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Memo

Subject	Mitigation Actions
To	Jeffrey Willis, Executive Director; James Boyd, Coastal Policy Analyst (CRMC)
Copy	Rhode Island Fishermen's Advisory Board (FAB) Robin Main (Hinckley Allen), Liz Gowell, Olivia Larsen Tesse (Orsted)
From	Melanie Gearon (Orsted)
Date	December 15, 2020
Regarding	South Fork Wind Project, Mitigation Settlement RI CRMC

As part of the mitigation negotiations with the Coastal Resources Management Council (CRMC) and its Fishermen's Advisory Board (FAB), South Fork Wind, LLC (SFW) provides this memo with information on certain requested mitigation actions that the FAB raised in its proposal made on November 19, 2020. This memorandum addresses: SFW's commitment in the federal permitting process to pile-driving noise attenuation and sound verification; SFW's commitment to no temporal overlap and minimal spatial overlap between the low frequency High Resolution Geophysical surveys and the SFW fisheries monitoring surveys conducted prior to construction; SFW's supporting information on HRG survey equipment and lack of impacts to fish and invertebrates; details on the gillnet survey for the SFW fisheries monitoring plan; and post-construction radar study that SFW will provide to the US Coast Guard.

Pile-driving Noise Attenuation and Sound Verification

This issue is regulated under NOAA. In its Application submitted to NOAA for an Incidental Harassment Authorization (IHA), SFW has committed to monitoring and exclusion zones that are based on modelled 10 dB broadband underwater noise reduction levels during pile driving of foundations. Under the current federal permitting schedule, the IHA application will be published in the Federal Register on February 8, 2021.

SFW will take sound source verification measurements during pile driving of foundations to verify in situ underwater noise levels. A sound source measurement plan is included in the IHA application.

High-Resolution Geophysical (HRG) Surveys and Fisheries Monitoring Surveys

HRG Survey Equipment Overview

HRG surveys are conducted by wind energy developers for site investigation to inform engineering and design, to conduct archaeological assessments, and to perform benthic habitat mapping. These surveys are also required by the

Bureau of Ocean Energy Management (BOEM) for offshore wind development activities.

HRG surveys for offshore wind development do not use 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). SFW has not used seismic air guns and does not intend to utilize seismic air guns during future site investigations surveys in the wind energy lease areas on the Atlantic seaboard. Offshore wind HRG surveys employ a variety of equipment types, other than seismic air guns, as summarized in Table 1.

The acoustic characteristics of HRG survey equipment used during offshore wind development are well known. Table 1 includes all equipment authorized for use under the approved 2019 Ørsted HRG IHA application and 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. Offshore wind HRG equipment operate at a range of frequencies. 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 in offshore wind HRG surveys, non-airgun sub bottom profilers known as 'sparkers' and 'boomers' operate at the lowest frequency range, and thus are most relevant to assess further for any potential to impact the distribution and behavior of fish in the region, based on their hearing sensitivity. For this reason, HRG equipment commonly used in offshore wind surveys have been studied by BOEM.

In the BOEM Final Programmatic Environmental Impact Statement (EIS) for Geological and Geophysical Surveys in the Gulf of Mexico, several alternatives were considered, which included >180,000 km of non-airgun HRG surveys using equipment such as boomers, sparkers, CHIRP sub-bottom profilers, side-scan sonars and multibeam echosounders. For all alternatives, the EIS concluded that non-airgun HRG equipment would have little to no measurable impacts on fisheries resources, Essential Fish Habitat, commercial and recreational fisheries, and benthic communities (BOEM, 2017). The Vineyard Wind Supplemental EIS also concluded that impacts of HRG survey noise to finfish, invertebrates and Essential Fish Habitat were negligible (BOEM, 2020).

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 RMS90 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

Species/Species Group	Family	Order	Sound Detection	Sensitivity
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

Schedules for SFW Fisheries Monitoring Survey and HRG Surveys

The FAB has raised the question about whether any spatial and temporal overlap of HRG surveys with fisheries monitoring surveys could bias the results of the pre-construction fisheries monitoring.

SFW commits to no temporal overlap and minimal spatial overlap between the low frequency HRG Surveys (e.g., boomers and sparkers) and the SFW fisheries monitoring surveys prior to construction.

Fisheries monitoring surveys began at SFW in October 2020, when the first beam trawl survey trip was completed (Figure 1). SFW concluded HRG surveys at the SFW lease area in June 2020, prior to the start of the beam trawl survey, and no additional HRG surveys using this equipment are planned at the SFW lease site in 2020. Monthly sampling trips are scheduled to continue for the beam trawl survey through October of 2022. The SFW gillnet and fish pot surveys are scheduled to begin in April 2021, and the ventless trap survey will begin in May of 2021. Those pre-construction fisheries surveys will also continue through 2022. SFW does not plan to use 'sparkers' and/or 'boomers' in the SFW lease areas in 2021 when all four of the SFW fisheries monitoring surveys will be sampling. Sparkers and boomers are also not planned for use in SFW in 2022.

In addition, the reference areas for the SFW gillnet, beam trawl, and ventless trap fisheries monitoring studies are located well outside of the SFW lease area in areas that have not been directly surveyed using HRG equipment (Figures 2-4).

Figure 1. Planned timeline for pre-construction fisheries monitoring surveys at SFW from 2020 through 2022. Note that the beam trawl and fish pot surveys will sample once per month, while the gillnet and ventless trap surveys will sample twice per month. NOTE: SFW concluded HRG surveys at the SFW lease area in June 2020.

	2020			2021												2022											
Survey	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Gillnet							X	X	X				X	X	X				X	X	X				X	X	X
Beam Trawl	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Ventless								X	X	X	X	X	X	X						X	X	X	X	X	X	X	
Fish Pot							X	X	X	X	X	X	X						X	X	X	X	X	X	X		

Figure 2. SFW gillnet survey area, along with the two reference areas that will be sampled during the survey.

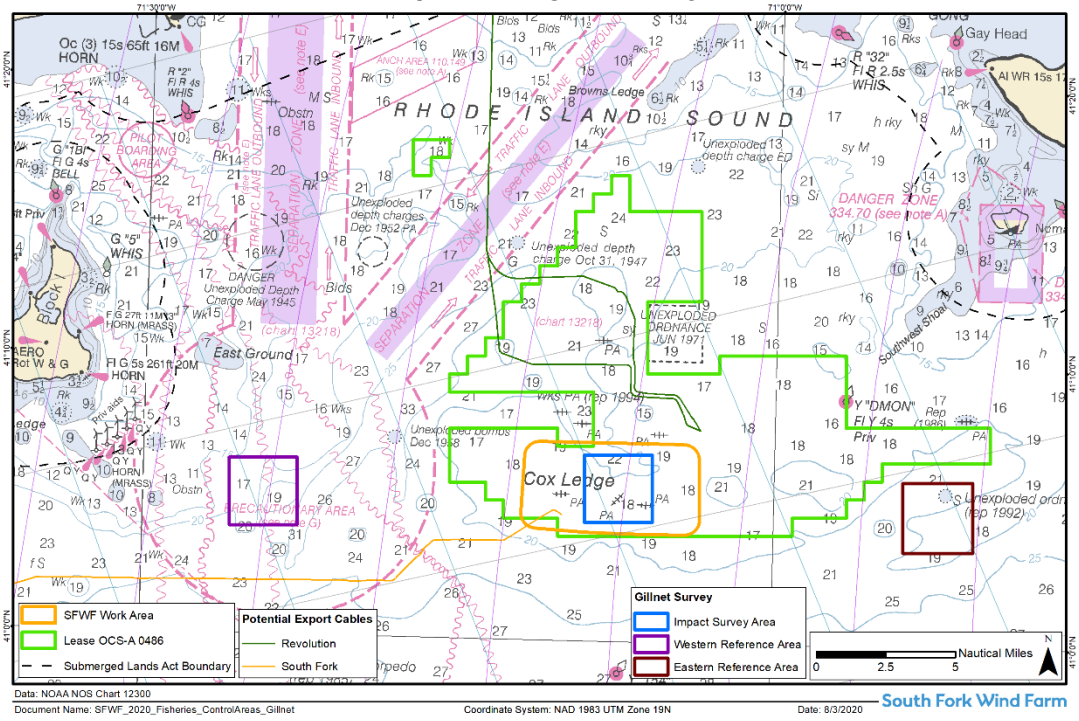


Figure 3. SFW beam trawl survey area, along with the two reference areas that will be sampled during the survey.

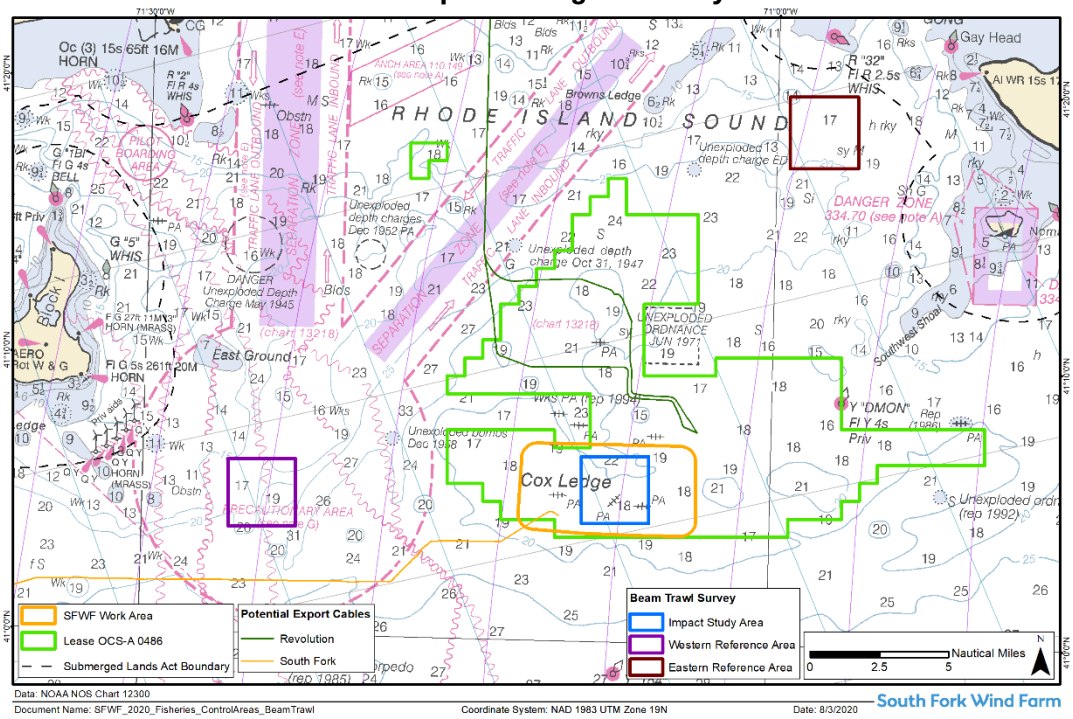
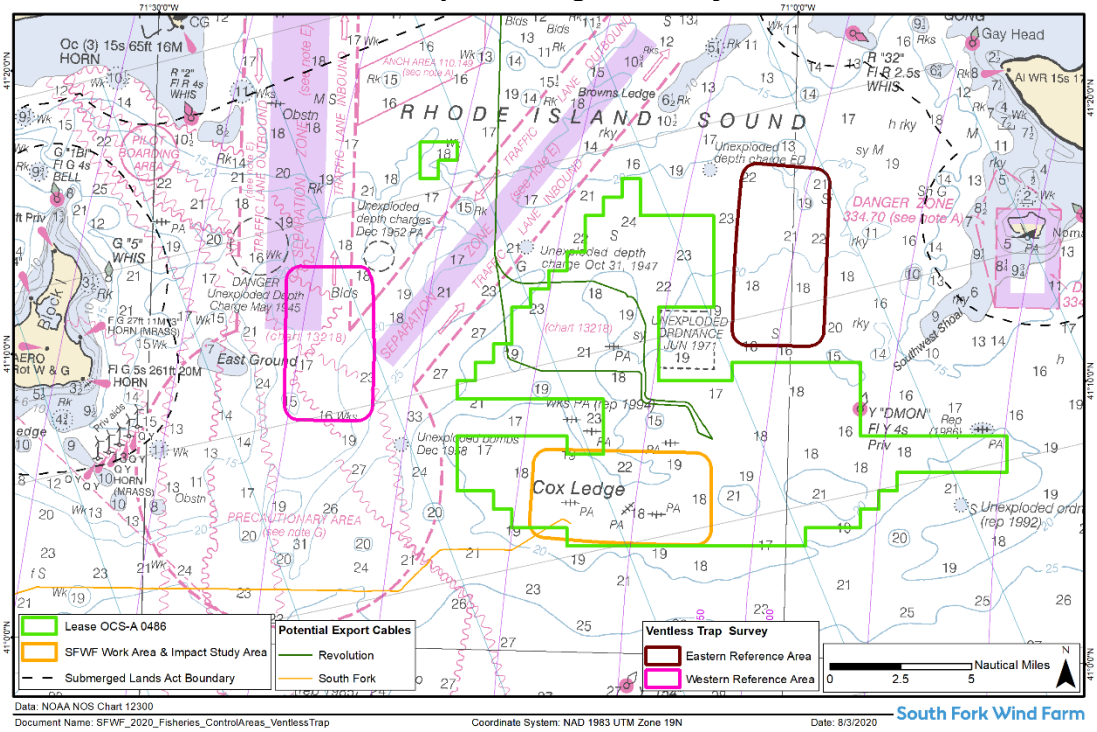


Figure 4. SFW ventless trap survey location, and the two reference areas that will be sampled during the survey.



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Fisheries Monitoring Plan (FMP), Gillnet Survey

The gillnet survey to be conducted at the SFW lease area has been in development since 2018 and was initiated following stakeholder input on the importance of the demersal monkfish and winter skate gillnet fishery in and around Cox Ledge. The survey design has undergone extensive revisions based on feedback from a variety of stakeholder groups including state and federal agencies and the commercial and recreational fishing industries. Due to the reasons explained below, at this time SFW is unable to modify the gillnet methodology to accommodate the FAB's request to expand the survey to include 6.5-inch and 8-inch mesh sizes.

The initial survey design considered multiple mesh sizes in a gillnet panel to target a range of species and size classes at the site, however this approach was deemed problematic by reviewers. The use of multi-mesh gillnet panels creates challenges for statistical analysis. When panels with varying mesh sizes are randomly placed within the same string, the panels influence each other's catchability, which violates the independence assumptions of parametric statistical analyses (van Hal et al. 2017). Ideally, if multiple mesh sizes are to be considered, a string of gillnets should contain only one mesh size, and strings of different mesh sizes should be set in proximity at each sampling location. However, this would lead to more gear set in the area which would increase potential for protected species interactions (see below). Increased gear deployment in the SFWF could lead to saturation in the area and conflict with existing uses (e.g. existing commercial and recreational fishing interests).

Gillnets also present a significant entanglement risk to protected species in the region. Several meetings and conversations were conducted with the Greater Atlantic Regional Fisheries Office (GARFO) Protected Species Division to discuss potential impacts of a gillnet survey on protected resources. GARFO reviewers who ultimately permit the survey were not in favour of having more gillnet gear in the water. Vertical buoy lines on the ends of gillnet strings, along with the nets themselves can lead to interactions with large whales, including the North Atlantic Right Whale, small cetaceans like dolphins and the Harbor Porpoise, sea turtles, and Atlantic sturgeon. Stand-up gear can lead to a higher incidence of interactions, when compared to tie-down gear (Fox et al. 2011).

The seasonality of sampling also influences the likelihood of interactions with protected species. The monkfish gillnet fishery in the region typically occurs in spring (Apr-Jun) and fall (Oct.-Dec) when the monkfish migrate on and offshore. Large mesh (12 in) is typically used along with tie downs creating a lower profile of the net in the water column. The area off southern New England is closed to all gillnetting in March in accordance with the Harbor Porpoise Take Reduction Plan. Feedback from the industry, including a member of the FAB, indicated that monkfish gillnetting in summer does not occur in the area because it would lead to a higher incidence of interaction with sea turtles and large sharks (which would collapse or damage the gear).

The design of the gillnet survey balances feedback received from multiple stakeholder groups including fishermen and regulatory agencies. The gillnet survey is intended to representatively sample demersal winter skate and monkfish in a manner consistent with the practices of the commercial fishery, while also minimizing the potential risks to protected species in the area. This gillnet survey is not meant to sample the entire species assemblage at the site, but will complement the beam trawl (currently underway), ventless trap, ventless fish pot, acoustic telemetry, and benthic monitoring surveys planned for the SFW (SFW Fisheries Research and Monitoring Plan, Sept 2020). Ultimately, SFW added more gear types to the monitoring survey (e.g. fish pots, beam trawl) when the issue of other species was brought up in the review. For more information regarding feedback and changes made to the survey design please see Appendix A to the monitoring plan.

References

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Radar Study

SFW will conduct a post construction researched radar analysis that will be submitted to the U.S. Coast Guard. The purpose of the analysis will be to determine the extent, if any, that SFW WTGs and OSS may produce radar reflections, blind spots, shadow areas, or other radar effects that may have a significant adverse impact on the safety of navigation. This analysis shall specifically consider the types of vessels that regularly navigate in the area of the SFW installation, taking into account the navigation, communications and collision avoidance equipment typically in use on those vessels.

The U.S. Coast Guard has stated that the potential for wind turbine generator (WTG) and offshore substation (OSS) interference with marine radar is site specific and a function of many factors including turbine size, layout of the SFW array, number of turbines, construction material(s), topographical features, and the types of vessels impacted. It is further understood that different vessels or classes of vessels will have various types of electronic equipment.

The final analysis and recommended mitigation measures will be submitted to the U.S. Coast Guard for its approval.

To the extent that its analysis identifies any significant adverse impacts to navigation, SFW will develop recommended mitigation measures to minimize such impacts. Both a draft of the analysis and any recommended mitigation measures will be shared with the maritime community via the U.S. Coast Guard Southeastern New England Port Safety Forum and Orsted's "Information for Mariners" web page.