analysis should be conducted using pre-construction data for lobster in the SFW site from previous surveys (cited on page 12 of the monitoring plan) to determine appropriate sample size. The power analysis should be conducted again using year 1 of pre-construction data from this survey to confirm that sample size is adequate.
3. Trap gear is subject to rules and regulations outlined under the Marine Mammal Protection Act and the Endangered Species Act. All gear restrictions, closures, and other regulations set forth by take reduction plans must be adhered to.
4. Bait used should be recorded since a specific bait is not specified. This may affect catchability.
5. It is unclear why other fish species, particularly tautog and scup, are not being measured.

6. It is unclear how many years of pre-and post-construction sampling are proposed.

Ventless Fish Pot

1. The power analysis on the first year's data could lead to unusable data if the sampling effort is too low in the first year, unless the first year sampling is being treated as a pilot and additional years of pre-construction sampling will be conducted to adequately establish a baseline.
    a. If additional pre-construction monitoring can't be done, NYSDEC recommends oversampling the pre-construction year to ensure adequate power to detect changes.
2. BAG design will allow for interesting comparisons. It is unclear if the fish pot trawls will extend in a direction that is absent of any other turbines so that the turbine of origin is always the closest turbine. Depending upon the questions being asked, the survey may need to quantify distances from all proximate turbines and any scour protection (will scour protection be uniform?). Despite best efforts, pots may not be laid out in a straight line with no slack in between.
3. It is unclear if a survey site would change in the middle of a survey year due to gear conflict and how that will impact the BAG analysis.
4. It is unclear how many years of sampling post-construction, are being proposed.

Acoustic Telemetry

1. Acoustic telemetry study goals/objectives are not well defined and no discussion of post-construction monitoring is mentioned.
2. Where possible, incorporating data from ongoing and existing studies can be beneficial to further understanding the marine species in the project areas as well as on a regional scale. Since ongoing studies often meet a specific need, the project could make use of valuable resources (such as ship time and sample design) while still helping to address project-specific data gaps and needs of the state. Capturing the potential value added to studies by SFW would strengthen the benefits of the usage of these studies and helps to increase not only site knowledge but regional knowledge as well.

Benthic Survey

1. The current plan proposes conducting two benthic surveys, one "not more than six months before construction and not more than six months after operation has begun, providing neither period is during the winter." All benthic surveys should be conducted within a similar time of year, preferably August 1st through October 31st, in order to accurately compare results between different years. In addition, multiple post-construction surveys should be conducted to account for inter-annual variability and potential long-term impacts to benthic community structure.
2. The current plan proposes to use Sediment Profile and Plan View Imaging (SPI/PV). NYSDEC suggests that the SPI/PV imagery be supplemented with benthic grab samples in order for identification and enumeration of the benthic infauna community.

3. NYSDEC suggests that temperature and salinity data from the surface to the sediment-water interface be collected at each benthic sampling station.

NYSDEC appreciates the opportunity to provide feedback on South Fork Wind Farm's Fisheries Research and Monitoring Plan. Please feel free to contact me at cassandra.bauer@dec.ny.gov or Rhianna Bozzi at rhianna.bozzi@dec.ny.gov if you have any questions.

Sincerely,

Cassandra Bauer
Biologist II (Marine)
Marine Habitat Management Unit Leader

ecc: DEC Review Team
Laura Mclean, NYSDOS
Kathryn Ford, MADMF
Julia Livermore, RIDEM
Morgan Brunbauer, NYSERDA
Susan Tuxbury, NOAA
Matthew Gates, CTDEEP
Colleen Brust, NJDEP
Brian Hooker, BOEM

From:	Livermore, Julia (DEM)
To:	Melanie Gearon; Gregory DeCelles; Brian Gervelis
Cc:	McNamee, Jason (DEM); Mcmanus, Conor (DEM); Andy Lipsky (Andrew.Lipsky@noaa.gov); Susan Tuxbury - NOAA Federal; Elizabeth Methratta - NOAA Affiliate; Kathryn Ford; Morgan Brunbauer
Subject:	RIDEM DMF Comments on SFWF Fisheries Monitoring Protocol
Date:	Wednesday, June 10, 2020 2:57:43 PM
Attachments:	image003.png RIDEM_Comments_Survey_Protocol_SFWF_6-9-20.pdf

Hi Melanie, Greg and Brian,

Attached are some additional comments from RIDEM DMF on the proposed survey protocol. I don't believe any will come as a surprise based on our recent discussions, but please don't hesitate to reach out if you have any questions for me.

Best wishes,
Julia

Julia Livermore, Supervising Marine Biologist
Rhode Island Department of Environmental Management
Division of Marine Fisheries
3 Ft. Wetherill Rd.
Jamestown, RI 02835
Office: 401.423.1937
Fax: 401.423.1925

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
DIVISION OF MARINE FISHERIES
3 Fort Wetherill Road
Jamestown, RI 02835

June 9, 2020

Melanie Gearon
Project Manager
Permitting - Offshore
Ørsted

Re: Comments on the Revised South Fork Wind Farm Fisheries Research and Monitoring Plan

Dear Ms. Gearon,

The Rhode Island Department of Environmental Management's Division of Marine Fisheries (DMF) has reviewed the revised South Fork Wind Farm Fisheries Research and Monitoring Plan as of the May 23, 2020 federal and state agencies meeting and offers the following comments:

- Additional information on power analyses is still necessary.
    - Within the revised protocol in both the beam trawl and gillnet survey sections, an adaptive approach to survey design is referenced. We support the concept of an adaptive approach, taking year one's data to conduct a power analysis to determine whether the survey should be modified. However, target power levels and effect sizes are never identified, and it is therefore unclear that year one of data will achieve adequate power levels and effect sizes.
        - If year one data reveal that targets were not reached, a portion of the baseline on which comparisons will be made will be inadequate to detect possible changes. Sampling can be reduced in subsequent years, but increased sampling in year one is not possible retroactively.
        - As such, more comprehensive power analysis may be necessary to demonstrate that the proposed survey designs are more than adequate for year one of sampling. There are approaches available to expand the data or develop an approximating distribution for more rigorous preliminary analysis (e.g., bootstrapping).
    - Study designs should have at minimum 80% statistical power, or more simply, each test of significance should have at least an 80% probability of detecting an effect that is present (avoiding a type II statistical error).
        - 80% is an acceptable power level within the scientific community (Cohen 1988). However, a power of 80% means that there is a 20% chance that a present effect may go undetected. Power levels >80% should be targeted. Nonetheless, given

    the high variance in fisheries data, creating sampling designs with higher power can be unachievable given time and monetary constraints.

  - Furthermore, in the power analyses provided by Ørsted on December 12, 2019, only total fish abundance was assessed. Additional analysis should be conducted to determine if changes in abundance, biomass or condition of species of interest could be detected.
    - Recreational and party/charter fishers have noted a very recent increase in Atlantic cod in and around the SFWF project area. Both juvenile and adult cod have been noted in the area in June 2020 in larger numbers than previous years. How does Ørsted's survey protocol address assessment of changes in abundance of cod (i.e., will any of the surveys be able to detect this change).
    - Assessment of changes in individual species' abundance, biomass, and condition will be very important to understand whether wind development has affected populations, and how development may interact with past and ongoing fisheries management efforts (e.g., rebuilding timelines).
  - It may be most effective to develop specific hypotheses to be addressed using the surveys, and conduct power analyses to answer these more targeted questions.
    - Taking a broad approach without a hypothesis in mind may lead to data-rich, information-poor survey designs. Past monitoring programs in Europe were extensive and costly yet provided little useful data in relation to ecosystem-scale-related changes (DRIPy data; Wilding et al. 2017).
    - To avoid this issue, efforts should target metrics that can be bounded in space and time (Wilding et al. 2017).
- Related to the previous point about Atlantic cod, none of the proposed surveys will effectively capture adult and juvenile cod.
  - A beam trawl is unlikely to capture cod in hardbottom, complex habitat; most cod will swim through a gillnet with 12" mesh; and only juveniles will be captured using fish pots.
  - How will Ørsted's surveys address this species given the importance of Cox Ledge habitat to Atlantic cod and long-term efforts to rebuild the Cod population?
  - This will be especially important as NOAA's trawl surveying of the area will be interrupted by the presence of offshore wind farms.
- It should be noted within the protocol that lobster trap trawls from the ventless lobster survey will not be set near gillnets.
  - Dead fish from gillnets may attract lobsters away from baited lobster pots and affect the survey results.
- The Rhode Island Fishermen's Advisory Board has expressed concerns regarding fisheries monitoring work occurring simultaneously with geophysical and geotechnical work in the wind farm area.
  - Data on this topic are extremely limited. However, Kikuchi (2010) suggest that cod may be affected by boomers and sparkers, as their auditory threshold is below the noise created by the geotechnical gear described.
  - Nedwell and Howell (2004) discuss the issue in greater detail and outline the large amount of uncertainty associated with the sound estimates for boomers and sparkers.
  - "There are no independent measurements or animal reaction studies available of geophysical survey sources, such as boomers and sparkers, used in windfarm development." … "While this data may not be used to assess the environmental effect of windfarm geophysical surveys, it suggests that windfarm related geophysical surveys are an area for concern and research should be conducted." (Nedwell and Howell 2004, page 21).

    - Therefore, understanding of the potential effects of boomers and sparkers is limited due to uncertainty. However, Nedwell and Howell (2004) recommend that this topic be studied in greater detail, not ignored.
    - If Ørsted feels that no issues should arise from temporally overlapping surveys, detailed justification and supporting data (e.g., frequencies and intensities of specific geotechnical/geophysical equipment being used compared with thresholds of a variety of species of interest) should be provided to support this argument.
- Based on discussion during the March 11th, 2020 Fisheries Monitoring Planning Session organized by the Commercial Fisheries Center of Rhode Island, it was inferred that experimental gillnets (with multiple mesh sizes) were ruled out due to protected species concerns.
    - If this is the case, please discuss this within the protocol. If the use of only 12" mesh was selected for other reasons, please explain within the protocol.
    - The use of only 12" mesh will target monkfish and skates.
        - The fish collected will not be representative of the fish community or of individual species' size distributions.
        - Only a representation of the commercial monkfish and skate harvest in the area will be assessed using the proposed design.
- A data release plan should be provided within the protocol.
    - The suggested release plan would clearly state who will have access to the raw data.
    - Each survey protocol mentions sharing annual and project completion reports with fisheries management agencies, but there is no mention of raw data sharing.
    - Some of these data may be of value to stock assessment, and more generally, fisheries management, by way of supplementing existing sampling. DMF would support the implementation of standard data delivery dates to fishery management agencies.
    - Groups involving fishing industry representation (e.g., the Responsible Offshore Science Alliance, the Rhode Island Fishermen's Advisory Board) should also have access to the data to ensure for complete transparency.

References:

Cohen, J (1988). Statistical Power Analysis for the Behavioral Sciences. 2nd ed. Lawrence Erlbaum Associates. https://doi.org/10.1016/C2013-0-10517-X

Kikuchi, R. (2010). Risk formulation for the sonic effects of offshore wind farms on fish in the EU region. *Marine Pollution Bulletin*, *60*(2), 172–177. https://doi.org/10.1016/j.marpolbul.2009.09.023

Nedwell, J. and Howell, D. (2004). A review of offshore windfarm related underwater noise sources. Report No. 544 R 0308. Collaborative Offshore Wind Energy Research Into the Environment. https://tethys.pnnl.gov/sites/default/files/publications/Nedwell-Howell-2004.pdf

Wilding, T. A., Gill, A. B., Boon, A., Sheehan, E., Dauvin, J., Pezy, J.-P., O'Beirn, F., Janas, U., Rostin, L., & De Mesel, I. (2017). Turning off the DRIP ('Data-rich, information-poor') – rationalising monitoring with a focus on marine renewable energy developments and the benthos. Renewable and Sustainable Energy Reviews, 74, 848–859. https://doi.org/10.1016/j.rser.2017.03.013

EXHIBIT 6

Date	Organizations/Individuals Contacted[6]	Location/Form of Contact and Response	Purpose of Contact
5/22/20	BOEM, CT DEEP, MA CZM, MA DMF, NOAA/NMFS, NYS DEC, NYS DOS, RIDEM	Webinar; See Exhibit 6 to Appendix A	Updated Final Fisheries Monitoring Plan

[6] BOEM – Bureau of Ocean Energy Management; CFCRI – Commercial Fisheries Center of Rhode Island; CFRF – Commercial Fisheries Research Foundation; CT DEEP – Connecticut Department of Energy and Environmental Protection; MA DMF- Massachusetts Division of Marine Fisheries; MA CZM – Massachusetts Center of Coastal Zone Management; MA FWG – Massachusetts Offshore Wind Fisheries Working Group; NEFMC – New England Fisheries Management Council; NOAA/GARFO - National Oceanic and Atmospheric Administration's Greater Atlantic Regional Fisheries Office; NOAA/NMFS – National Oceanic and Atmospheric Administration's National Marine Fisheries Service; NYS DEC – New York State Department of Environmental Conservation; NYS DOS – New York Department of State; NYS DPS – New York State Department of Public Service; NYSERDA – New York State Energy and Research Development Authority; RI CRMC – Rhode Island Coastal Resources Management Council; RI DEM – Rhode Island Department of Environmental Management; RISAA – Rhode Island Saltwater Angler's Association; RODA – Responsible Offshore Development Alliance; ROSA – Responsible Offshore science Alliance; USACE – United States Army Corps of Engineers

South Fork Wind

A Joint Venture of Ørsted and Eversource

05.22.2020

SFW Fisheries Monitoring Plan

South Fork Wind | Powered by Ørsted & Eversource

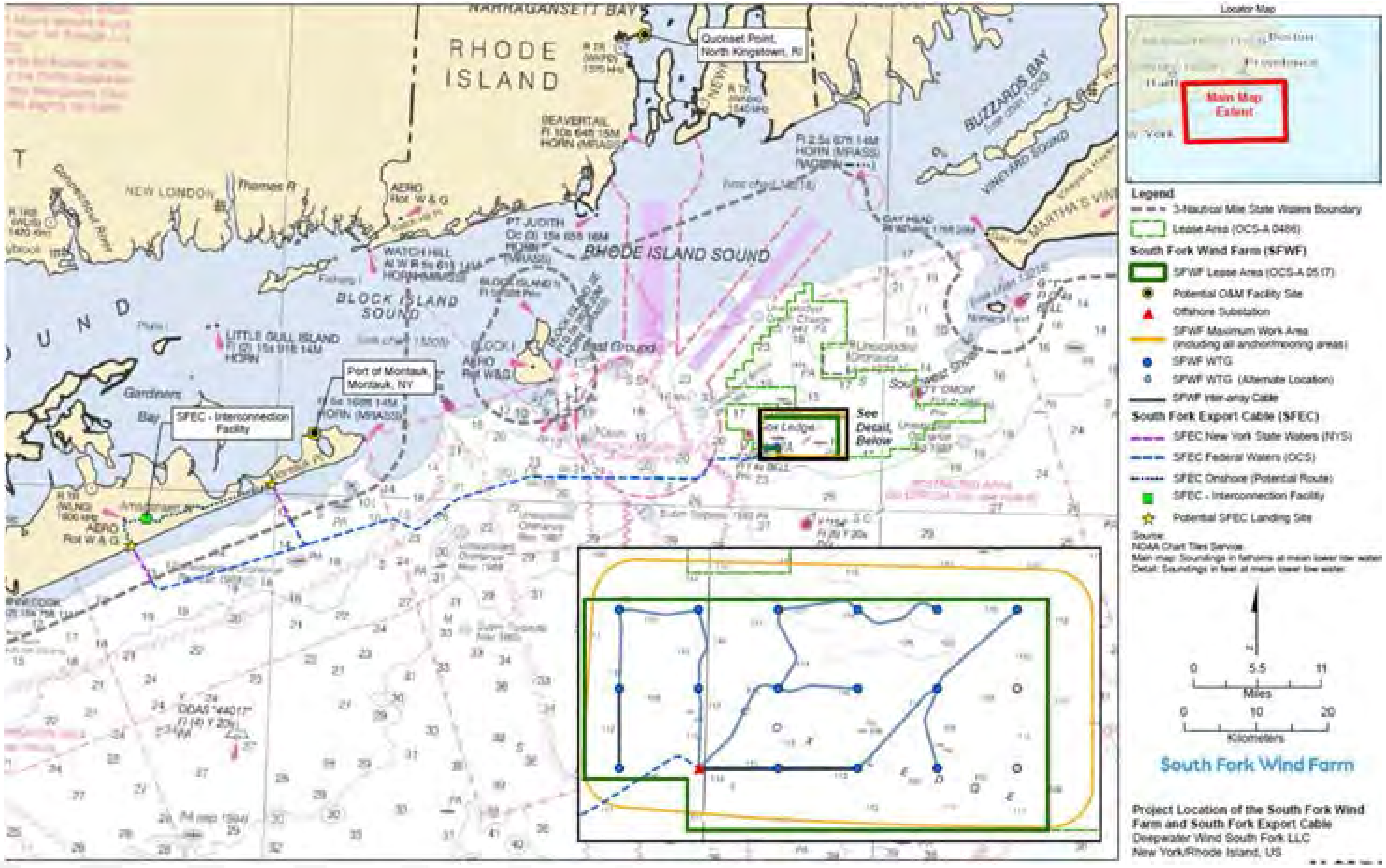
Agenda

01 Project Updates

02 Fisheries Monitoring Plan

03 Next Steps

Project Location



Project Components and Envelope

SFWF

Up to 15 Wind Turbine Generators (WTGs)

1 Offshore Substation (OSS)

Inter-array cable

Onshore O&M Facility

SFEC

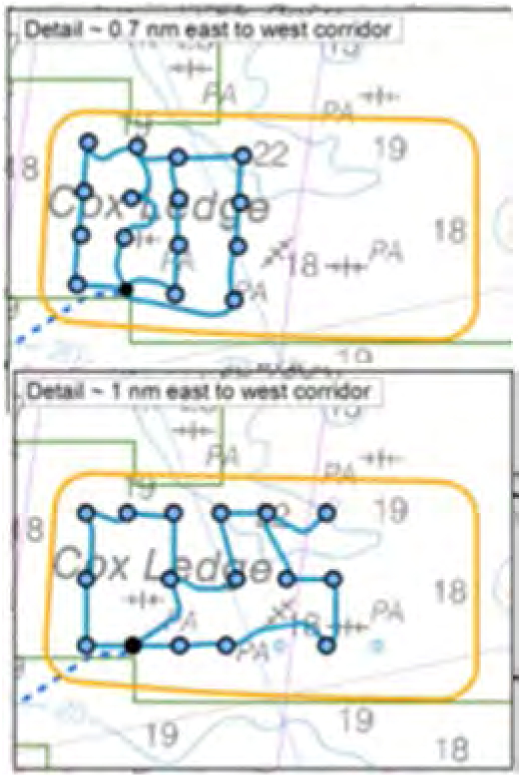
Export cable (offshore & onshore)

Sea-to-Shore Transition

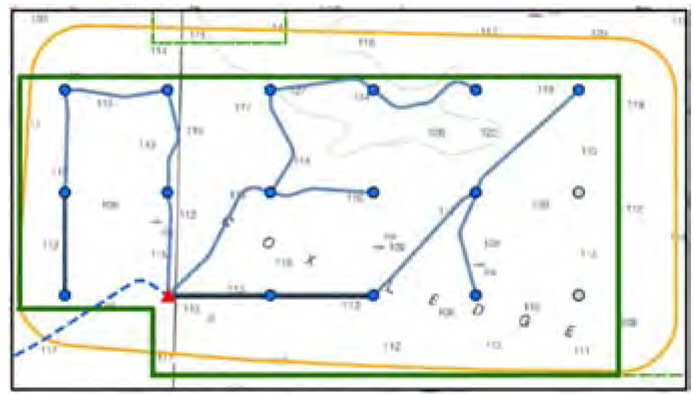
Onshore interconnection facility to existing East Hampton Substation

Progression of Layouts

Former Layouts



2020 Layout



Now 1 nautical mile by 1 nautical mile grid layout

Monitoring Plan Development: Guiding Principles

- Getting input from the fishing industry and other stakeholders
- Working collaboratively with the fishing industry
- Collecting thorough and credible science
- Obtaining unbiased clear results
- Standardizing monitoring protocols to build on and support existing fisheries research
- Sharing data while maintaining confidentiality about sensitive fishing areas
- Supporting regional science efforts

How did we get here?
Direct Feedback on Fisheries Research & Monitoring Plans

- **Attended fisheries-related meetings beginning in 2017 to answer questions and seek input**
- **Questionnaire to solicit fishermen's priorities**
  - Distributed January 2019
- **One-on-one outreach through FRs/FLs and project team**
  - RIDEM – Oct., Nov. 2019; Jan. 2020
  - MA DMF – Nov. 2019
  - NOAA – Apr. 2020
  - Numerous interactions with stakeholders through FRs/FLs since in 2017
- **Circulation and comments on draft plans**
  - Originally distributed Nov. 2018, Revised plans distributed June and Sept. 2019
- **Agency webinars**
  - Two sessions held March 2019
- **Vetting at state fisheries working group and advisory board meetings**
  - RI FAB – March 2017; Apr., Aug. 2018; Sept. 2019
  - MA FWG – Sept., Nov. 2019
  - RI Fisheries Working Group – March 2020

Updates and Revisions Based on Feedback

Examples

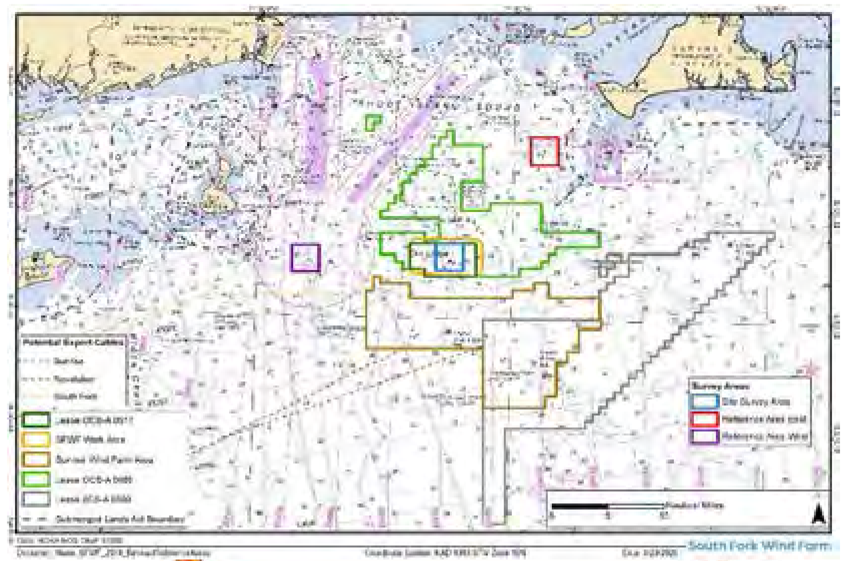
- Single mesh size and survey timing for gillnet to limit protected species interactions based on feedback from federal agencies and industry
- Control sites for gillnet and beam trawl determined through extensive discussions with agencies (e.g., RI DEM and MA DMF) and industry members
- Adaptive sampling (power analysis after Year 1 data collection) used to determine if adjustments to sampling intensity need to be made in subsequent years
- Surveys and gear types added throughout the development of the plan based on industry and agency feedback (e.g.,ventless trap, fish pot, support for telemetry projects)
- Support for telemetry projects added in response to comments from recreational fishing community in particular
- BAG design incorporated into fish pot survey based on feedback from agencies

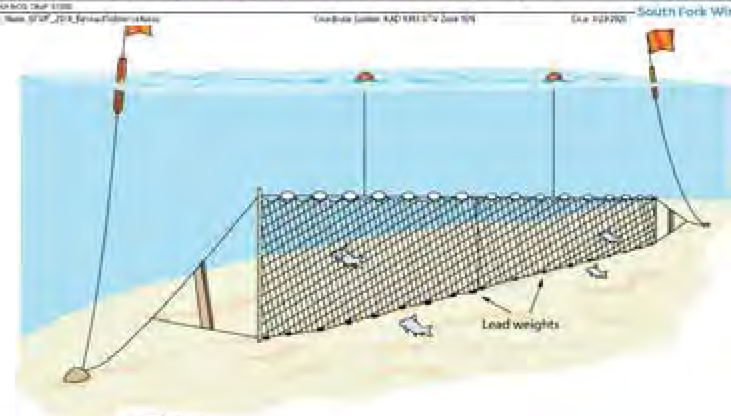
Elements and Timeline of the Monitoring Plan

- Gillnet Survey
- Beam Trawl Survey
- Ventless Trap Survey for lobster and crabs
- Fish Pot Survey
- Acoustic telemetry
- Benthic monitoring – will begin within 6 months of start of construction

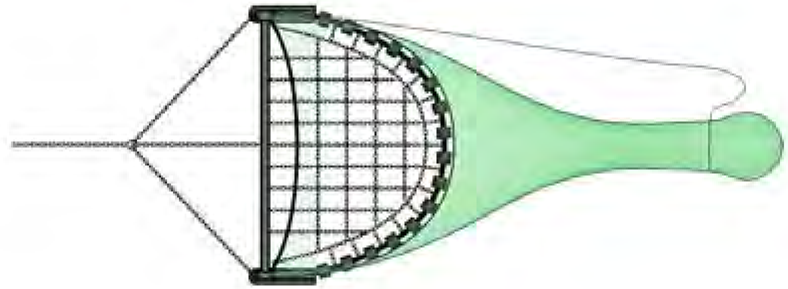
Gillnet Survey

- **Objectives – collect information on the relative abundance, demographics and distribution of demersal fish in the area. Use asymmetrical BACI design to identify changes in relative abundance.**
- **Sample twice monthly in the impact area and two control areas from April through June, and October through December.**
- **Year 1: set up to five gillnet strings in each area**
  - Adaptive sampling approach: Use Year 1 data to conduct power analysis and modify sampling intensity if needed.

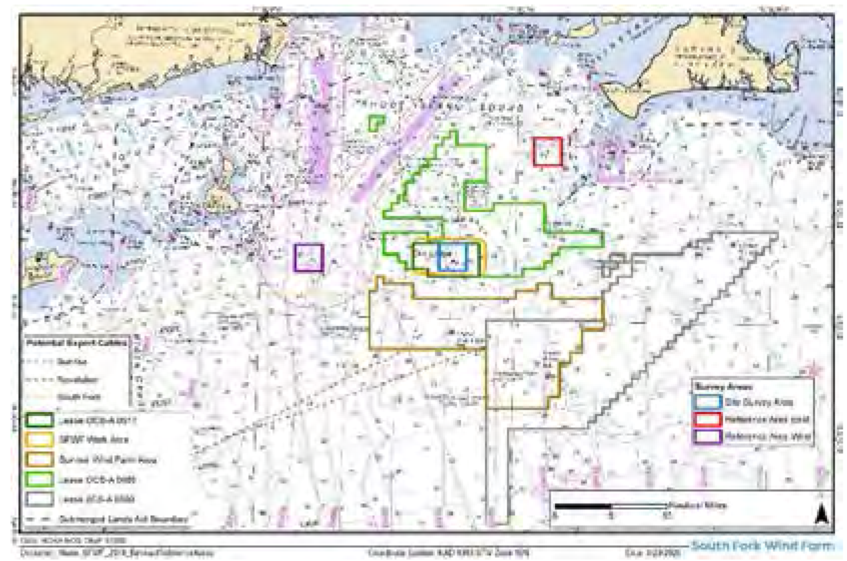




Beam Trawl Survey

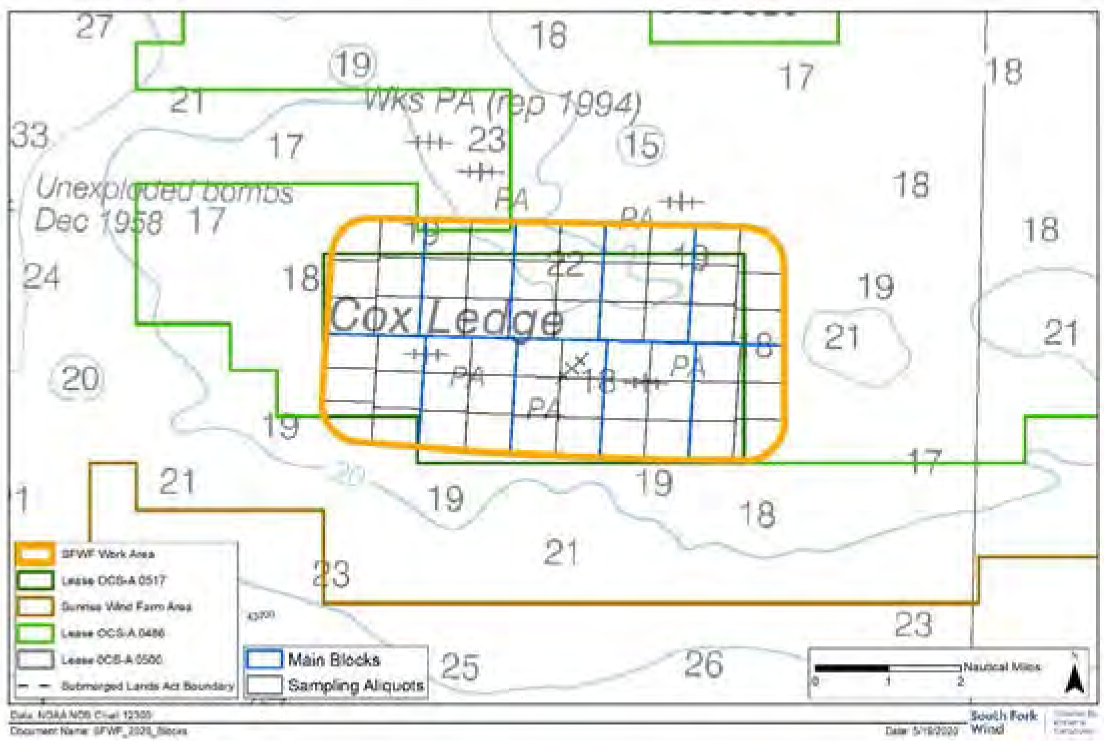


- **Objectives – collect information on the relative abundance, demographics, and distribution of demersal fish and benthic invertebrates in the area. Use asymmetrical BACI design to identify changes in relative abundance.**
- **Monthly sampling at one impact location and two reference locations with three replicate tows per area (nine total tows per month).**
  - 3m beam trawl with 4.5” mesh and a 1” codend liner towed at 4 knots for 20 minutes.
  - Adaptive sampling approach: use Year 1 data to conduct power analysis and modify sampling intensity if needed.



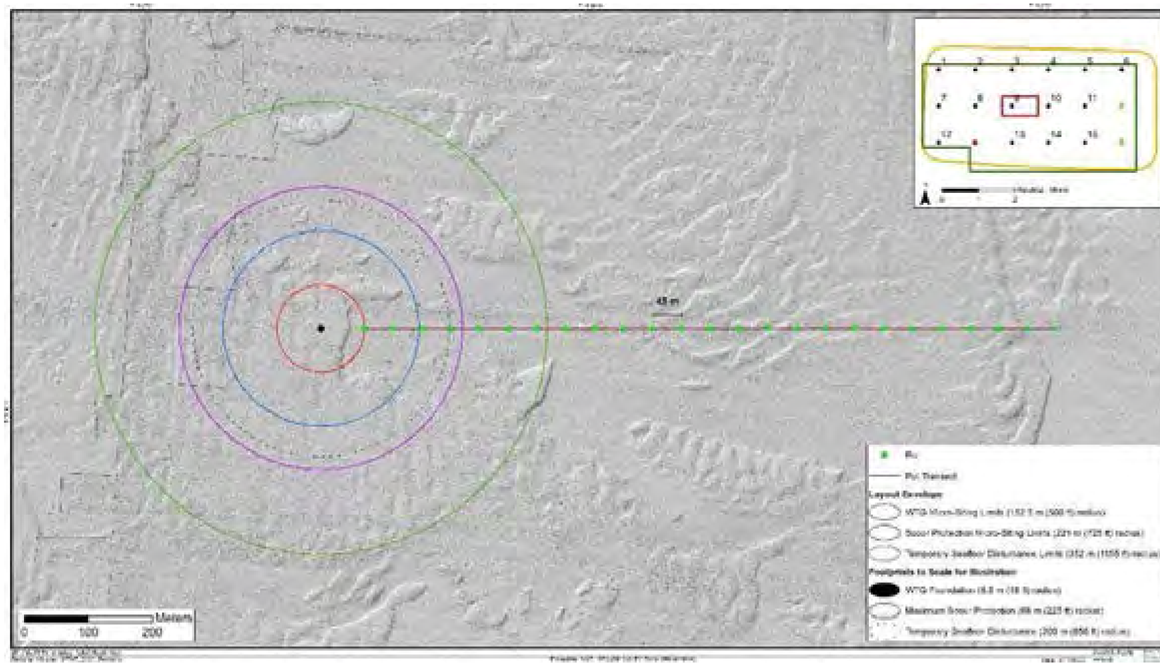
Ventless Lobster Trap Survey

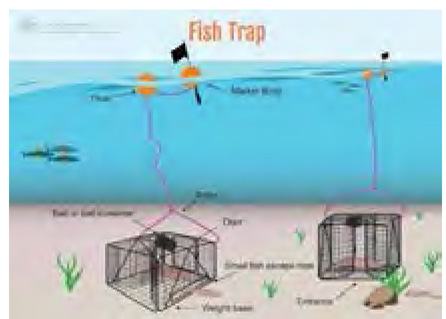
- BACI design following SNECVTS conducted in 2014, 2015, 2018.
- Random stratified sample allocation.
- 10 trap trawls (6 ventless, 4 vented) will be fished on a 5-night soak
- Sampling to occur twice per month May-Nov.
- Biological sampling will be consistent with ASMFC protocols.



Fish Pot Survey

- **Monitor species associated with complex bottom habitats (black sea bass, tautog, and scup) that may not be well sampled by the other gear types.**
- **Before-After Gradient Design (BAG)**
- **25 pot strings will be set at 6 randomly selected turbine locations with a 24-hour soak time.**
    - Adaptive sampling will be used.
- **Sampling to occur monthly from Apr-Oct.**





BAG design added through suggestion from agencies

Acoustic Telemetry - Cod

Purpose

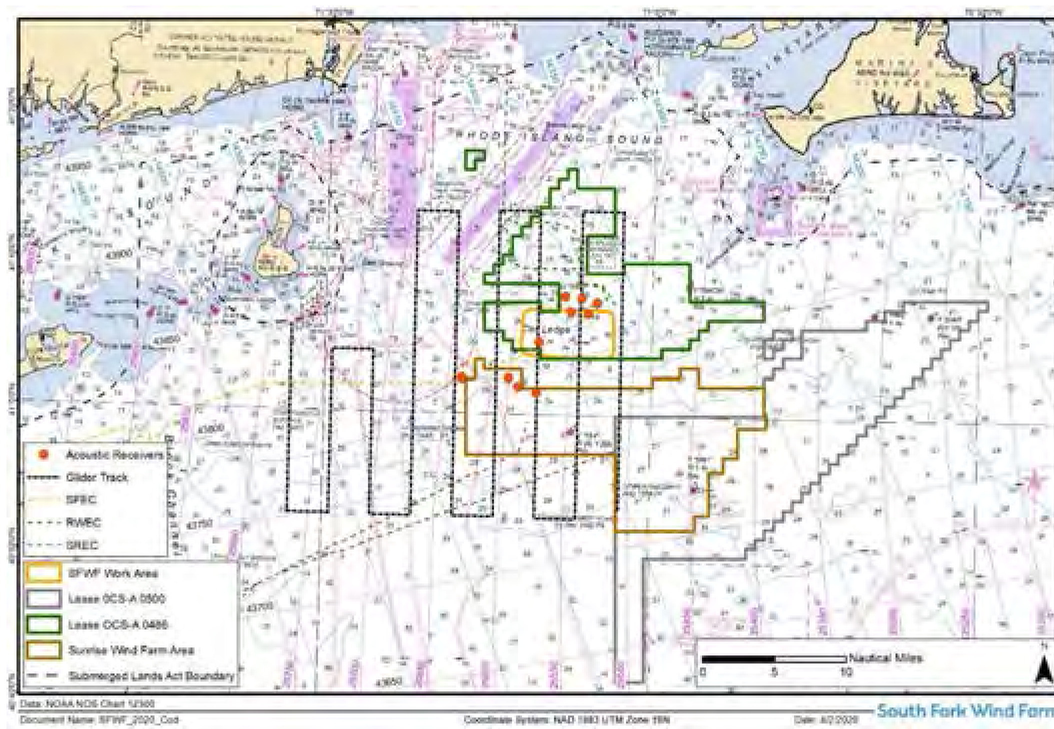
- Collect baseline data on the distribution, habitat use, and behavior of spawning cod on and near Cox Ledge.
- Biological sampling to fill data gaps
- Environmental data

Methods

- Tag up to 100 spawning cod with acoustic transmitters.
- Track cod movements with fixed receivers and a mobile glider.

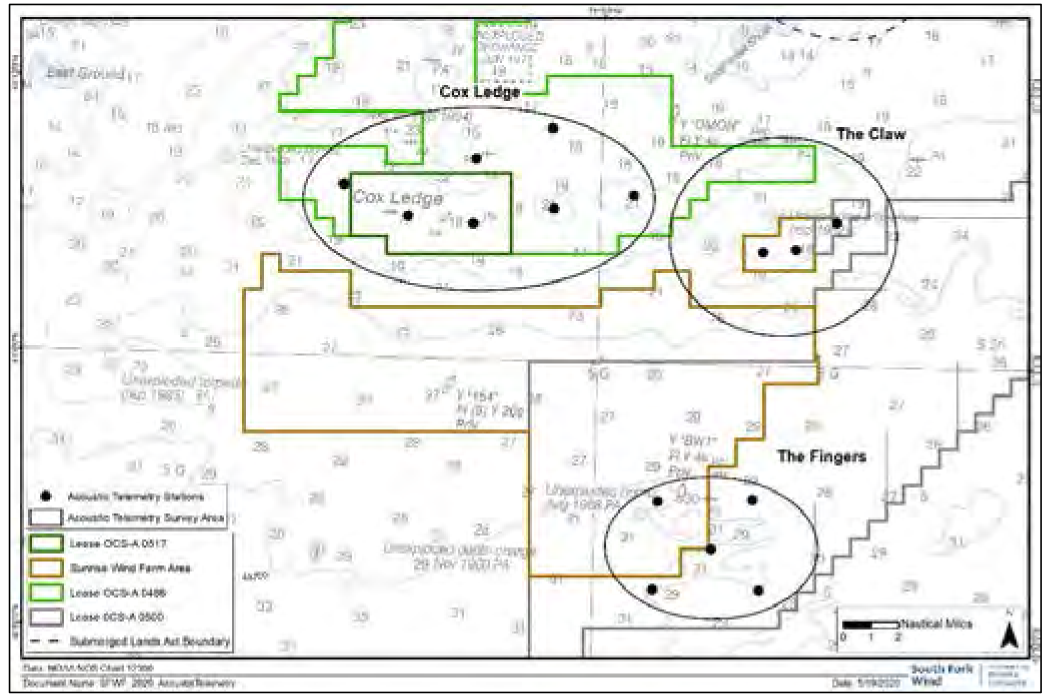
Collaborators

- TNC, BOEM, SMAST, WHOI, Rutgers, NOAA



Acoustic Telemetry – Highly Migratory Species

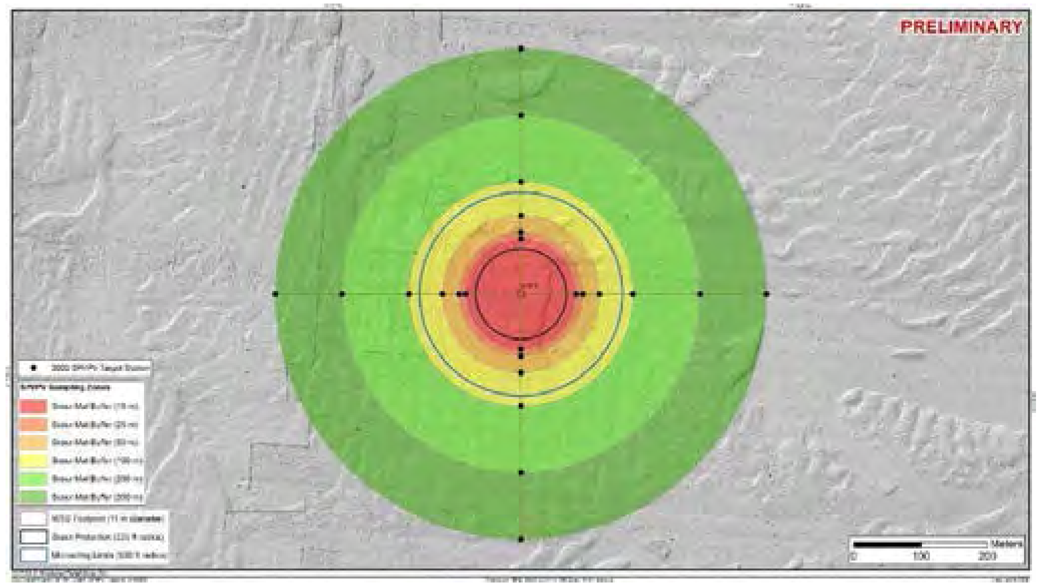
- Joint project between INSPIRE and Anderson Cabot Center for Marine Life at NEAQ funded through MA CEC
- Monitor presence and persistence of 3 HMS species at popular recreational fishing sites within WEA's
- Tag 20 individuals each of blue sharks, shortfin mako sharks, and bluefin tuna
- Up to 15 receivers will be deployed at 3 sites identified by recreational fishing community
- Receivers deployed strategically with MA DMF cod study
- Data shared between projects as well as regional telemetry data sharing networks

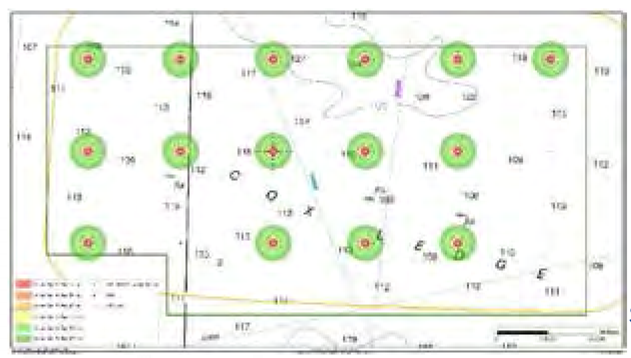


https://www.projectaware.org/news/success-mako-sharks-cites-cop18

Benthic Monitoring – Turbine Foundations

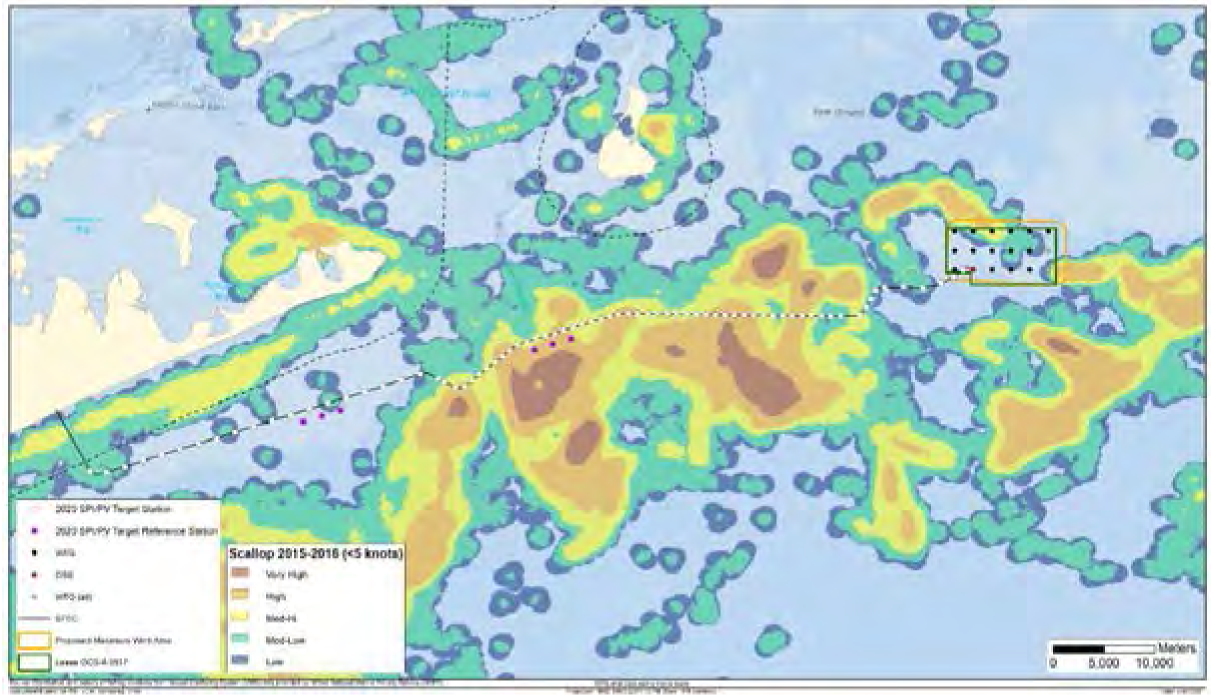
- Conducted to monitor spatial scale of potential impacts to benthic habitats and biological communities within SFW site
- SPI/PV sampling using BAG design
- 4 transects in each direction from foundation site
- 6 sampling stations in each transect extending to max planned extent of scour protection





Benthic Monitoring – Export cable (SFEC)

- Examine the effects of installation and operation of the export cable on the benthic habitat and scallop abundance
- SPI/PV sampling using BACI design
- Sampling density doubled in areas of higher scallop abundance



Request for Proposals

- **Requests for Interest was issued to local universities and research institutions on April 22nd**
- **Request for Proposals was sent on May 5th**
  - Gillnet, Beam Trawl, Ventless Trap, Fish Pot surveys
- **Proposal submission deadline is May 26th**
- **Applicants will be selected, and contracts will be awarded in late June**
  - Applications will be evaluated based on technical solutions and experience, economics, and health and safety management.

Next Steps

Pre-construction fish and lobster surveys anticipated to begin in August or September 2020

- Ørsted HSE requirements and vessel inspections
- Covid-19 and associated regulations on field work

THANK YOU

Contact Us

Melanie Gearon

1-857-348-3261

melge@orsted.com

Greg DeCelles

1-857-408-4497

grede@orsted.com

www.southforkwind.com

info@southforkwind.com

South Fork Wind | Powered by Ørsted & Eversource