

Year 2 Report

SFW01-0097 Fisheries Monitoring Plan

WP2: Beam Trawl Monitoring Survey

Reporting Period: 1 October 2020 to 31 September 2022

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Executive Summary

The Commercial Fisheries Research Foundation (CFRF) and collaborators have completed the 24 months of the South Fork Wind Farm (SFWF) pre-development fisheries monitoring beam trawl survey. The survey was conducted once per month within the South Fork Wind Farm development area as well as nearby reference areas. The survey gear consisted of a 3-m beam trawl outfitted with a 2.4 cm knotless nylon liner. For the first 20 months of the survey, three twenty-minute tows each in the SFWF development area, a Western reference area, and an Eastern reference area, for total of nine tows per month, were sampled. However, due to differences in catch among areas, particularly for the Eastern area, and a lack of scallops caught in the SFWF area, the sampling design changed in the 21st month of the predevelopment survey. The updated design included an expansion of the impact sampling area within the SFWF area and sampling five twenty-minute tows each in the SFWF development area and the Western reference area, for a total of ten tows per month. For all tows, the entire catch was enumerated and weighed, and length/width measurements were taken of individual fish and selected invertebrate species. Stomach samples were collected from select commercially valuable fish species for prey composition analysis. Oceanographic conditions including salinity, water temperature, and weather conditions were recorded each haul. Preliminary results from the 24 months of sampling showed the Eastern reference area was muddy and dominated by crabs, skate, squid, and hake. The Western reference area was rocky with many small invertebrates and high catches of scallop and skate. The SFWF development area was predominantly skate, crabs, scallops, scup, and miscellaneous invertebrates. Importantly, the SFWF area often had low catches of scallops prior to the expansion of the survey area in the 21st month of the survey.

Introduction

The Commercial Fisheries Research Foundation, in partnership with local fishermen and the University of Rhode Island, is conducting pre-construction fisheries monitoring surveys of the South Fork Wind Offshore Wind Farm near Cox Ledge. Due to the differences in selectivity of different gear types, four different surveys, each using a different gear type, are currently being conducted: beam trawl survey, gillnet survey, ventless trap survey, and fish pot survey. One of the primary methods for assessing anthropogenic impacts on natural habitats is the Before-After-Control-Impact design. The ideal design for this experiment requires baseline information before impact in multiple control areas from several points in time. This asymmetrical design is needed not only to evaluate the variation in animals and habitat within impact areas before and after development, but also to ensure changes in variation can be attributed to the anthropogenic impact. The pre-construction beam trawl survey aimed to provide the pre-impact data on fish and invertebrate species that are commonly selected by this gear type. Such data is needed to apply the asymmetrical Before-After-Control-Impact design to the South Fork Wind Farm (Figure 1). The survey also collected data on the oceanic conditions associated with catch which may help to interpret results in the context of a changing environment and provide general information about animal ecology. The survey began in October 2020 and sampling occurred once per month year-round through September 2022. This report details the methods of the survey and summarizes the results from the first 24 months of sampling.

Methods

The pre-development beam trawl survey was conducted once per month for two years prior to construction of the SFWF. For the first 20 months of the survey, three twenty-minute tows each in the SFWF development area, a Western reference area, and an Eastern reference area, for total

of nine tows per month, were sampled (Figure 1). However, due to differences in catch among areas, particularly for the Eastern area, and a lack of scallops caught in the SFWF area, the sampling design changed in the 21st month of the pre-development survey. The updated design included an expansion of the sampling locations within the SFWF and Western survey areas and sampling five twenty-minute tows each in the SFWF development area and the Western reference area, for a total of ten tows per month (Figure 2). Prior to the official expansion of the SFWF survey area, the CFRF received supplementary funding from the Sea Scallop Research Set-Aside (RSA) program (NOAA Award #NA22NMF4540054) to support the addition of an extra tow in the SFWF impact area to identify additional sampling locations that were more likely to yield higher catches of scallops. Prior to each survey departure, the pre-determined potential sampling stations in each area were randomly ranked. For the first 20 months of the survey, the first three ranked stations were selected as the primary stations for that month. Beginning in the 21st month of the survey, the first three stations from the original list of potential locations were selected, as well as the top two ranked stations from the list of expanded sampling locations.

Upon arrival at the vessel, the gear was inspected and a temperature logger, recording every 30 seconds, was attached to the frame. A handheld GPS unit was set to record position, heading, and speed every 15 seconds. Upon arrival at the station, the captain and lead scientist determined if there is a gear conflict; if so, the next station on the list was selected as the backup station. If there were no gear conflicts, the gear was deployed. Once the brake had been engaged on the winch, the time, depth and tow start position were recorded. The beam trawl was then towed for 20 minutes at a target speed of 4.5 knots with the wire at a 4:1 scope. Once the tow was complete the sea state, end depth, time, and position were recorded, and then the gear was examined to ensure it was sampling properly and there was no damage. If the tow was deemed invalid, the

station was resampled. If the tow was considered valid, the crew members emptied the entire codend onto the deck, and hydrographic data was collected via a conductivity, depth, and temperature sensor (CTD) cast.

The entire catch was then sorted by species. For all species of fish, cephalopods, crustaceans, elasmobranchs, and scallops, a subsample of 30 individuals was measured, and then all individuals were counted and aggregated for a total weight (0.01 kg) by species. Fish were measured to the nearest cm, while scallops, squid, and octopus were measured to the nearest 0.1 cm. Cancer crabs and lobsters were measured for carapace width/length to the nearest 0.1 mm then evaluated for shell condition, number of claws, disease status, sex, egg status, and the presence of v-notches for lobsters. The remaining invertebrates were identified to the species or group level and then counted and weighed by species or group. Rocks were counted in two size groups: coble represents rocks less than 10 inches diameter, while boulders represent greater than 10 inches diameter. Further, thanks to support from the RSA project, protocols to evaluate the biological and reproductive condition of individual scallops were also developed and incorporated in the last few months of the pre-construction survey. Specifically, for a subset of 30 scallops per area, additional data parameters of scallop meat condition, sex, reproductive stage, meat weight, and tissue weight were recorded. As this preliminary data was collected with the support of the RSA award, the data is not included in this report; however, these parameters will be recorded for all sampling trips during the construction phase of the beam trawl survey to identify any potential changes in scallop condition over time.

In addition, the entire catch or up to 10 individuals of black sea bass, codfish, monkfish, winter flounder, and winter skate was selected for stomach analysis. No more than 15 individuals of each species were selected for stomach analysis per area. Fish selected for stomach analysis

were measured to the nearest cm and individually weighed, and then the stomachs were excised and stored on ice for further analysis. The reproductive stage and sex were also recorded for all codfish during the stomach sampling. The stomachs selected for further analysis were frozen upon returning to land then processed within two weeks of collection. The entire stomach was weighed prior to dissection, then each prey item was identified to the lowest possible taxonomical unit with the aid of a 5x magnifier or a 25x stereo microscope. If the prey item was intact enough, the total length (carapace width for crabs) was recorded and the individual was weighed to the nearest 0.01 g. Prey items that could not be measured were aggregated by species for the weight and if possible, the number of individuals recorded. If prey items could not be identified to the species level, they were grouped to the lowest possible level and weighed. After the stomach had been fully examined and all prey removed, an empty stomach weight was recorded.

The GPS data, temperature logger data, and CTD data were imported into an Access survey database and linked to each station sampled. Upon completion of data entry, all data was reviewed for accuracy by at least one of the scientists who sampled the data. Data was then submitted to INSPIRE Environmental.

Preliminary Results:

The data in this reporting period covers the 24 sampling trips of the full two years of the predevelopment beam trawl survey. Each trip was conducted as close to the middle of the month as possible. The CTD cast was successful for all except two hauls (Station SF4 on 11/02/2021 and station SF6 on 05/19/2022). All data for these trips has been entered into the project database, reviewed for accuracy, and shared with INSPIRE Environmental.

Environmental conditions were relatively similar between areas, however the Eastern area had colder winter and warmer summer bottom water temperatures compared to the SFWF and Western area during the period in which all three areas were sampled (Table 1). Overall, 43,492 fish (bony and elasmobranch), 24,716 scallops, and 7,562 crustaceans were caught in the first 24 months of the survey. Although we did observe some seasonal patterns in each area, the dominant species/groups in each area remained mostly consistent for the pre-development survey, and there appeared to be differences in species composition among areas (Figure 3, Figure 4). For example, the Eastern reference area was muddy and dominated by crabs, skate, squid, and hake. The Western reference area was rocky with many small invertebrates and high catches of scallop and skate. The South Fork Wind Farm development area was predominantly skate, crabs, scallops, scup, and miscellaneous invertebrates (Figure 3, Table 2). Importantly, the SFWF area often had very low catches of scallops prior to the expansion of the survey area in the 21st month of the survey (Figure 5). For example, for the first 20 months, the average total weight of scallops caught in the SFWF area was 4.73 kg (\pm 4.73 SD). In contrast, the average total weight of scallops caught in months 21 through 24 in the SFWF area was 13.3 kg (\pm 4.42 SD). This increase in scallop catch within the SFWF area will better allow for potential impacts of wind farm construction on scallops to be determined.

A total of 321 winter skate, 23 codfish, 153 winter flounder, 63 black sea bass, 7 unclassified skate, and 45 monkfish have been processed for stomach content analysis. Of the examined fish, 2 codfish (9%), 26 black sea bass (41%), 16 monkfish (36%), 3 unclassified skate (43%), 52 winter flounder (34%), and 69 winter skate (21%) had empty stomachs. Table 3 shows the total weight of each prey type identified for each predator species.

Outreach:

The CFRF maintains a project webpage for the beam trawl survey at <http://www.cfrfoundation.org/sfwf-beam-trawl-survey> where data summaries are uploaded as the survey progresses. This survey has also been highlighted three times in the CFRF quarterly newsletter ([November 2020](#), [November 2021](#), and [November 2022](#)). The year one results of this survey were presented at the 151st annual meeting of the American Fisheries Society in Baltimore, Maryland in November 2021. A public outreach event regarding year 1 of the South Fork Wind Farm pre-development surveys was held at Champlin's Seafood Deck in Point Judith, Rhode Island on March 28, 2022. At the event a poster displayed survey and stomach content results and a presentation sharing similar information was given to a live and virtual audience. In total, approximately 40 people attended the event.

Tables

Table 1. Average air temperature, bottom water temperature by survey area, and Beaufort Sea State for each of the 24 predevelopment beam trawl surveys. The East area was not surveyed after May 2022.

Survey Date	Average Temperature (°C)				Average Beaufort Sea State
	Air	East Bottom	SF Bottom	West Bottom	
10/28/2020	13.2	16.4	16.3	16.7	5
11/24/2020	12.4	12.2	13.6	13.3	3
12/19/2020	1.4	8.4	10.3	10.1	2
1/13/2021	5.5	6.3	7.2	9.3	2
2/11/2021	-0.5	3.2	4.3	5.1	2
3/18/2021	4.8	3.3	5.0	6.8	2
4/14/2021	9.4	5.6	5.9	6.0	1
5/17/2021	14.0	7.3	6.9	6.5	2
6/17/2021	18.0	11.2	10.1	9.5	3
7/14/2021	19.8	14.4	11.6	11.8	2
8/17/2021	22.7	15.5	12.8	13.4	2
9/16/2021	21.2	18.8	17.7	16.8	4
10/15/2021	18.5	18	17.9	17.7	2
11/20/2021	5.5	13.5	14.7	16.0	3
12/10/2021	NA	10.3	11.9	12.2	3
1/24/2022	1	4.9	6.9	8.4	3
2/21/2022	5.6	3.5	6.1	6.2	2
3/16/2022	7.2	4.4	5.7	6.5	2
4/13/2022	11.4	6.2	6.2	6.6	2
5/19/2022	11.8	9.6	9.1	8.4	4
6/15/2022	18.5	NA	9.6	9.5	3
7/20/2022	23.2	NA	11.4	10.6	3
8/19/2022	22.8	NA	14.4	13.4	2
9/13/2022	21.8	NA	16.0	14.8	3

Table 2. Total number of each species caught for each area sampled during the first 24 months of the beam trawl survey.

Species	East	SFWF	West
ALEWIFE	1	2	
AMERICAN LOBSTER	31	5	10
ASTERIAS SPP		182	2636
ASTROPECTEN SPP	3	3	1861
ATLANTIC COD	3	1	19
BARNDOR SKATE	13	7	8
BLACK SEA BASS	11	15	57
BLUE CRAB	5		
BLUE MUSSEL		11	8
BOBTAIL SQUID UNCL.	1		2
BOULDER		2	48
BREAD SPONGE	4	531	1056
BUCKLER DORY (JOHN DORY)		2	
BUTTERFISH	1	8	
BUTTERFLY BOBTAIL SQUID		7	9
CHANNELED WHELK			43
COBBLE	1	127	1599
CRABS UNCL	1		
CUNNER		5	1
FOURSPOT FLOUNDER	58	36	31
GRAY TRIGGERFISH		1	3
GULFSTREAM FLOUNDER	60	24	18
HENRICIA SPP		14	198
HERMIT CRAB	2	123	259
HORSE MUSSEL		13	1
HORSESHOE CRAB	1		
ILLEX SQUID	6	29	16
INSHORE LIZARDFISH			1
JONAH CRAB	1437	858	495
LOLIGO SQUID	226	112	82
LONGHORN SCULPIN	18	24	71
MAHI MAHI	1		
MANTIS SHRIMP	14		
MONKFISH	10	16	27
MOON SNAIL	69	391	273
NORTH ATLANTIC OCTOPUS	1	6	9
NORTHERN SEAHORSE	1	2	1
NORTHERN PIPEFISH	19	1	2
NORTHERN PUFFER	1		
NORTHERN SAND LANCE	10	4	

Table 2 Cont. Total number of each species caught for each area sampled during the first 24 months of the beam trawl survey.

Species	East	SFWF	West
NORTHERN SEAROBIN	19	90	98
NUDIBRANCH		7	23
OCEAN POUT	12	7	30
OCEAN QUAHOG (LIVE)	133	60	5
ORANGE SEA CUCUMBER	5		3
PENAEUS SHRIMP	59		4
RED HAKE	137	57	102
RIBBED MUSSEL			1
ROCK CRAB	4060	295	371
ROCK GUNNEL		1	
SAND DOLLAR		37	166
SCUP	20	184	98
SEA MOUSE	13	1	40
SEA RAVEN		1	2
SEA SCALLOP	6	581	24129
SEA SCALLOP (CLAPPER)		21	525
SEA URCHIN		1	2
SILVER HAKE	144	68	63
SKATE EGGS	55	54	189
SMOOTH ASTARTE			7
SMOOTH DOGFISH		1	
SPIDER CRAB UNCL	37	6	5
SPINY DOGFISH		1	3
SPONGE UNIDENTIFIED		11	
SPOTTED HAKE	36	40	49
STRIPED CUSKEEL	1		
STRIPED SEAROBIN	1		1
SUMMER FLOUNDER	28	24	34
SURF CLAM (LIVE)		6	14
SWIMMING CRAB UNCL.	74		
UNCLASSIFIED LITTLE/WINTER SKATE	615	3931	3250
WAVED WHELK			144
WEAKFISH		1	1
WHITE HAKE	1		
WINDOWPANE FLOUNDER	29	82	60
WINTER FLOUNDER	44	13	109
WRYMOUTH	2		
YELLOWTAIL FLOUNDER		5	2

Table 3. Total weight (g) of each prey item grouped by predator.

Prey	Atlantic Cod	Black Sea Bass	Monkfish	Unclassified Skate	Winter Flounder	Winter Skate
Amphipod sp	2.59	0.04	0.01	0.01	30.49	161.54
Black Sea Bass	5.92					
Cancer Crab	14.76	2.75		0.08	0.14	9.36
Cestode sp	0.64		2.34		3.97	3.06
Fish Eggs	4.2					
Fish_Unid	160.14	19.25	901.08		0.28	11.62
Gulf Stream Flounder	37.03		17.7			
Hake_Unid	3.31	1.43	12.44			
Hermit Crab		2.91			6.84	0.07
Herring Sp	82.66					
Illex			9.59			
Isopod sp		0.02		0.37	0.11	0.01
Jonah Crab	32.19	8.54		1.56	0.52	3.72
Little/Winter Skate						1.07
Lobster						1.44
Menhaden			1620			
Nematode Sp			0.01		0.005	1.216
Pea Crab					0.07	0.8
Plastic		0.01				
Polychaete sp		0.2		0.71	28.89	30.89
Razor Clam						14.64
Red Hake	179.79	5.96	104.96			
Rock Crab	16.06	75.3				14.26
Rocks	1.48				0.01	
Sand Dollar					0.12	

Table 3 cont. Total weight (g) of each prey item grouped by predator.

Prey	Atlantic Cod	Black Sea Bass	Monkfish	Unclassified Skate	Winter Flounder	Winter Skate
Sand Flea						27.43
Sand Lance			185.08			600.95
Scallop					2.84	0.12
Sea Cucumber Unid					0.38	0.28
Sea Robin						7.66
Shell	0.09				0.64	0.16
Shrimp_Unid	4.48	3.22	0.12		0.02	2.75
Silver Hake	2.48		51.42			2.61
Skate Egg Case	0.19					
Squid_Unid			2.7		2.01	1.65
Surf Clam					1.41	
Unidentified Plant Material			0.3		7.55	0.11
Waved Whelk					0.01	
Well Digested Prey	20.61	10.08	36.93	0.42	117.46	382.74

Figures

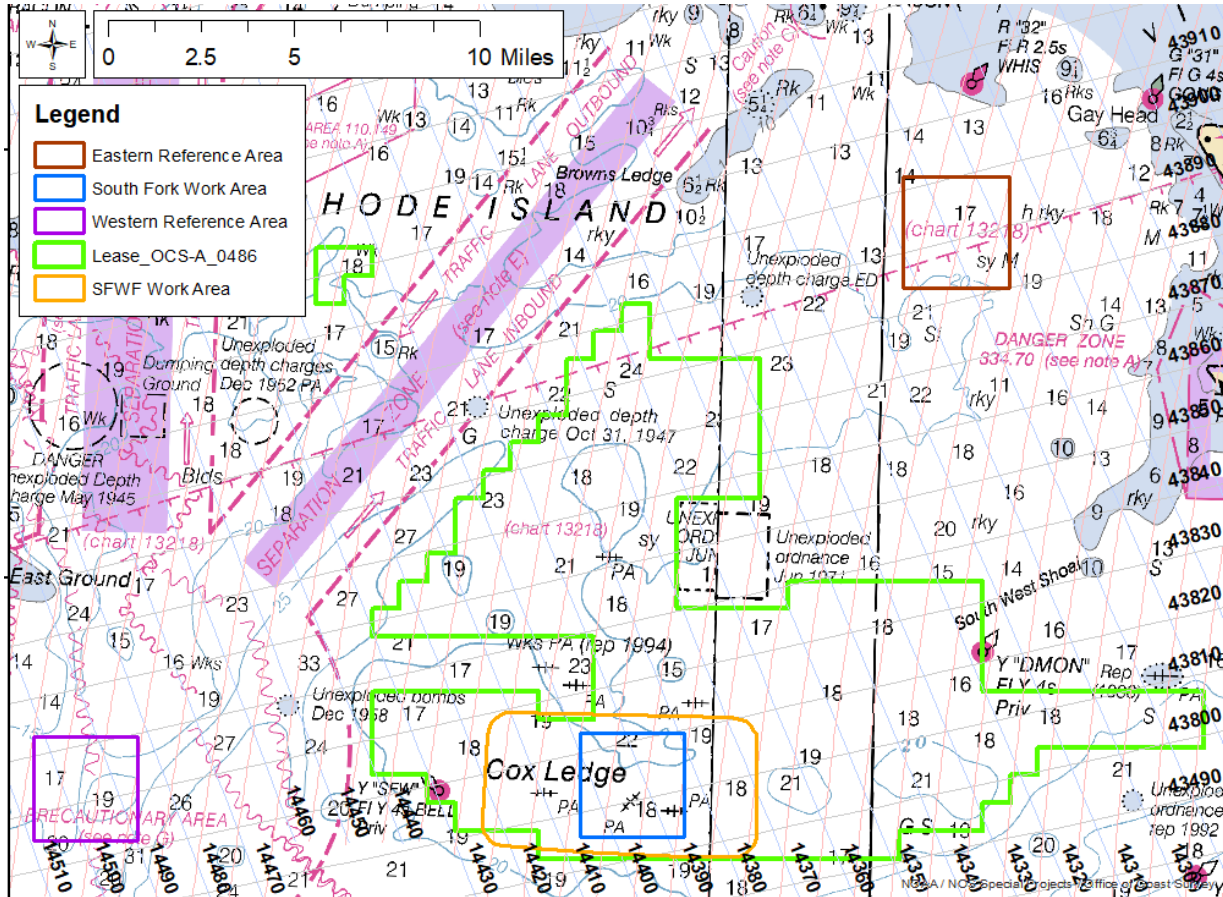


Figure 1. The South Fork Wind Farm (SFWF) development area and the three areas monitored by the beam trawl survey throughout the first 20 months of the survey. After the 20th month of the survey, the Eastern reference area (red box) was no longer monitored by this survey.

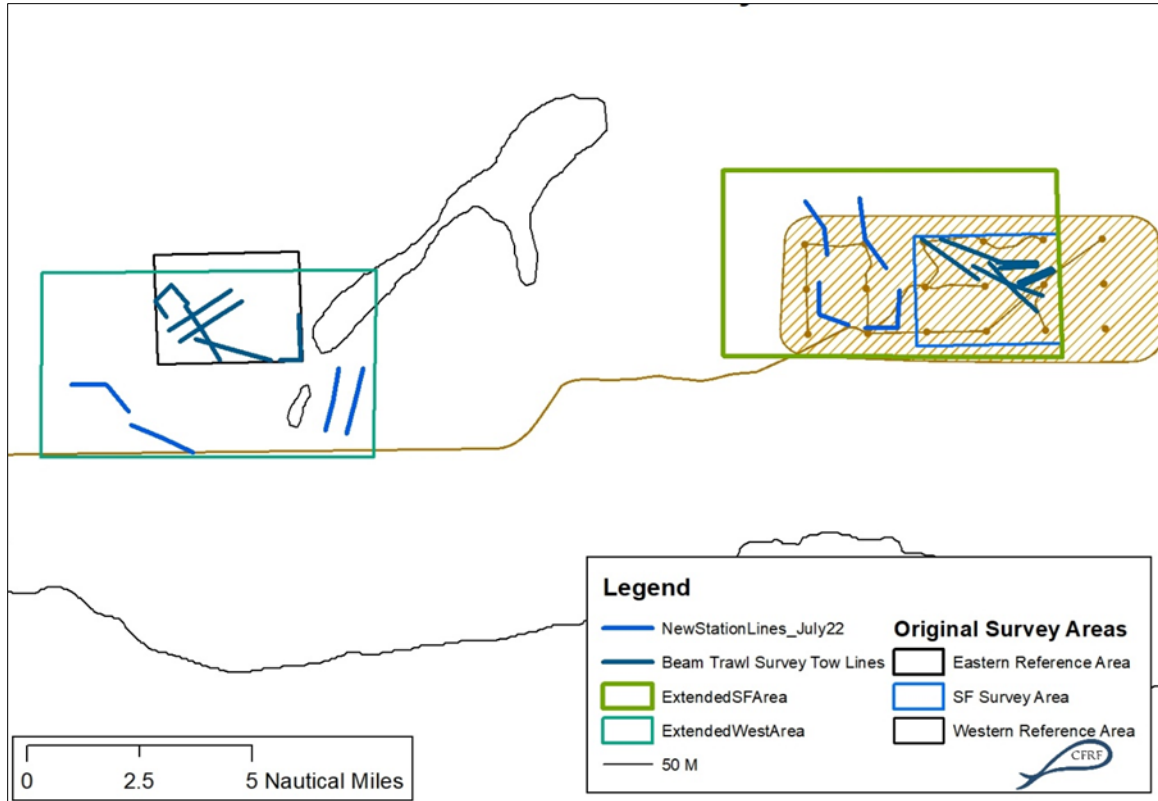


Figure 2. The expanded South Fork Wind Farm (SF) and Western survey areas monitored by the beam trawl survey beginning in the 21st month of surveying.

Preliminary

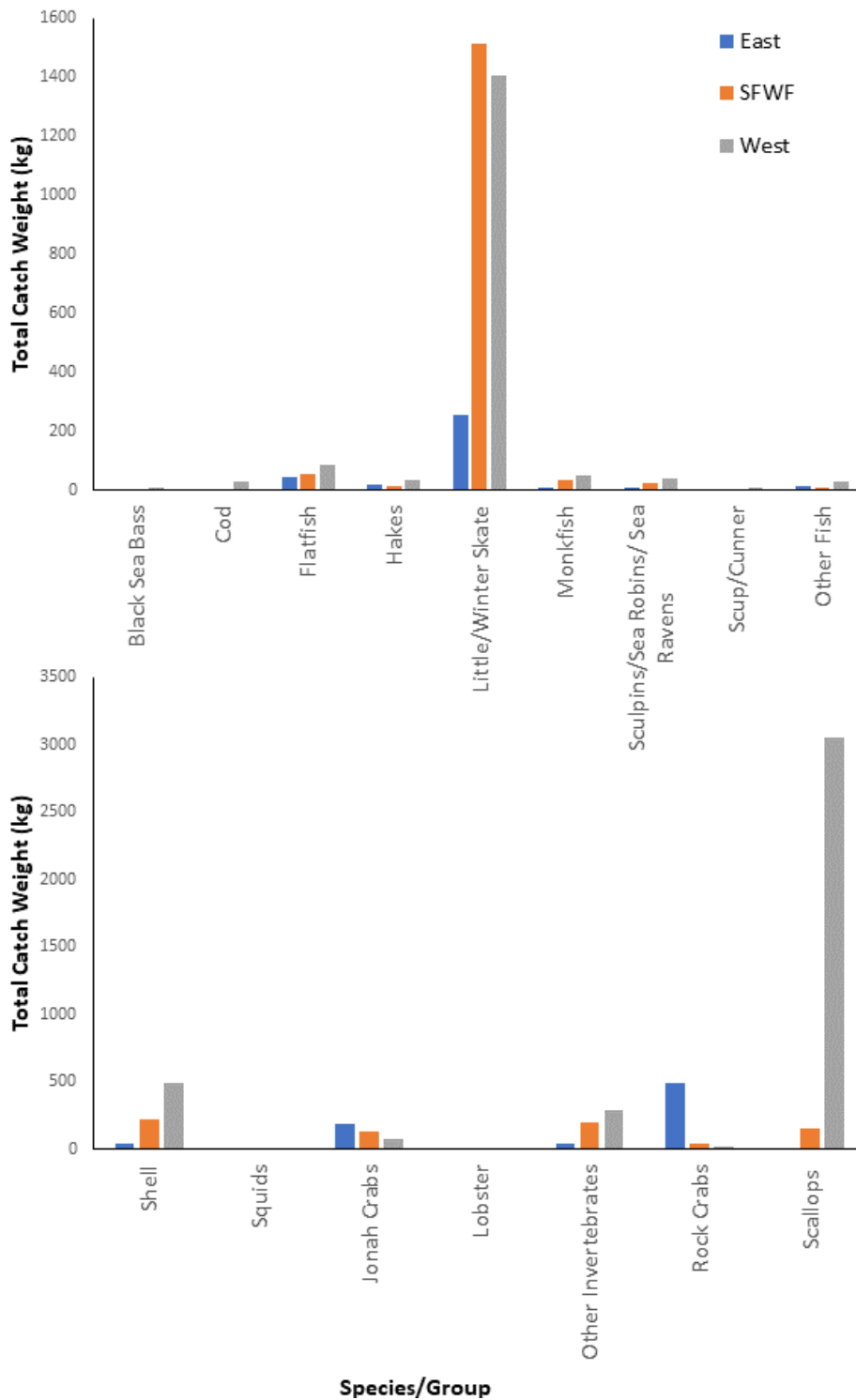


Figure 3. Total catch by weight of each major species/group of fish (top) or invertebrates (bottom) for each survey area during the 24 months of the predevelopment beam trawl survey in the South Fork Wind Farm development area and control areas to the east or west.

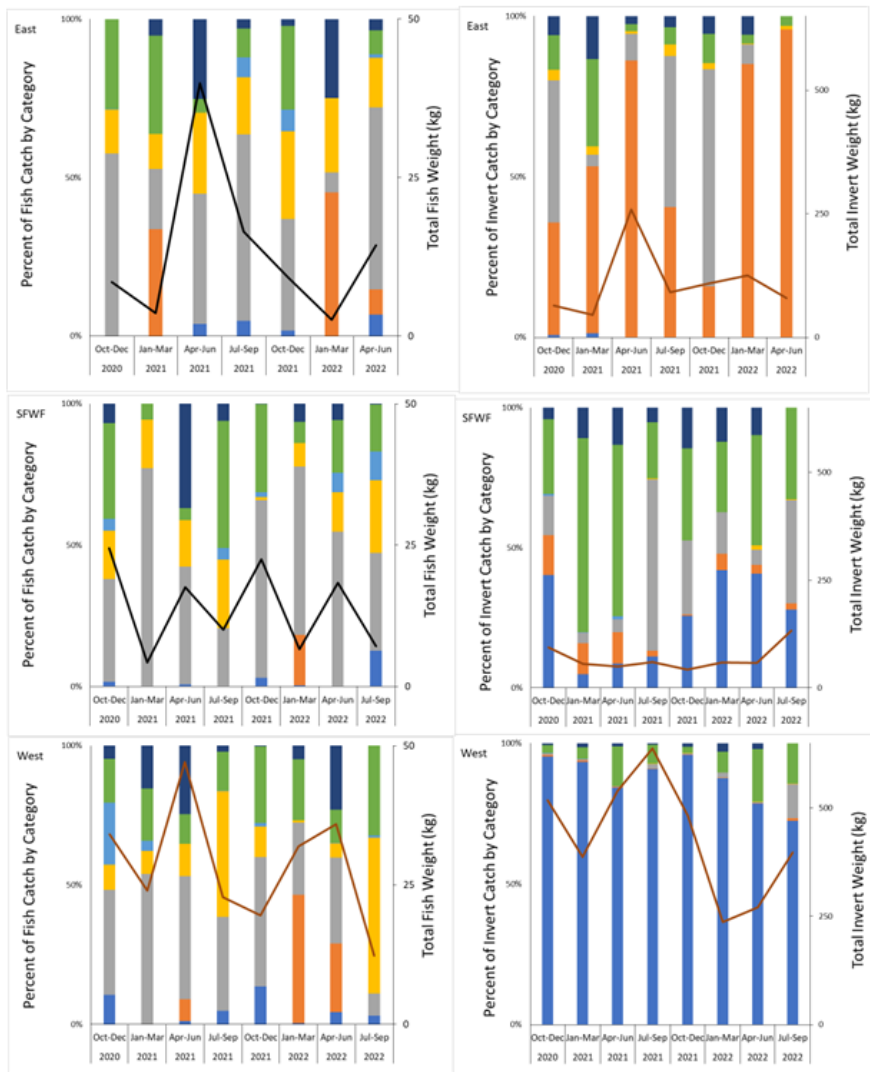
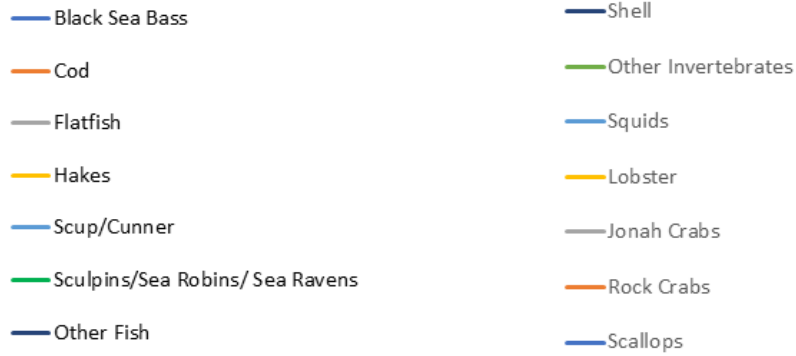


Figure 4. Percent of the major catch categories by weight for each season of the beam trawl survey for the three survey areas (Top- East; Middle- SFWF; Bottom- West) plotted against the total weight per area for fish (left) or invertebrates (right).

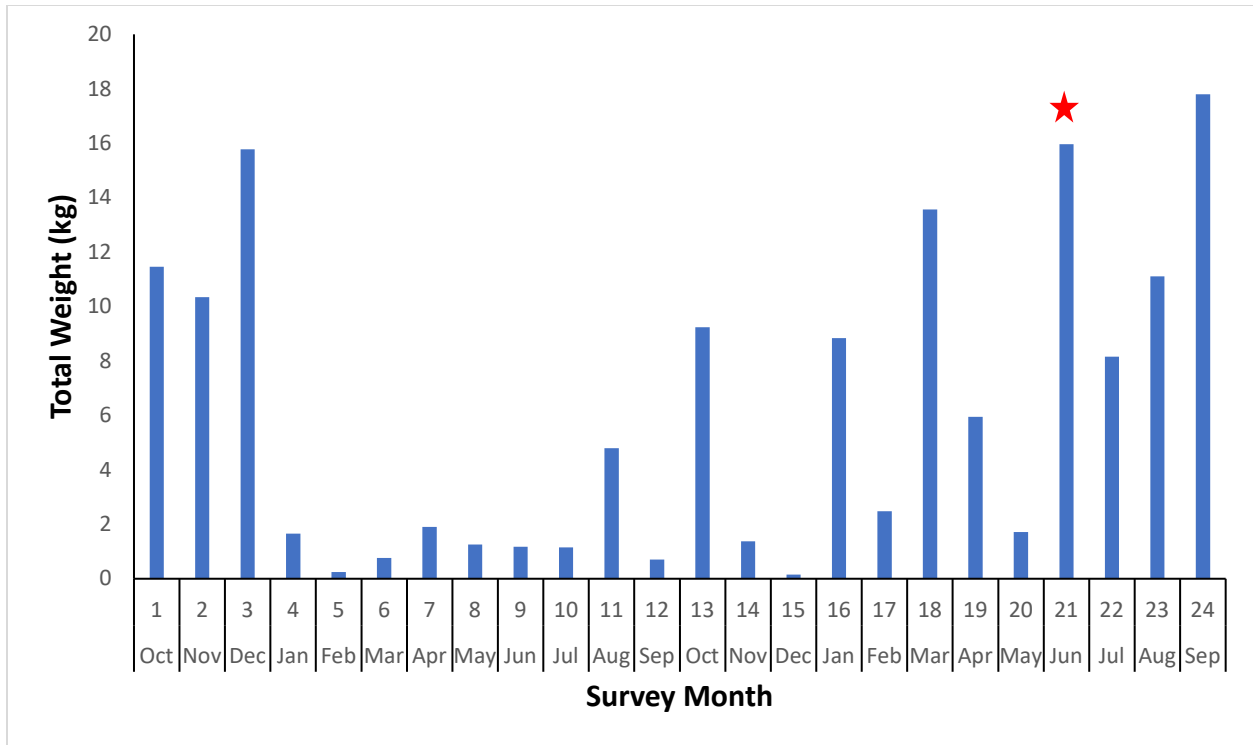


Figure 5. Total weight of scallops caught in the South Fork Wind Farm (SFWF) area for each of the 24 months of the predevelopment beam trawl survey. The red star indicates the month in which the SFWF survey area was expanded and additional tows within the SFWF area were added.

Preliminary