Vineyard Wind Monitoring Plan

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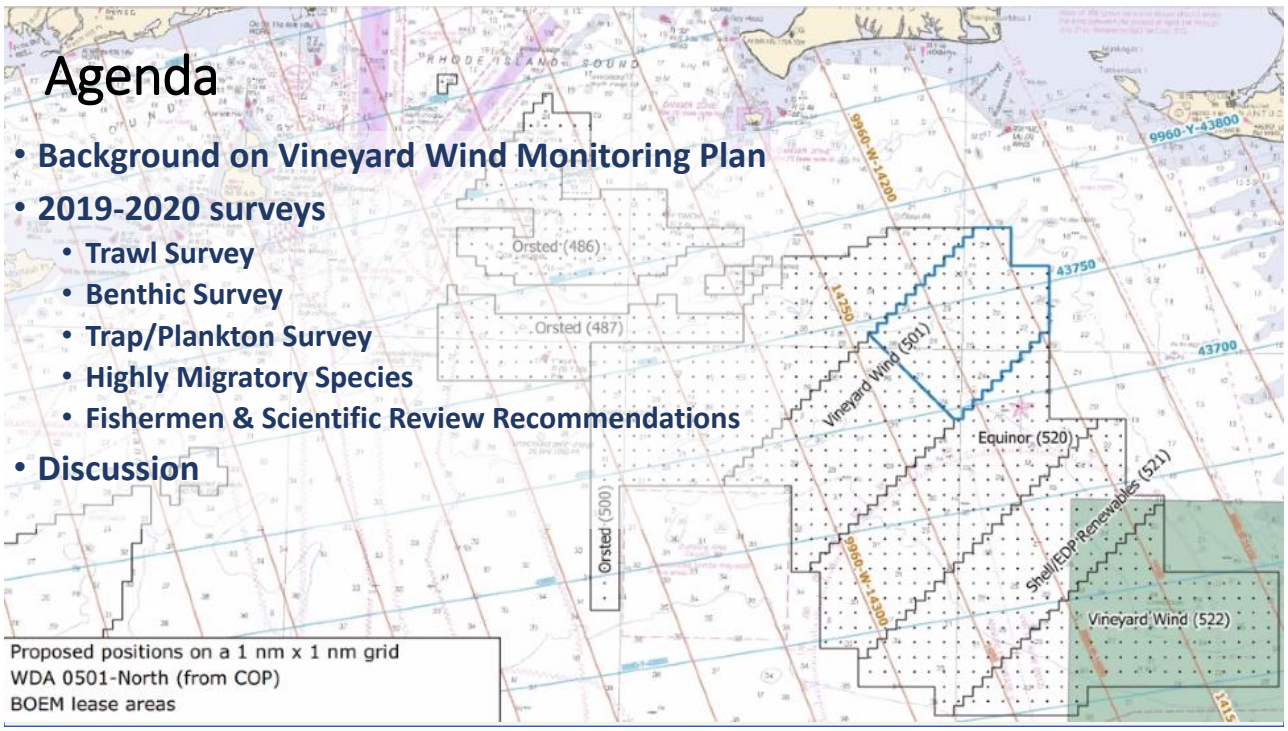
OCS-A 0501 MASS USA

VINEYARD WIND

1

Agenda

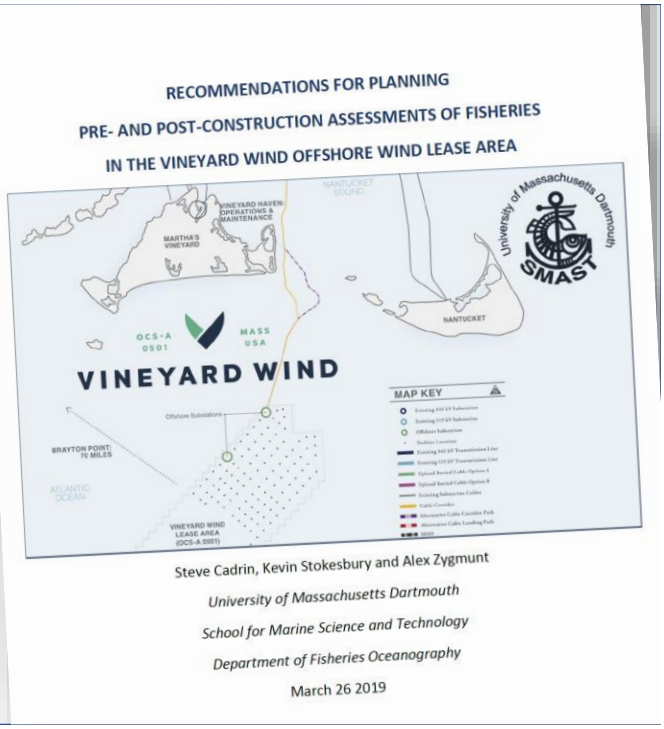
- **Background on Vineyard Wind Monitoring Plan**
- **2019-2020 surveys**
  - **Trawl Survey**
  - **Benthic Survey**
  - **Trap/Plankton Survey**
  - **Highly Migratory Species**
  - **Fishermen & Scientific Review Recommendations**
- **Discussion**



2

Monitoring Plan

- Background
  - State and Federal Guidance
  - Best Practices
- Currently Available Monitoring Data
  - Oceanographic Surveys
  - Benthic Surveys
  - Fish and Invertebrate Trawl Surveys
  - Avian Surveys
  - Marine Mammal and Sea Turtle Surveys
- Workshops with Fishermen
- Meetings with Regulators
- Recommendations



3

Monitoring Plan Guidance

- RI Coastal Resources Management Council (2010) Special Area Management Plan
  - relative abundance, distribution, and life stages of commercially and recreationally targeted species in all seasons
  - pre-construction, during construction, and post-construction
  - include evaluation of survey data collected through an existing survey program
- Bureau of Ocean Energy Management (2013) Fisheries Information for Renewable Energy
  - seasonal presence/absence of commercially and recreationally-important fish and shellfish
  - Before-After-Control-Impact (BACI) sampling designs
  - specifications for trawl and trap surveys
- MA Marine Fisheries (2018) recommended regional studies
  - standardize monitoring protocols among lease areas and existing survey programs
  - fish and invertebrate species of interest and their habitat
- MA Fisheries Working Group on Offshore Wind Energy – monitoring plans should be coordinated for regional impact assessment

4

Workshops with Fishermen

- November-December 2018
- >100 participants
- 63 commercial fishermen

Species	New Bedford	Rhode Island	Chatham	Marthas Vineyard
Lobster	X	X	X	X
Monkfish	X	X	X	X
Squid	X	X	X	X
Fluke	X		X	X
Jonah crab	X	X		X
Scallop	X		X	X
Tuna	X	X		X
Black sea bass	X			X
Cod	X			X
Conch	X			X
Scup	X			X
Sharks	X	X		
Skate	X	X		
Surf clam	X	X		
Winter flounder			X	X
Yellowtail flounder			X	X
Butterfish				X
Haddock				X
Herring	X			
Horseshoe crab			X	
Mackerel	X			
Mahi mahi		X		
Ocean quahog	X			
River herring			X	
Striped bass				X
Swordfish		X		
Whiting	X			

5

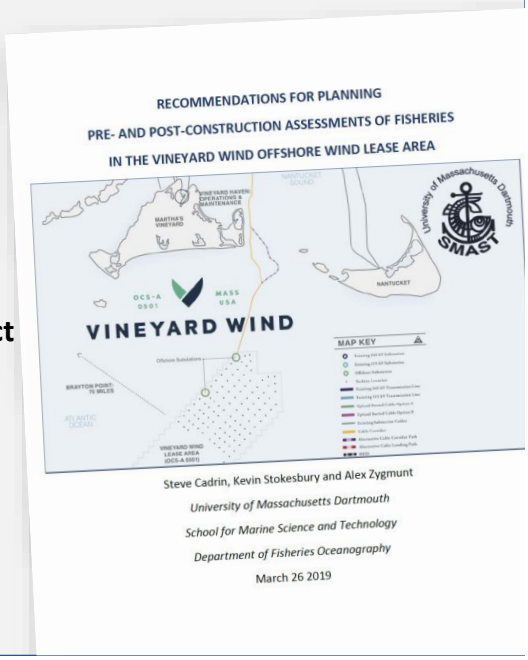
Monitoring Objectives

- Main Objective: detect impacts of the proposed wind farm on fishery resources.
  - The primary question:
    - "***Does the Wind Farm affect the local density of target fisheries species in the development area?***"
    - Compare density of each species before-during-after construction in control and impact areas.
  - Secondary questions:
    - "***Does the Wind Farm affect the local size distribution of target fisheries species in the development area?***" – sample size distributions from density sample locations
    - "***Which aspect of the wind farm is affecting fishery resources?***" - regional research is needed to answer such broader

6

Monitoring Recommendations

- Seasonal Fishery Resource Surveys
  - **Trawl survey**
  - **Benthic survey**
  - **Trap survey**
  - **Plankton survey**
- Supplemental Studies
  - **Analysis of fishery monitoring data to detect impact on highly migratory species**
  - Egg and larval dispersal
  - Movement patterns of juvenile and adult life stages from tagging
  - Optical survey transects near turbines
  - Monitoring burial of cables
  - Monitoring and research on acoustic impacts


RECOMMENDATIONS FOR PLANNING
PRE- AND POST-CONSTRUCTION ASSESSMENTS OF FISHERIES
IN THE VINEYARD WIND OFFSHORE WIND LEASE AREA

VINEYARD WIND

Steve Cadrin, Kevin Stokesbury and Alex Zygmunt
University of Massachusetts Dartmouth
School for Marine Science and Technology
Department of Fisheries Oceanography
March 26 2019

7

Implementing a Monitoring Plan

- A collaborative approach.
  - Each survey was designed and conducted in collaboration with active fishermen who have expertise fishing in the area.
  - A scientific advisory group reviewed annual monitoring data, data analyses and interpretations to recommend improvements to the monitoring plan if needed.
  - Several fishermen reviewed each report and offered local and regional perceptions and recommended revisions to the monitoring plan.
- Today's meeting is intended to get your feedback on the monitoring plan
  - Summary of 2019-2020 results (https://www.vineyardwind.com/fisheries-science)
  - Your observations from 2019-2020
  - Recommendations

8

VINEYARD WIND

Projects About Us In the Community For Fishermen Join the Team News Take Action

FISHERIES STUDIES AND SCIENCE

Vineyard Wind firmly believes that offshore wind developers must support good fisheries studies and science as the offshore wind industry grows up alongside the region's oldest offshore industry- fishing. Fisheries related surveys, studies, and key research milestones are provided below. These studies should be in addition to past and on-going basic research such as conducted by the Bureau of Ocean Energy Management.

All fisheries survey and science reports to Vineyard Wind will be provided here, and updates of key milestones provided below.

RESPONSIBLE OFFSHORE SCIENCE ALLIANCE

ROSA

Vineyard Wind is supportive of the Responsible Offshore Science Alliance (ROSA), founded in March 2019 by the Responsible Offshore Development Alliance. ROSA advances regional fisheries research and monitoring related to offshore wind development in federal waters. ROSA's organizing framework was developed in partnership with state and federal regulators and support from Vineyard Wind and other offshore wind developers. Learn more about ROSA and it's framework.

ONGOING SURVEYS

9

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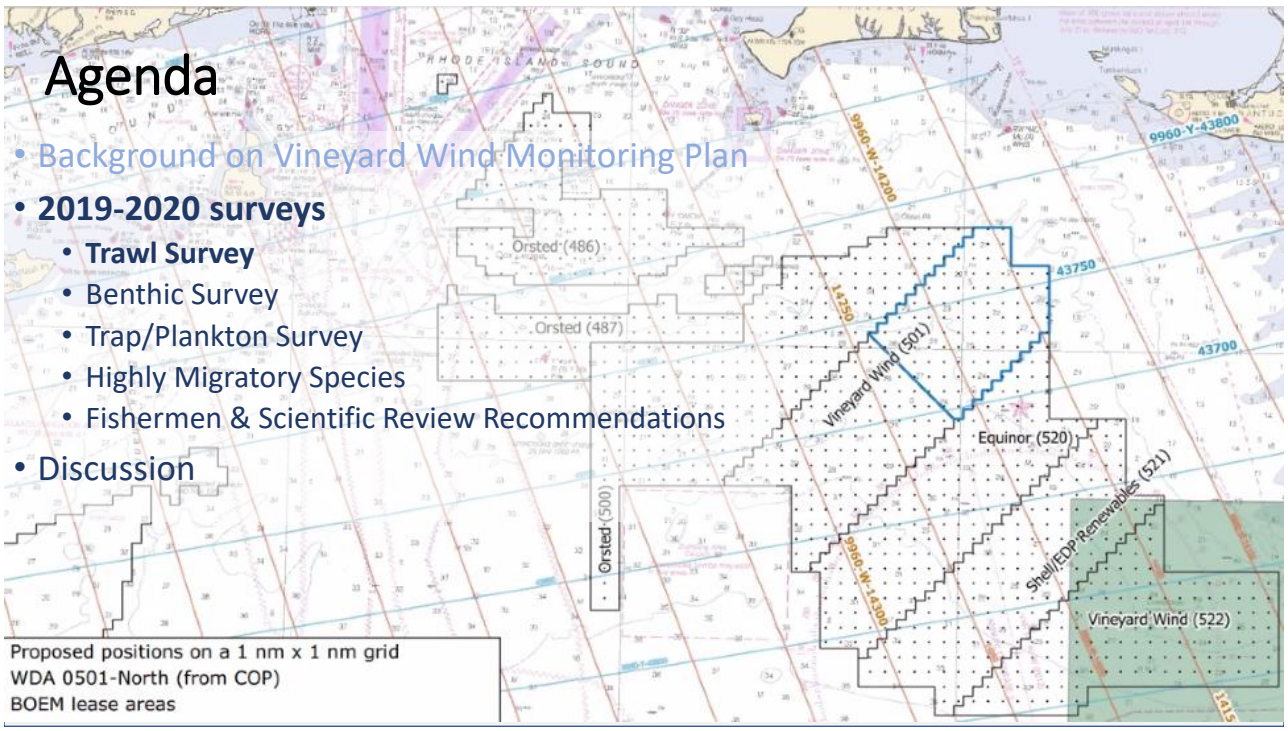
- Discussion

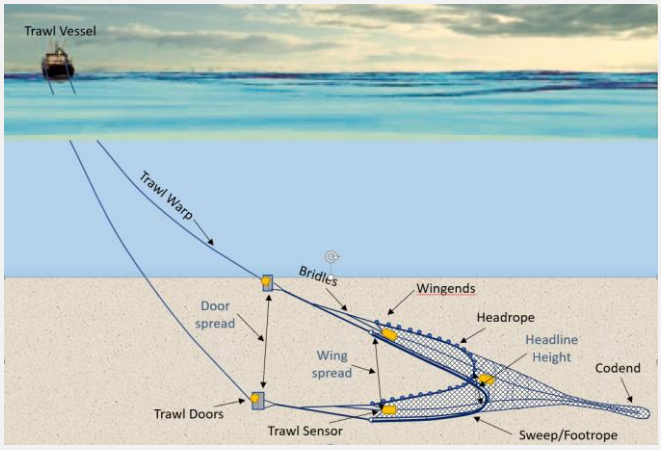


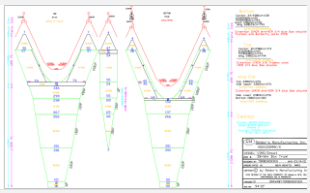
10

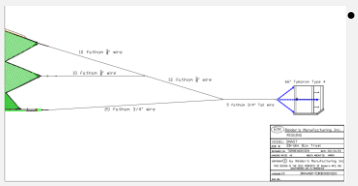
2019-2021 Vineyard Wind Bottom Trawl Surveys

Pingguo He and Chris Rillahan (UMass Dartmouth – SMAST)

11







Adoption of NEAMAP Trawl and Survey Protocol

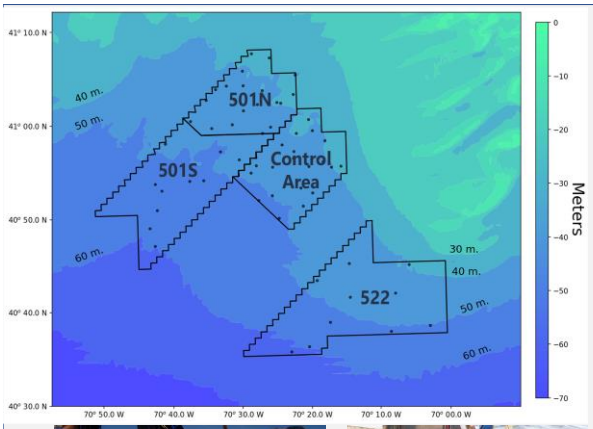
NEAMAP trawl

- Three-bridle, four-seam bottom trawl developed by Northeast Trawl Advisory Panel and in use by NEAMAP surveys
- Thyboron IV 66” door
- Uses a “flat-sweep” to reduce escape of fish under the net
- The use of 1” knotless liner in the codend to retain juvenile fish

NEAMAP survey protocol

- Provides consistency between regional surveys, and possible incorporation of high-resolution data for regional ecosystem assessments
  - Tow duration: 20 min
  - Tow speed: 3.0 knots
  - Daytime only: 30 min after sunrise – 30 min before sunset

12



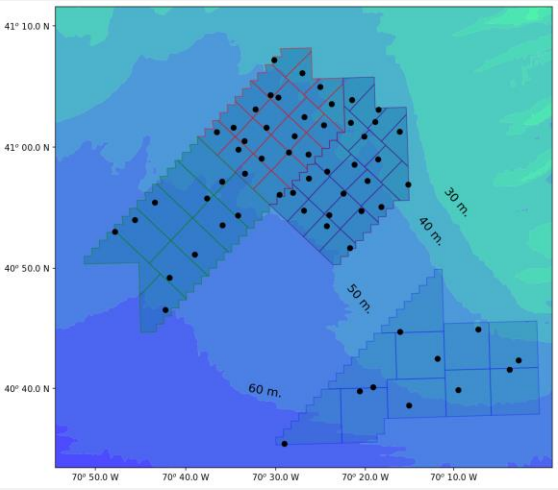
Sampling Design

- Before/After Control Impact (BACI) to account for changes in fish populations over space and time
  - Multiple tows across the development and control areas
  - Quarterly surveys for temporal variations in fish assemblages
- The statistical analysis compares catch rates, population structure and fish community composition before and after construction.
- The Control Area was selected based on adjacency, depth, and availability, and was extensively consulted with VW, and other survey groups.

13

Spring 2021

Seasons and Tows



Four seasons

- Winter: January – March
- Spring: April – June
- Summer: July – September
- Fall: October – December

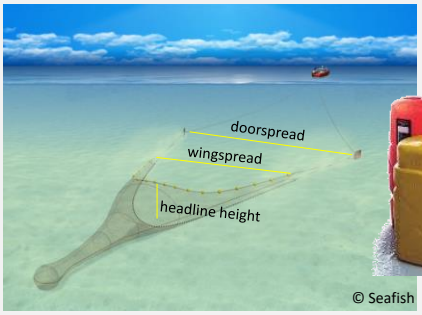
Tow locations

- Selected using systematic unaligned sampling design to ensure spatial distribution of tow locations
- 1 station every 3.6 – 4.5 sq. nautical miles
  - NEAMAP sampling resolution: 1 tow every 30 sq. nautical miles
  - NMFS sampling resolution: 1 tow every ~100 sq. nautical miles

Number of tows

- 60 tows per season
- 20 tows each in 501N Study Area and Control Area.
- 10 tows each in 501S and 522 Study Areas

14



Data Collected

Trawl Geometry

- SIMRAD PX Trawl Monitoring System (Notus Trawl Master for the Spring 2019 season)
- Wingspread – Horizontal opening of the net mouth
- Door Spread – Horizontal distance between the trawl doors
- Headline Height – Vertical opening of the net
- Pitch sensor in the net belly – Used to ensure the net on the bottom

Biological

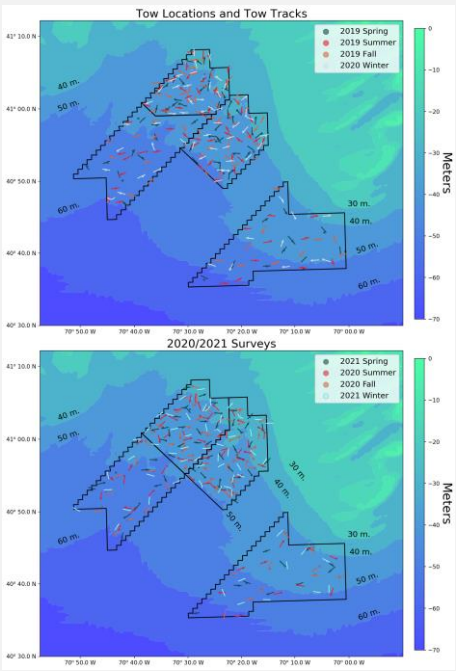
- Aggregated catch weight for each species
- Individual length and weights
  - ~50 individuals/species/tow
  - Length every tow, weights alternating tows

Environmental

- Sea state, Wind speed, Wind direction
- Bottom water temperature

15

2019 /2020 Surveys



2019 - 2021

8 Seasonal Surveys Completed:

- 2019: June, August, November
- 2020: February, August, November
- 2021: February, May
- 3 Fishing vessels used for the surveys (F/V Guardian, F/V Endurance, F/V Heather Lynn)
- 480 tows made (320 in 501N/Control Area)

Species and measurements:

2019 – 2020

- 53 species retained/identified/measured
- 69,299 individual fish length measurements
- Including ~30,000 individuals with length and weight measurements

2020 – 2021

- 46 species retained/identified/measured
- 45,197 individual fish length measurements
- Including ~25,000 individuals with length and weight measurements

16

Catch Composition – Main Species (2019 – 2020)

501N Study Area

Species Name	Total Weight (Kg)	Catch/Tow (Kg)		% of Total Catch	Tows with Species Present
		Mean	SEM*		
Dogfish, Spiny	18392.5	260.8	91.0	43.9	55
Skate, Little	6326.4	81.0	8.2	15.1	78
Hake, Silver	4512.5	56.0	6.8	10.8	80
Hake, Red	3574.1	43.8	8.4	8.5	74
Skate, Winter	2257.9	28.0	4.4	5.4	50
Scup	1559.6	20.9	5.0	3.7	31
Butterfish	1487.0	18.5	4.1	3.6	72
Alewife	1035.6	12.4	5.7	2.5	51
Skate, Barndoor	376.8	4.5	1.1	0.9	40
Squid, Atlantic Longfin	337.2	4.2	0.5	0.8	63
Dogfish, Smooth	323.5	3.8	1.6	0.8	20
Monkfish	296.3	3.6	0.7	0.7	47
Mackerel, Atlantic	197.0	2.5	2.0	0.5	16
Flounder, Fourspot	195.5	2.5	0.3	0.5	60
Herring, Atlantic	194.3	2.4	0.9	0.5	25
Crab, Cancer	121.3	1.5	0.3	0.3	57
Flounder, Winter	104.1	1.3	0.3	0.2	45
Sea Robin, Northern	79.5	1.1	0.3	0.2	26
Haddock	77.3	0.9	0.9	0.2	1
Flounder, Summer (Fluke)	71.8	0.9	0.2	0.2	32
Flounder, Windowpane	61.1	0.8	0.2	0.1	47
Herring, Blueback	38.2	0.5	0.2	0.1	17
Menhaden, Atlantic	32.3	0.4	0.3	0.1	2
Shad, American	29.8	0.4	0.1	0.1	29

Control Area

Species Name	Total Weight (Kg)	Catch/Tow (Kg)		% of Total Catch	Tows with Species Present
		Mean	SEM*		
Dogfish, Spiny	11174.5	141.7	63.7	23.4	59
Hake, Red	8879.7	110.4	17.8	18.6	72
Hake, Silver	7318.7	89.5	11.7	15.3	79
Skate, Little	6278.7	78.4	9.1	13.1	78
Butterfish	2563.8	31.8	8.3	5.4	70
Scup	2543.8	32.7	7.2	5.3	37
Skate, Winter	2401.6	29.4	5.1	5.0	47
Haddock	2042.4	25.8	17.6	4.3	9
Alewife	803.4	10.1	4.1	1.7	61
Monkfish	697.1	8.4	1.6	1.5	56
Skate, Barndoor	651.0	7.9	2.2	1.4	41
Sea Robin, Northern	556.1	7.1	4.5	1.2	26
Herring, Atlantic	540.3	6.7	2.8	1.1	22
Squid, Atlantic Longfin	288.9	3.6	0.5	0.6	60
Flounder, Fourspot	209.7	2.6	0.3	0.4	60
Flounder, Summer (Fluke)	205.6	2.6	0.5	0.4	36
Shad, American	127.5	1.6	1.0	0.3	24
Crab, Cancer	67.6	0.8	0.1	0.1	48
Flounder, Windowpane	65.6	0.8	0.2	0.1	35
Squid, Shortfin	64.5	0.8	0.3	0.1	14
Dogfish, Smooth	58.4	0.7	0.3	0.1	11
Flounder, Winter	37.0	0.5	0.1	0.1	24
Sculpin, Longhorn	33.0	0.4	0.1	0.1	29
Hake, Spotted	30.4	0.4	0.2	0.1	15

17

Catch Composition – Main Species (2020 – 2021)

501N Study Area

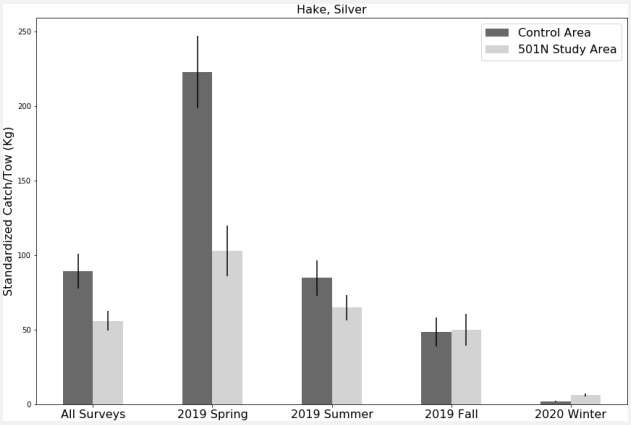
Species Name	Total Weight (Kg)	Catch/Tow (Kg)		% of Total Catch	Tows with Species Present
		Mean	SEM*		
Skate, Little	5215.1	64.9	8.4	27.4	75
Scup	3754.2	46.6	10.9	19.7	50
Dogfish, Spiny	3677.2	44.6	20.7	19.3	31
Skate, Winter	1030.1	12.7	2.0	5.4	46
Hake, Silver (Whiting)	1015.8	12.6	2.7	5.3	69
Butterfish	878.2	11.0	2.0	4.6	58
Squid, Atlantic Longfin	686.3	8.6	1.2	3.6	56
Herring, Atlantic	575.7	7.2	2.3	3.0	40
Hake, Red	472.8	5.9	1.1	2.5	50
Dogfish, Smooth	275.2	3.4	1.1	1.4	20
Flounder, Summer (Fluke)	223.8	2.8	0.6	1.2	46
Black Sea bass	177.5	2.2	0.3	0.9	45
Northern Sea Robin	152.6	1.9	0.4	0.8	50
Flounder, Winter	148.0	1.9	0.4	0.8	43
Shark, Thresher	100.0	1.2	1.2	0.5	1
Flounder, Fourspot	99.3	1.2	0.2	0.5	57
Flounder, Windowpane	82.3	1.0	0.2	0.4	48
Crab, Rock	66.6	0.8	0.2	0.4	42
Monkfish	59.3	0.7	0.2	0.3	19
Sculpin, Longhorn	56.7	0.7	0.4	0.3	34
Hake, Spotted	54.4	0.7	0.2	0.3	20
Herring, Blueback	47.6	0.6	0.3	0.3	17
Skate, Barndoor	37.5	0.5	0.1	0.2	36
Alewife	32.3	0.4	0.1	0.2	35

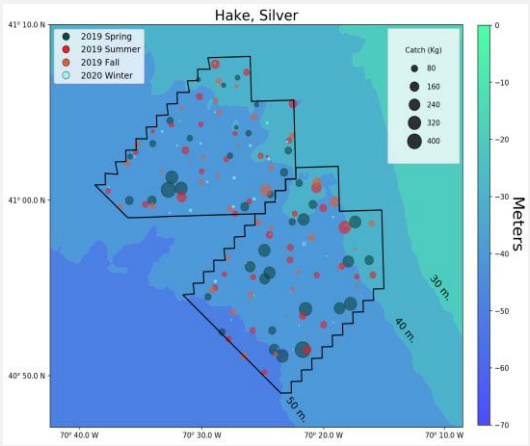
Control Area

Species Name	Total Weight (Kg)	Catch/Tow (Kg)		% of Total Catch	Tows with Species Present
		Mean	SEM*		
Skate, Little	7159.3	88.5	11.1	32.8	78
Scup	4705.3	58.2	16.5	21.6	51
Dogfish, Spiny	2637.5	32.7	13.1	12.1	31
Hake, Silver (Whiting)	1379.6	17.1	3.5	6.3	59
Skate, Winter	1109.8	13.7	2.2	5.1	45
Butterfish	1078.0	13.4	2.7	4.9	58
Hake, Red	737.1	9.1	1.7	3.4	43
Herring, Atlantic	645.5	8.1	3.9	3.0	36
Squid, Atlantic Longfin	583.9	7.2	1.1	2.7	58
Northern Sea Robin	416.7	5.1	1.9	1.9	47
Flounder, Summer (Fluke)	243.7	3.0	0.6	1.1	48
Dogfish, Smooth	188.8	2.3	0.7	0.9	21
Flounder, Windowpane	165.5	2.1	0.6	0.8	55
Flounder, Fourspot	137.9	1.7	0.3	0.6	55
Alewife	136.5	1.7	0.8	0.6	41
Black Sea bass	104.2	1.3	0.2	0.5	51
Hake, Spotted	72.4	0.9	0.5	0.3	17
Sculpin, Longhorn	61.8	0.8	0.2	0.3	28
Monkfish	45.8	0.6	0.2	0.2	16
Crab, Rock	36.3	0.5	0.1	0.2	37
Flounder, Winter	34.4	0.4	0.1	0.2	32
Shad, American	23.5	0.3	0.1	0.1	20
Mackeral, Atlantic	21.4	0.3	0.1	0.1	19
Skate, Barndoor	18.4	0.2	0.0	0.1	26

18

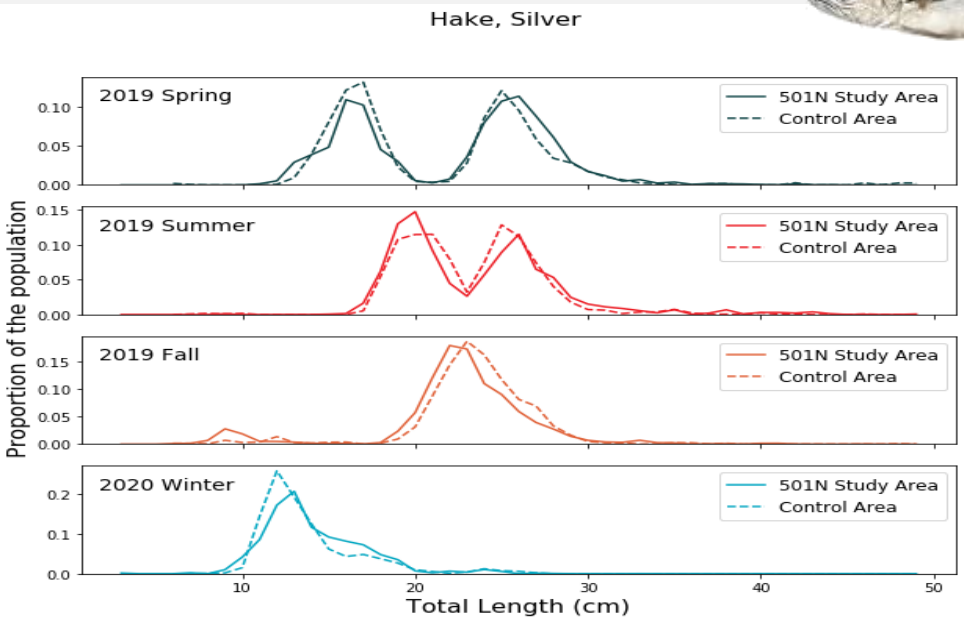
Example – Whiting (silver hake)





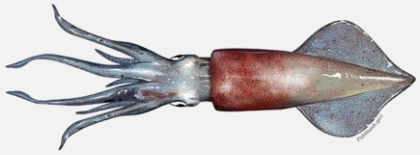
19

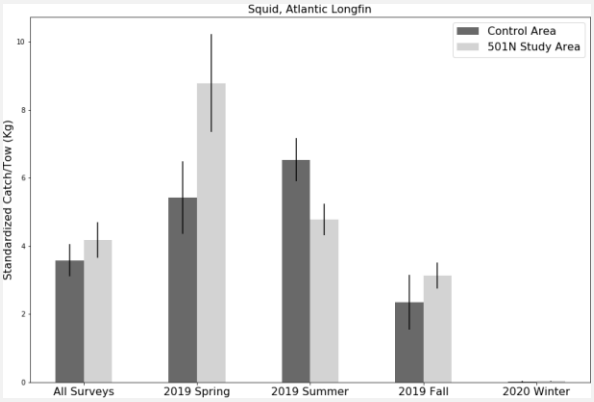
Population Structure

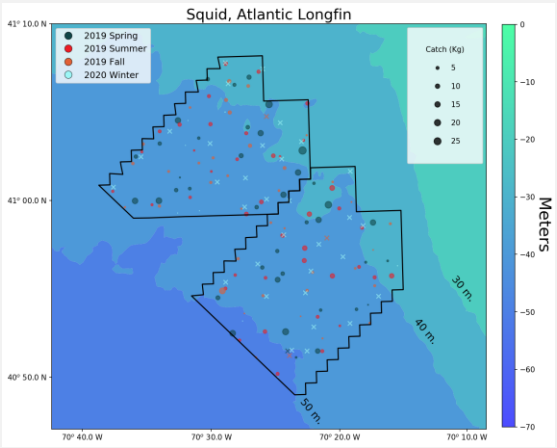


20

Atlantic Longfin Squid

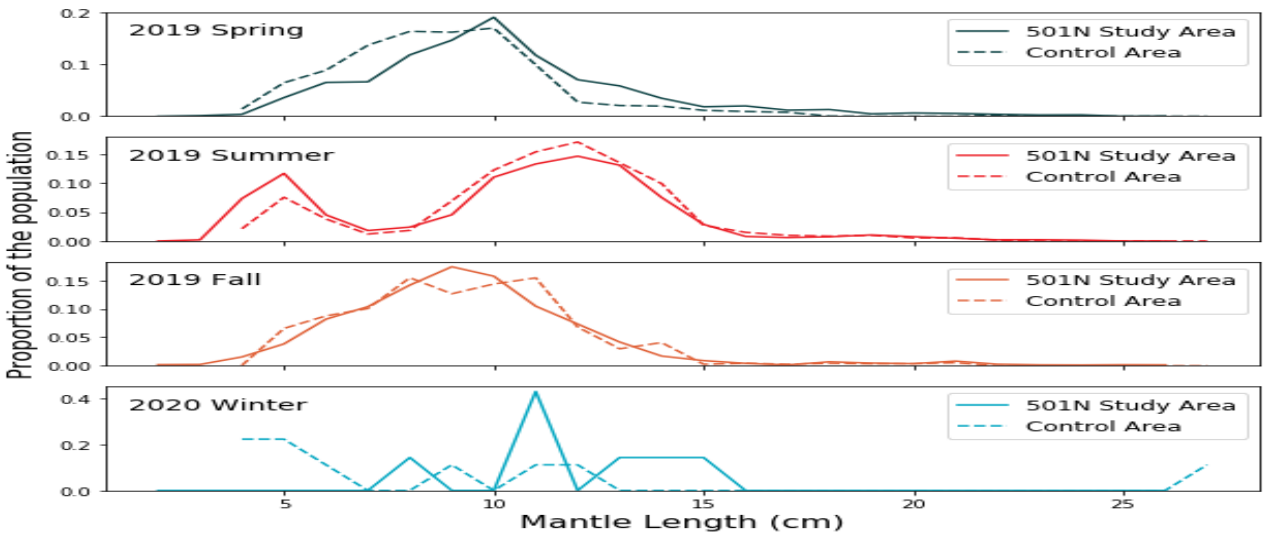






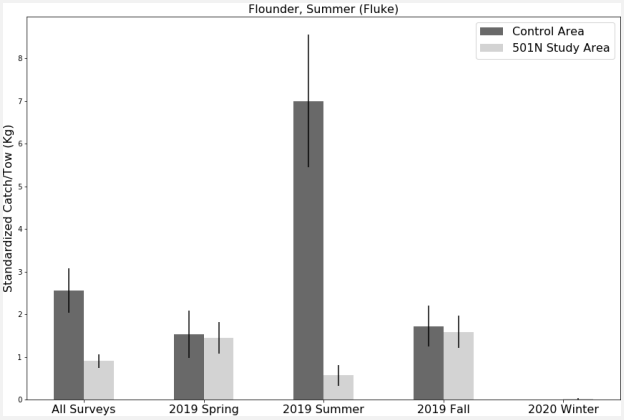
21

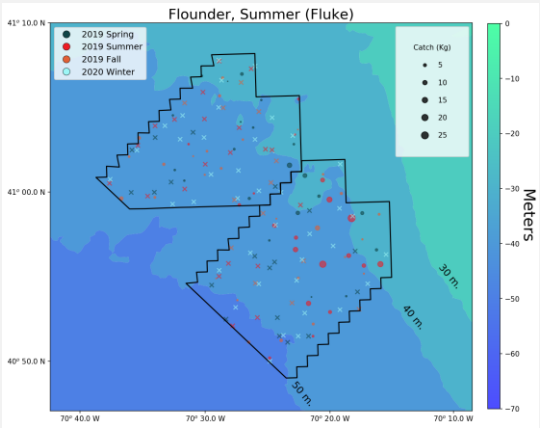
Population Structure



22

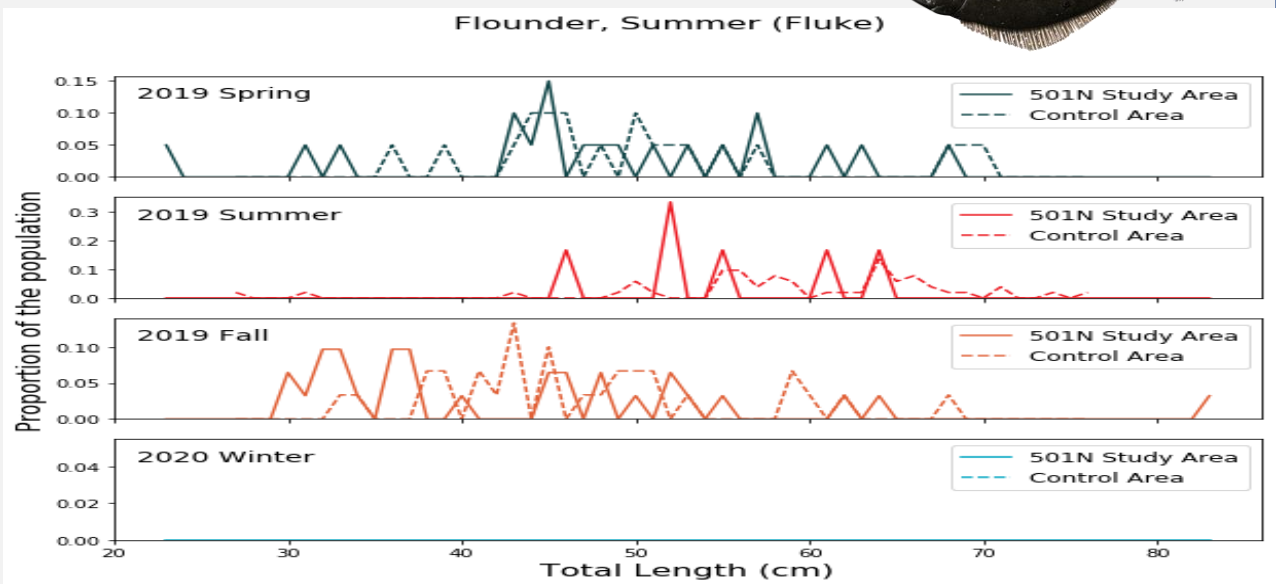
Fluke (summer flounder)





23

Population Structure



24

Trawl Survey Summary

- NEAMAP protocol and survey gear is suitable and useful for monitoring species composition and density in this area.
- There are significant seasonal variation in catch rates and species composition.
- A handful species dominate the catch.
- Based on the first year's results, the projected 240 tows before development would provide sufficient power to detect a moderate change for most important commercial species

25

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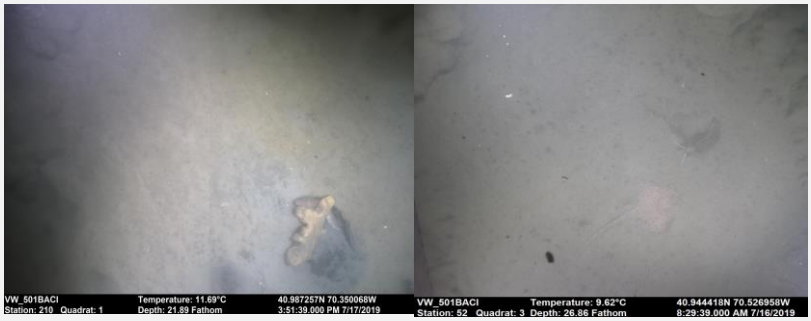
- 2019-2020 surveys
  - Trawl Survey
  - **Benthic Survey**
  - Trap/Plankton Survey
  - Highly Migratory Species
  - Fishermen & Scientific Review Recommendations
- Discussion

26

2019 Drop Camera Survey of Benthic Communities and Substrate in Vineyard Wind Lease Area OCS-A 0501 North, South, 0522 and a Control Area

PI: Kevin D.E. Stokesbury

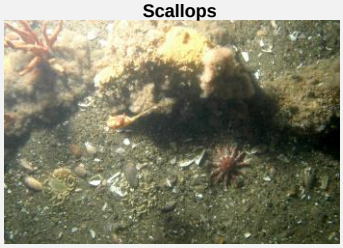
Co Authors: Kyle Cassidy, Caitlyn Riley, and N. David Bethoney



27

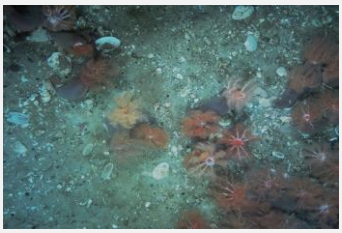
Marine Fisheries Field Research Group

Scallops



Habitat

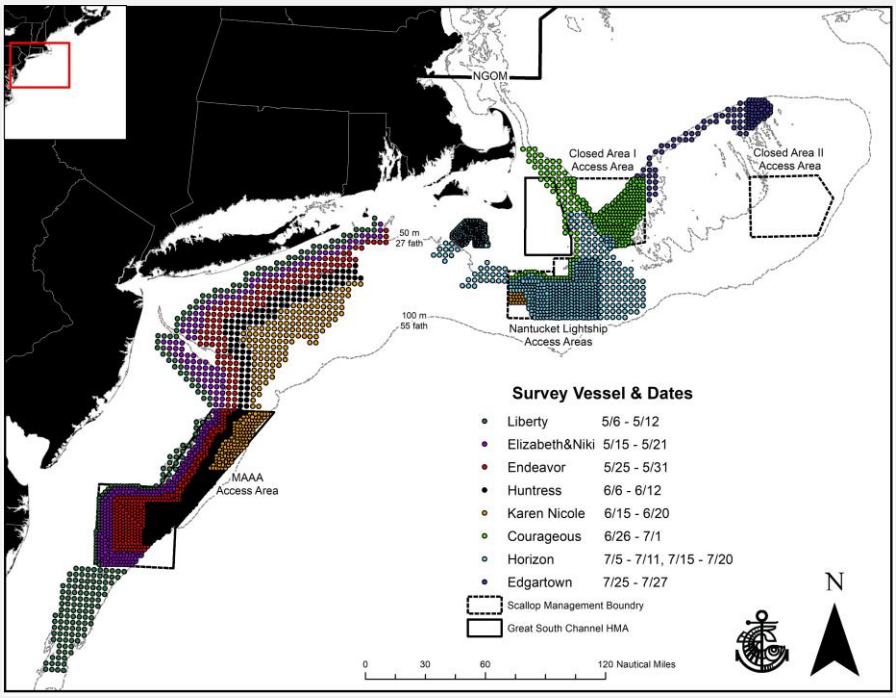
Drop Camera



Sea cucumbers

Benthic Communities

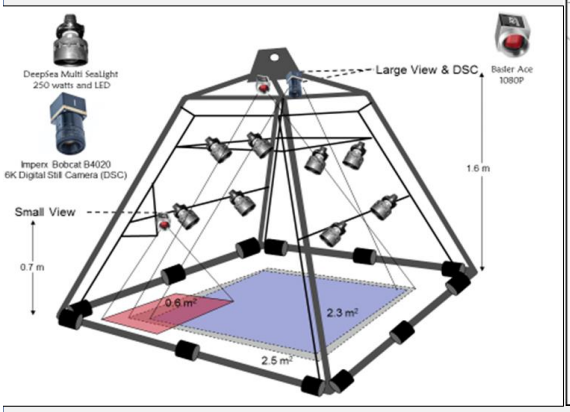
28

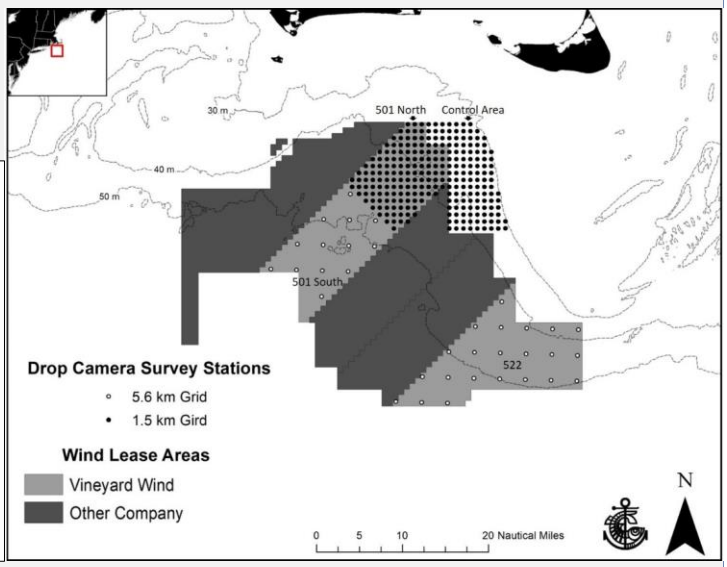


29

Survey Areas

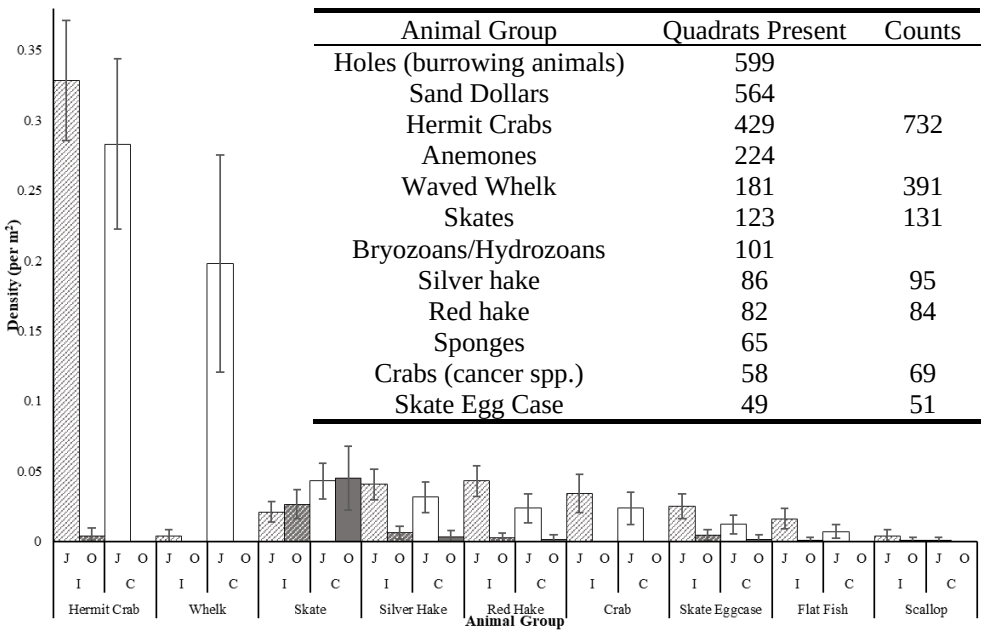
- Two surveys were conducted, one in July and October 2019 using the SMAST Drop camera technology





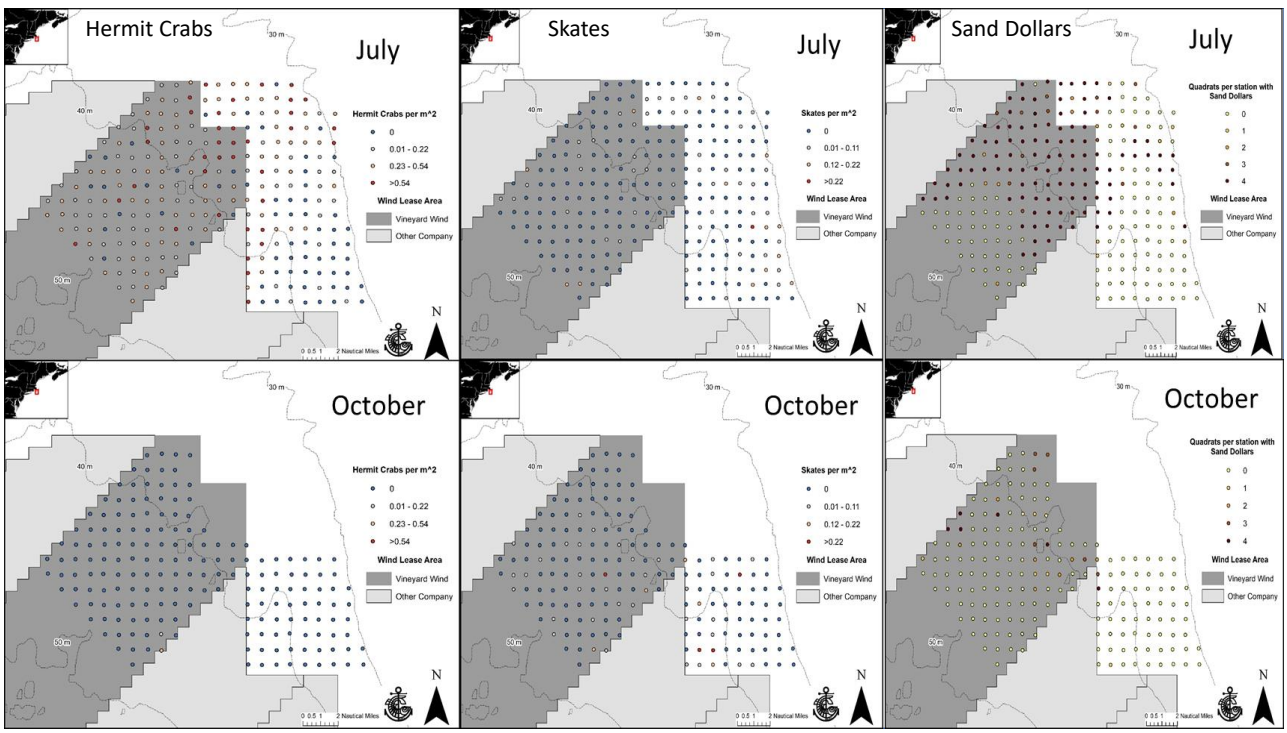
30

Species Density in 501 North



Animal Group	Quadrats Present	Counts
Holes (burrowing animals)	599	
Sand Dollars	564	
Hermit Crabs	429	732
Anemones	224	
Waved Whelk	181	391
Skates	123	131
Bryozoans/Hydrozoans	101	
Silver hake	86	95
Red hake	82	84
Sponges	65	
Crabs (cancer spp.)	58	69
Skate Egg Case	49	51

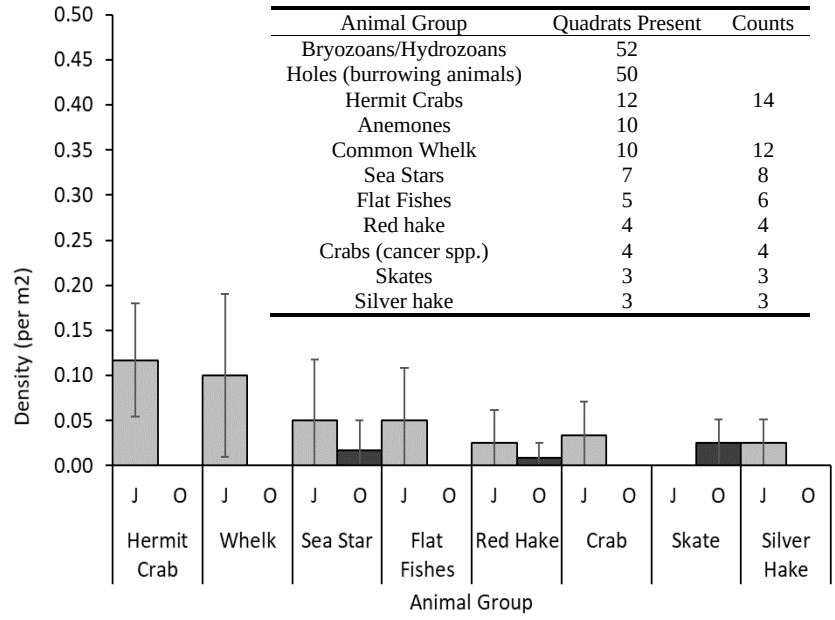
31



32

Species Density in 501 South

Animal Group	Quadrats Present	Counts
Bryozoans/Hydrozoans	52	
Holes (burrowing animals)	50	
Hermit Crabs	12	14
Anemones	10	
Common Whelk	10	12
Sea Stars	7	8
Flat Fishes	5	6
Red hake	4	4
Crabs (cancer spp.)	4	4
Skates	3	3
Silver hake	3	3



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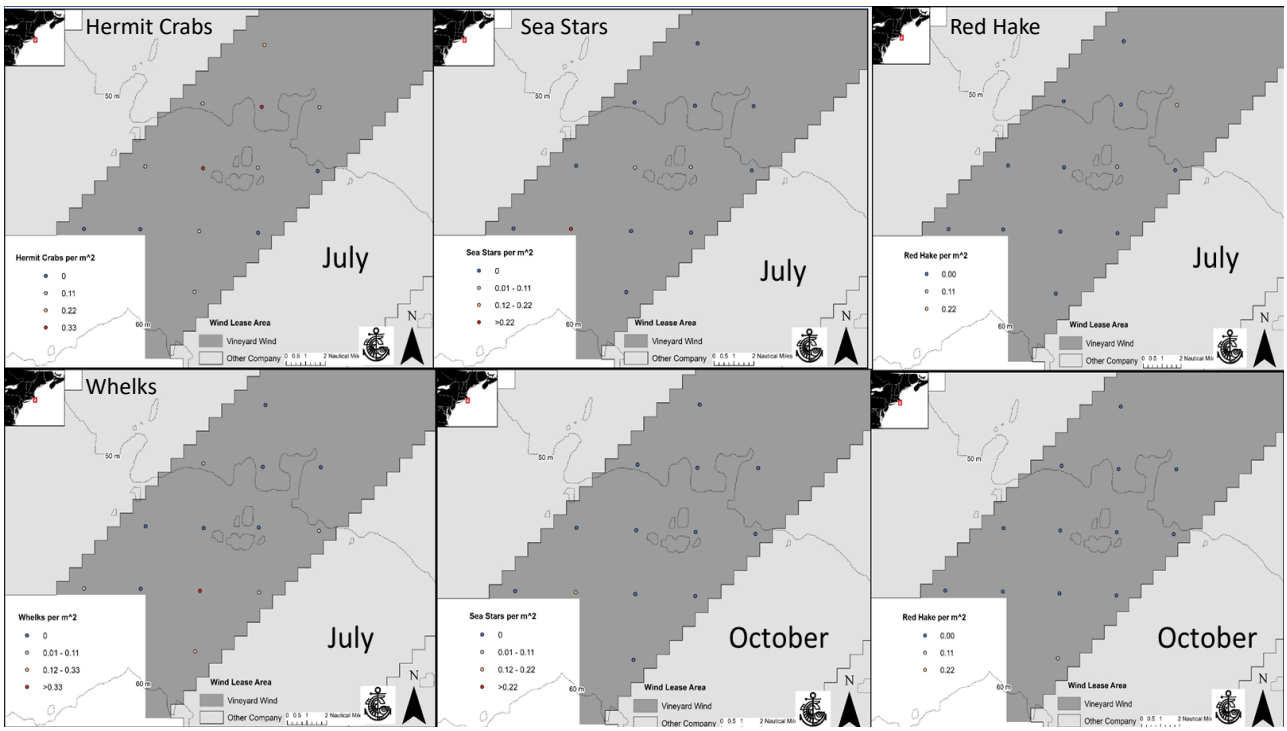
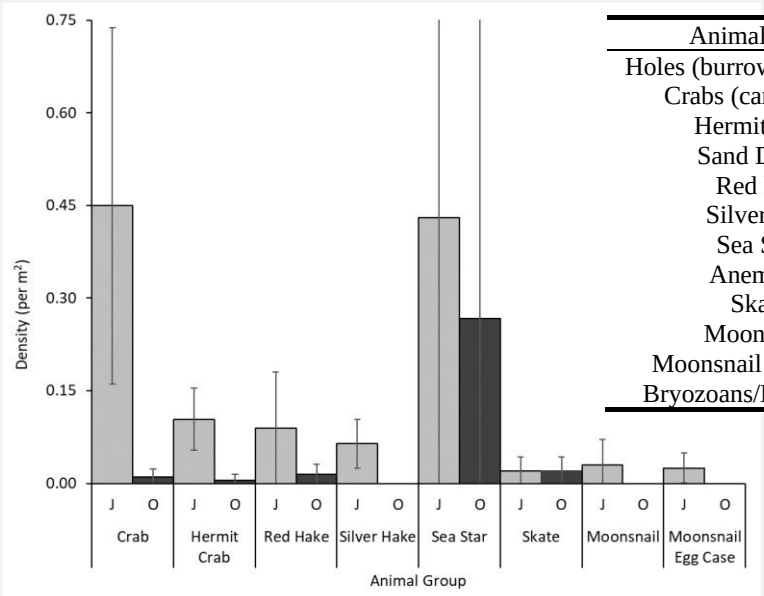


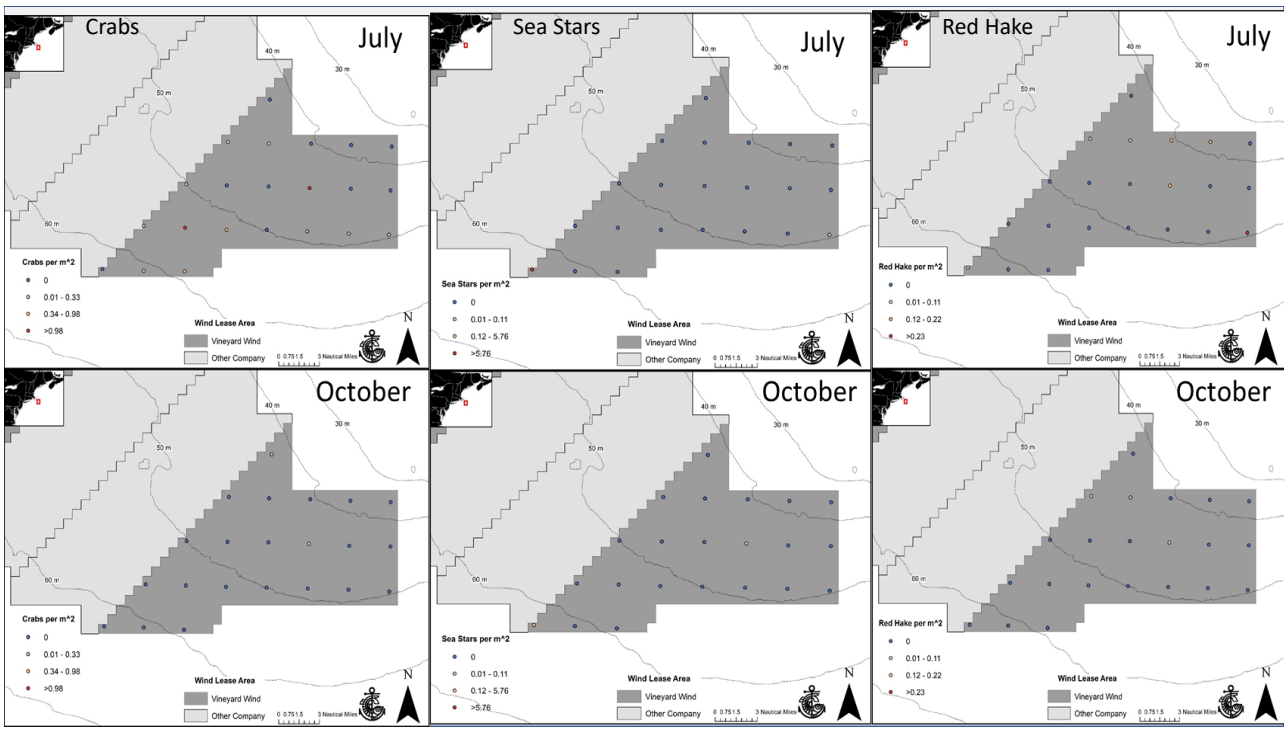
34

Species Density 522



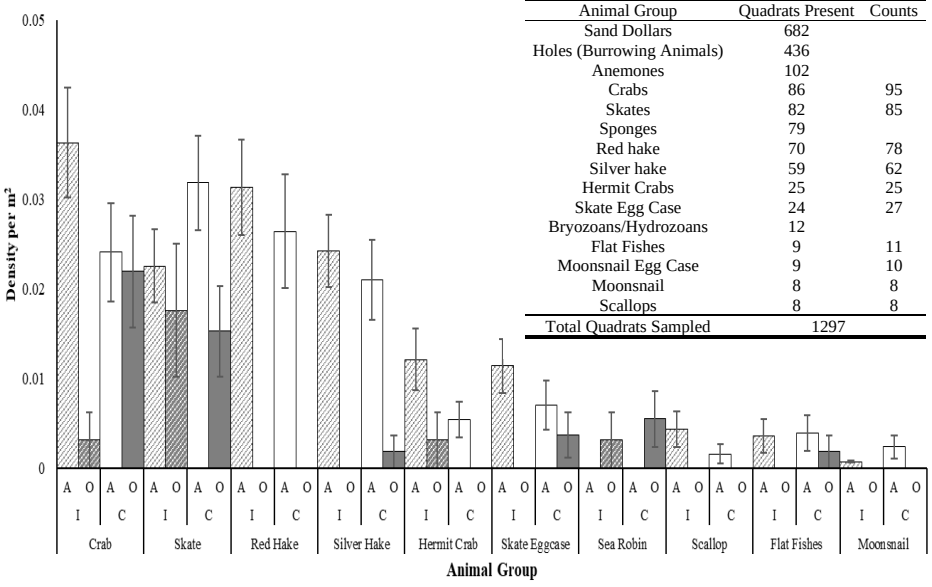
Animal Group	Quadrats Present	Counts
Holes (burrowing animals)	55	
Crabs (cancer spp.)	34	75
Hermit Crabs	18	22
Sand Dollars	17	
Red hake	13	21
Silver hake	13	13
Sea Stars	10	141
Anemones	6	
Skates	6	6
Moonsnails	5	6
Moonsnail Egg Cases	5	5
Bryozoans/Hydrozoans	4	

35



36

Preliminary Data for 2020

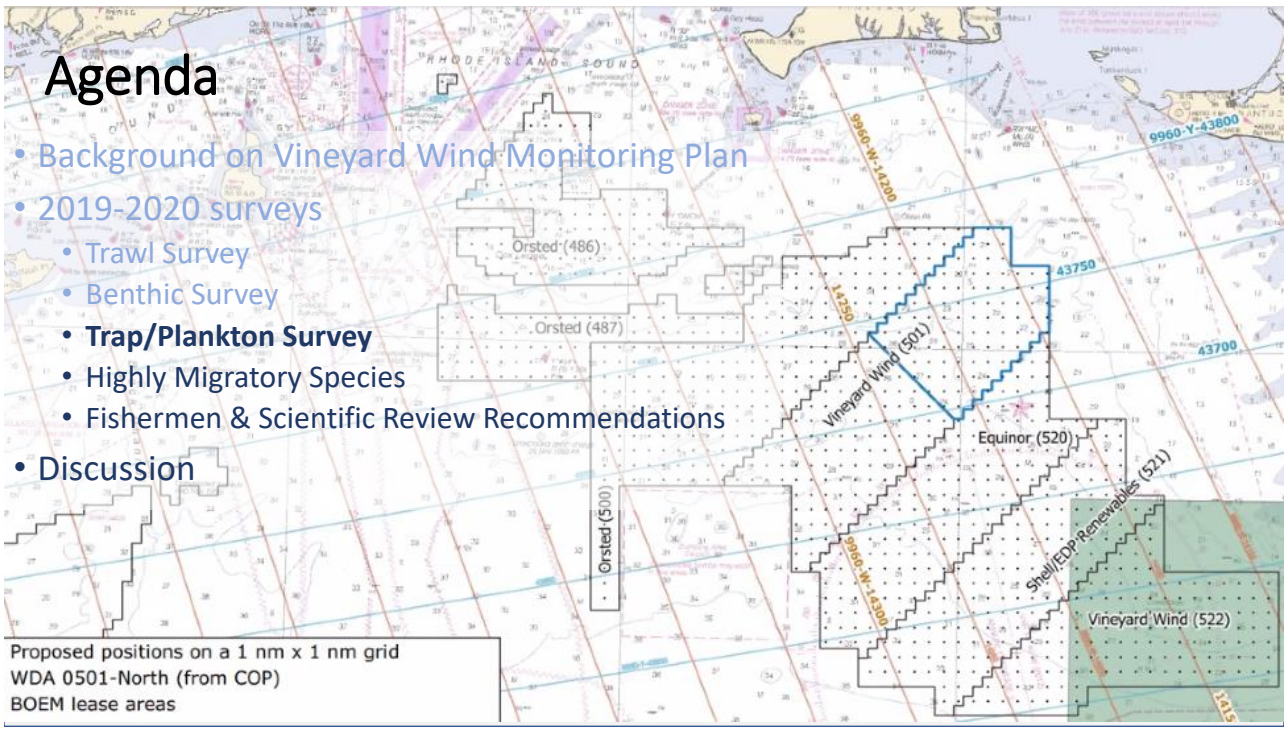


Animal Group	Quadrats Present	Counts
Sand Dollars	682	
Holes (Burrowing Animals)	436	
Anemones	102	
Crabs	86	95
Skates	82	85
Sponges	79	
Red hake	70	78
Silver hake	59	62
Hermit Crabs	25	25
Skate Egg Case	24	27
Bryozoans/Hydrozoans	12	
Flat Fishes	9	11
Moonsnail Egg Case	9	10
Moonsnail	8	8
Scallops	8	8
Total Quadrats Sampled	1297	

37

Agenda

- Background on Vineyard Wind Monitoring Plan
- 2019-2020 surveys
  - Trawl Survey
  - Benthic Survey
  - **Trap/Plankton Survey**
  - Highly Migratory Species
  - Fishermen & Scientific Review Recommendations
- Discussion



38

Vineyard Wind Ventless Trap Survey Review

Kevin Stokesbury, Kyle Cassidy, Amanda Meli, Andie Painten, Rachel Norton,Travis Lowery, Crista Bank, Beth Casoni, Mohawk Bolin, and Jarrett Drake

39

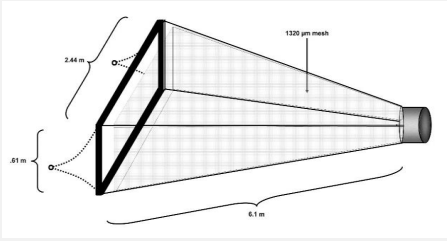
Project Goals and Objectives

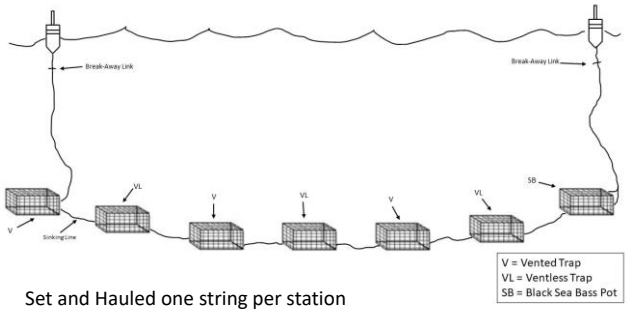
- To provide **baseline relative abundance data** for several species of concern to inform the environmental impact assessment of wind energy development in the 501N Study Area and the adjacent Control Area.
- Our primary objectives are to:
  - Estimate the size and distribution of **lobster** and **black sea bass** populations in the 501N Study Area and adjacent Control Area;
  - Classify population dynamics of these two species such as length, sex, reproductivity success, age, diet, and disease;
  - Estimate the relative abundance and distribution of planktonic species such as larval lobster in the neustonic layer of each area, using a towed ichthyoplankton net at each survey location; and
  - Obtain movement patterns of adult lobsters through a tagging study.

40

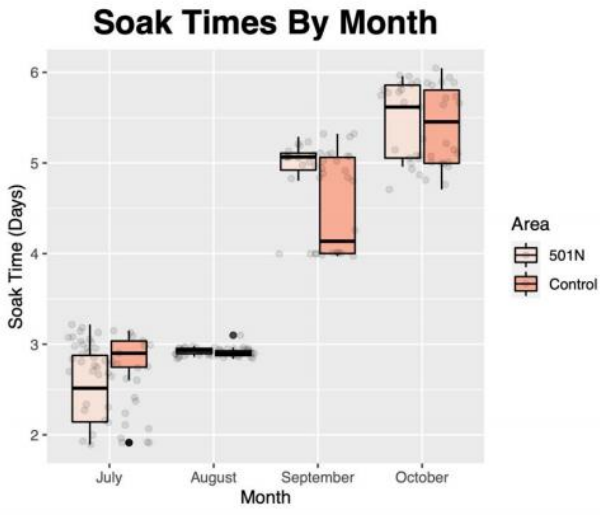
Survey Design

One 10 min tow at each station
twice per month from June to October





Set and Hauled one string per station
twice per month from June to October



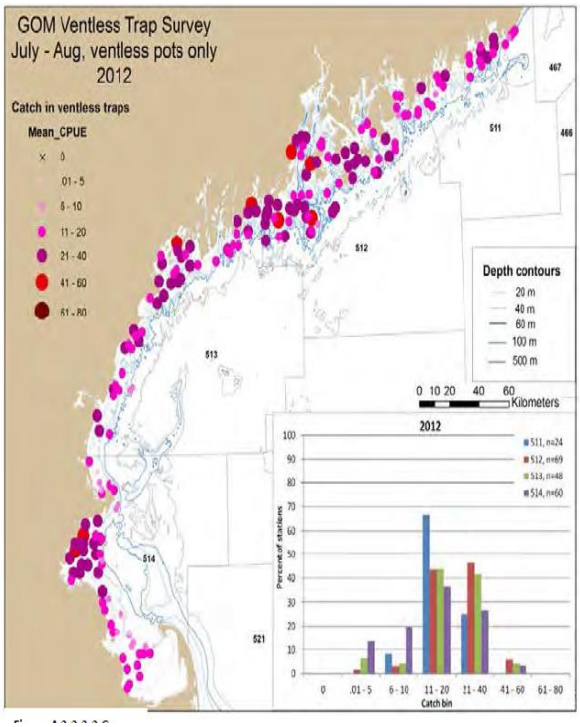
41

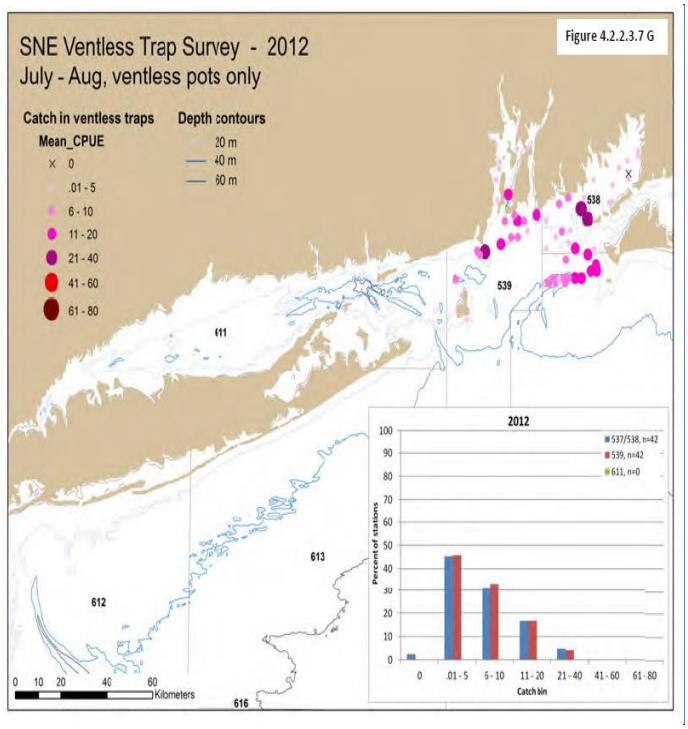
Methods

- After a 3 to 5 day soak the contents of the traps were measured, sexed, tagged, and released at each site
- Pots baited with herring
- Tags have ID and phone number

A Floy™ monofilament anchor tag

42

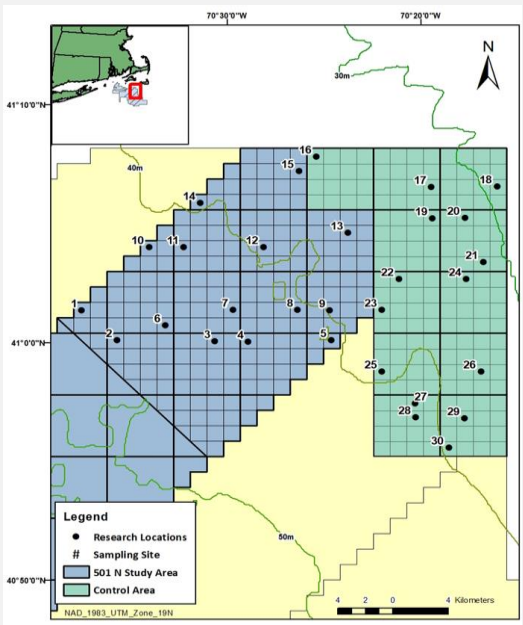




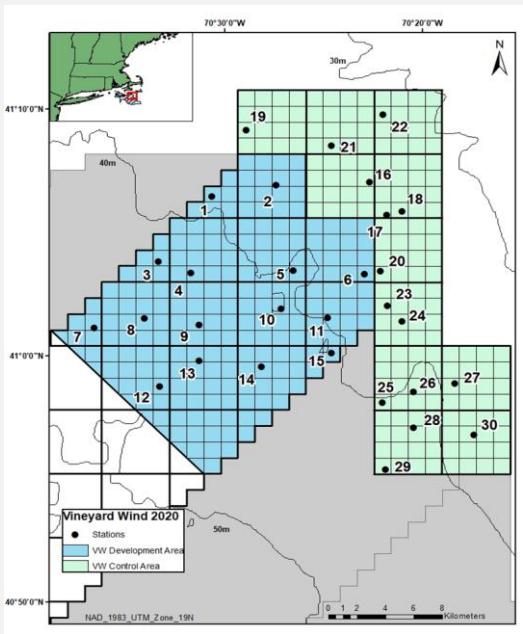
43

Survey Locations

2019



2020



44

Lobster Comparison

2019 July-October 8 Sampling Periods

Area	Month	Temp (°C)	N (Caught)	CPUE	Mean CL (mm)	Sex Ratio (M:F)	# with eggs	# Females	Eggers (%)	# Disease	Disease (%)
Impact	All	13.4	214	2.14	91	1.61	32	82	39%	13	6%
Control	All	14.5	137	1.44	91	2.43	18	40	45%	9	7%
Combined	All	13.9	351	1.80	91	1.88	50	122	41%	22	6%

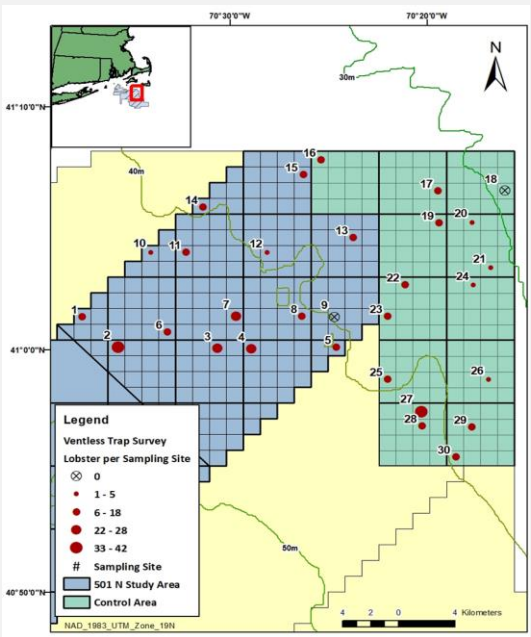
2020 June-October 10 Sampling Periods

Area	Month	Temp (°C)	N (Caught)	CPUE	Mean CL (mm)	Sex Ratio (M:F)	# with eggs	# Females	Eggers (%)	# Disease	Disease (%)
Impact	All	12.8	662	4.52	87	1.40	59	261	23%	53	8%
Control	All	13.9	259	1.95	94	3.20	17	60	28%	21	8%
Combined	All	13.3	921	3.24	89	1.74	76	321	24%	74	8%

45

Lobster

2019



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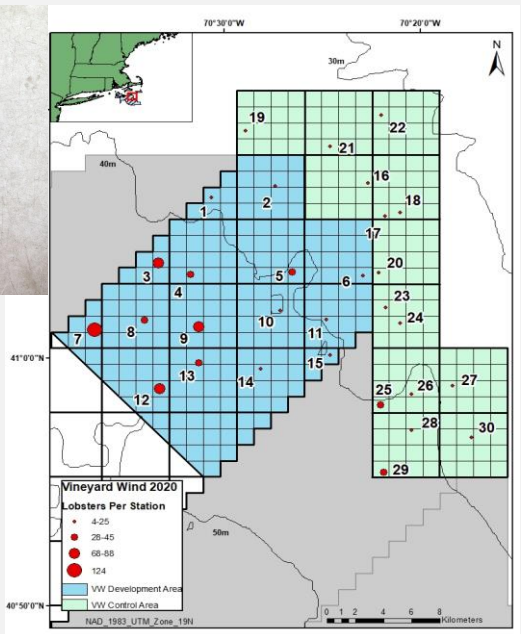
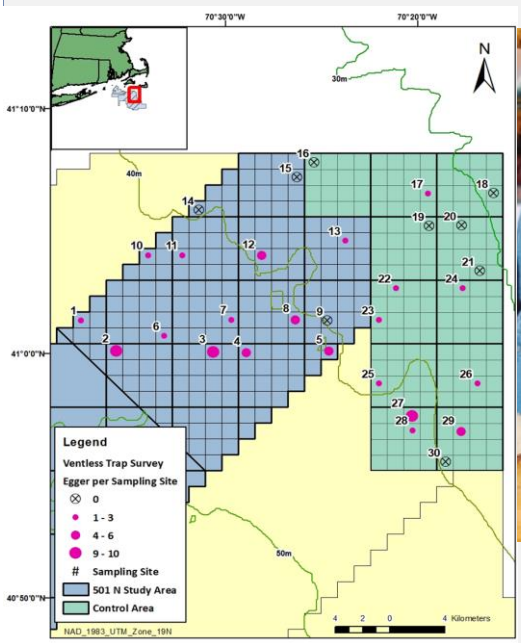


46

Lobster Eggers

2019



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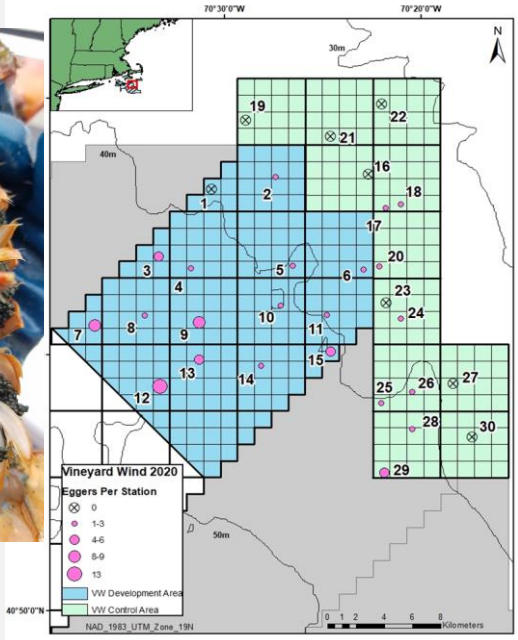
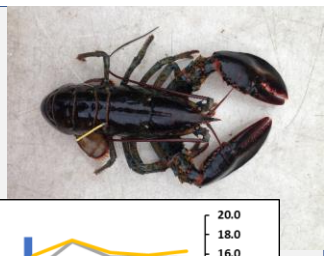


47

Lobster



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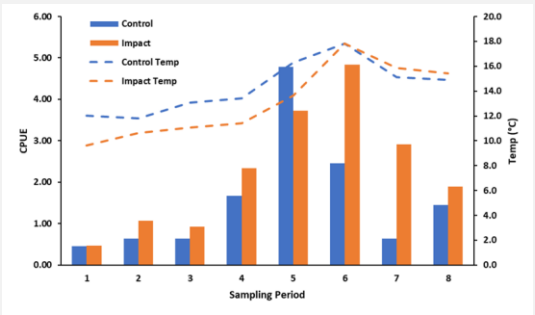
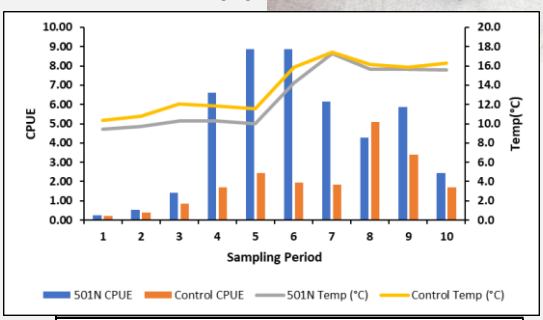


Trap Hauls		
Area	# of String Hauls	% Success
Control	95	79%
501N	100	83%
*% based on maximum of 120 hauls		

2020

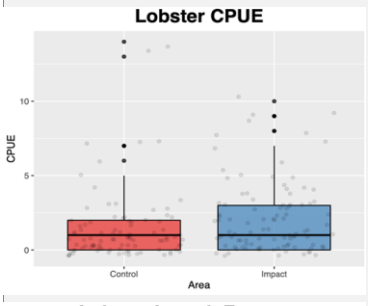


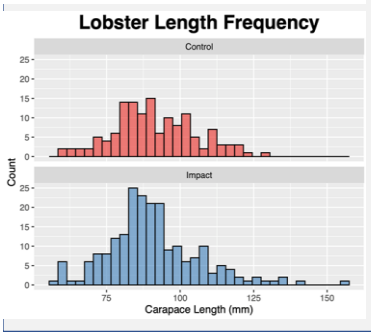
Trap Hauls		
Area	# of String Hauls	% Success
Control	140	93%
501N	147	98%
*% based on maximum of 150 hauls		

48

Lobster

2019





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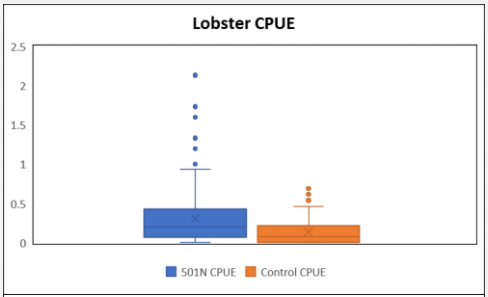
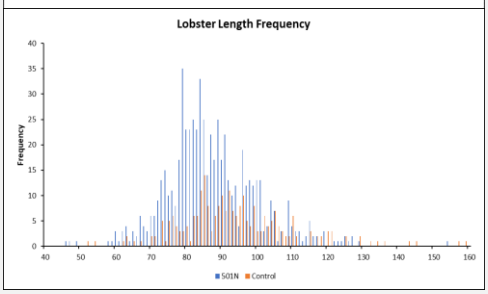
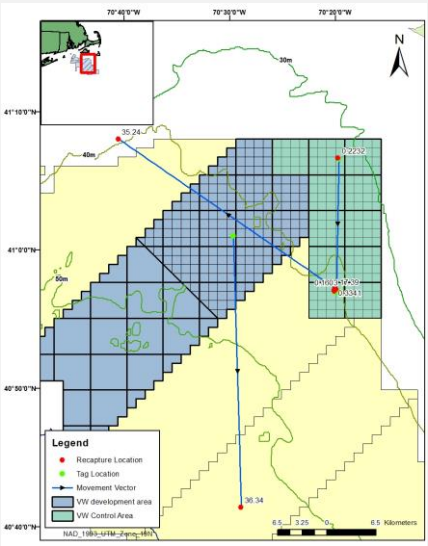




49

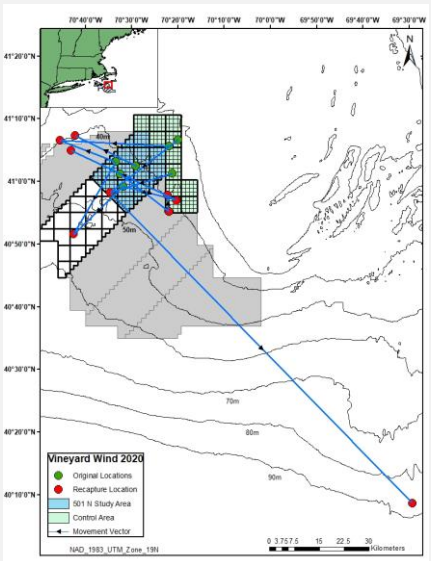
Recaptured Lobsters

2019



Tagged Lobsters				
N (Captured)	N (Tagged)	N (Recaptured)	Distance Range (km)	Days at Large Range
351	320	6	0.35 to 35.24	5 to 75

2020



Tagged Lobsters				
N (Captured)	N (Tagged)	N (Recaptured)	Distance Range (km)	N (Recaptured)
921	703	12	4.81 to 128.82	10 to 412

50

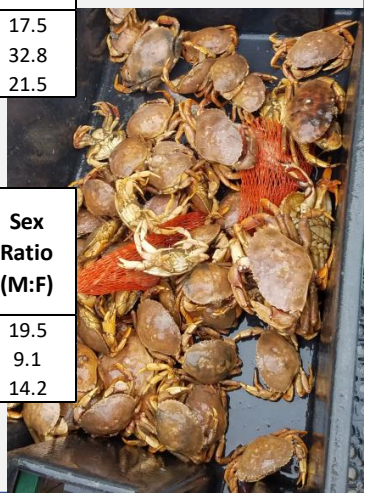
Jonah Crab Comparison

2019 July-October 8 Sampling Periods

Area	Month	Temp (°C)	N (Caught)	N (Measured & Sexed)	CPUE	Mean CW (mm)	Males	Females	Sex Ratio (M:F)
Impact	All	13.4	1160	1144	11.60	116	1082	62	17.5
Control	All	14.5	758	744	7.98	121	722	22	32.8
Combined	All	13.9	1918	1888	9.84	118	1804	84	21.5

2020 June-October 10 Sampling Periods

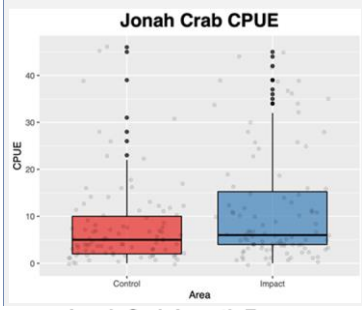
Area	Month	Temp (°C)	N (Caught)	N (Measured & Sexed)	CPUE	Mean CW (mm)	Males	Females	Sex Ratio (M:F)
Impact	All	12.8	2578	2439	17.78	121	2320	119	19.5
Control	All	13.9	1250	1244	9.19	117	1121	123	9.1
Combined	All	13.3	3828	3683	13.49	120	3441	242	14.2

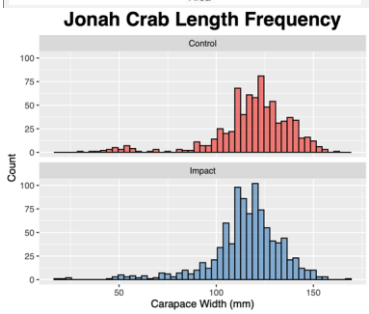


51

Jonah Crab

2019





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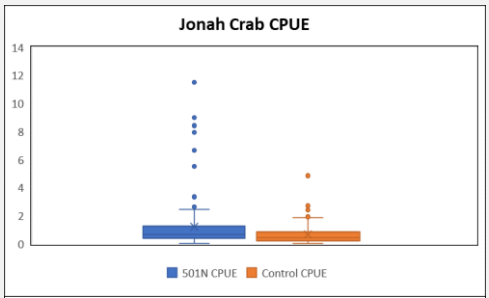
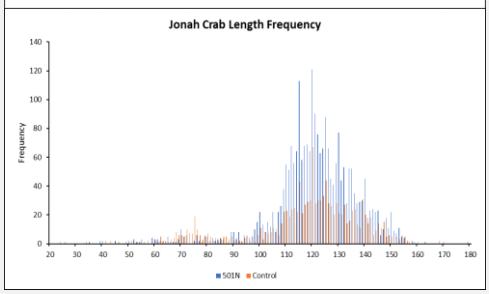
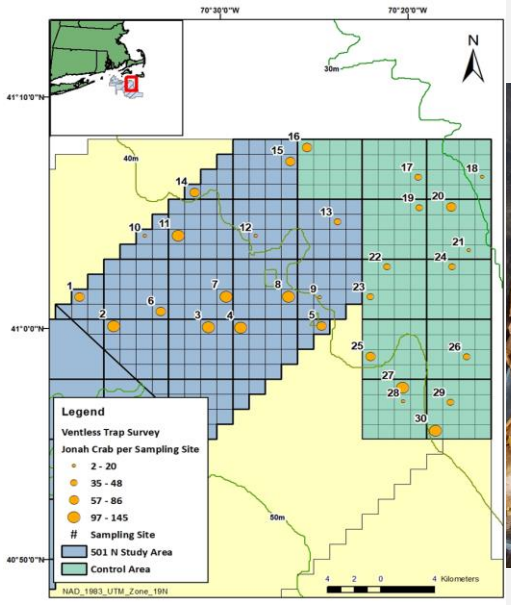




52

Jonah Crabs

2019



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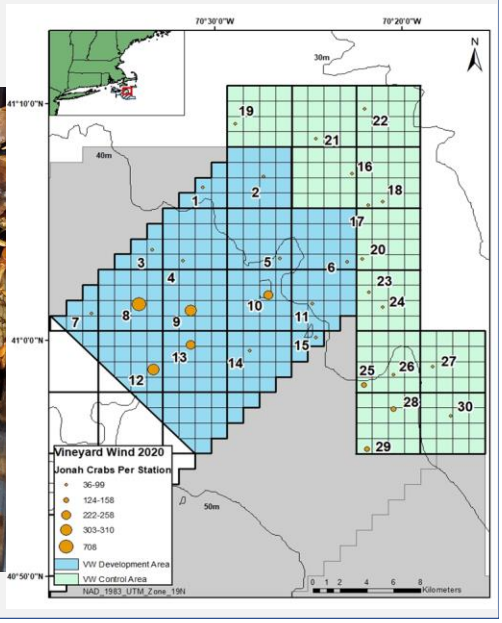


53

Black Sea Bass Comparison

2019 July-October 8 Sampling Periods

Sampling Period	Area	Month	Temp (°C)	N (Caught)	N (Measured)	CPUE	Mean Length (cm)
1-8	Impact	All	13.4	99	97	1.08	33
1-8	Control	All	14.5	165	163	2.12	34
1-8	Combined	All	13.9	264	260	1.55	33

2020 June-October 10 Sampling Periods

Sampling Period	Area	Month	Temp (°C)	N (Caught)	N (Measured)	CPUE	Mean Length (cm)
1-10	Impact	All	12.8	149	145	1.03	31
1-10	Control	All	13.9	307	306	2.31	31
1-10	Combined	All	13.3	456	451	1.67	31

2019

Black Sea Bass			
N (# Disected)	# Empty	# w/Contents	% Empty
87	63	24	72%

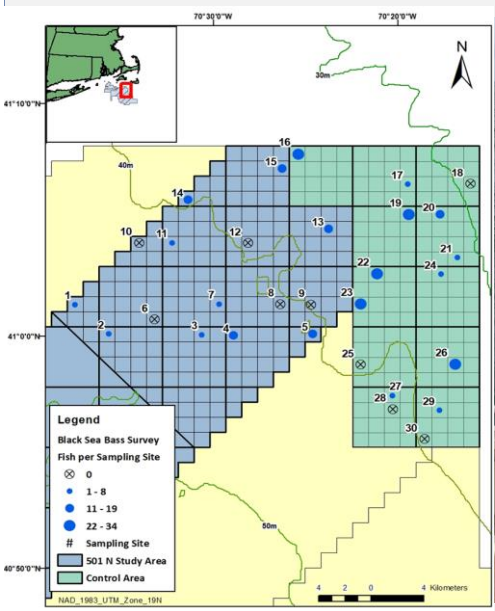
2020

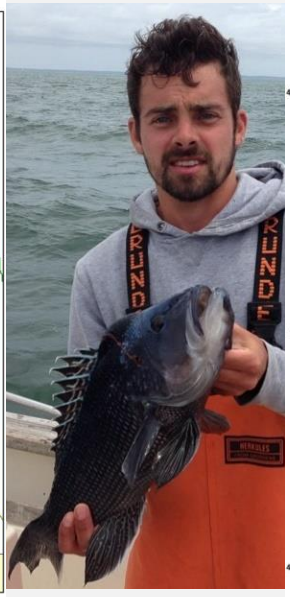
Black Sea Bass			
N (# Disected)	# Empty	# w/Contents	% Empty
166	138	28	83%

54

Black Sea Bass

2019





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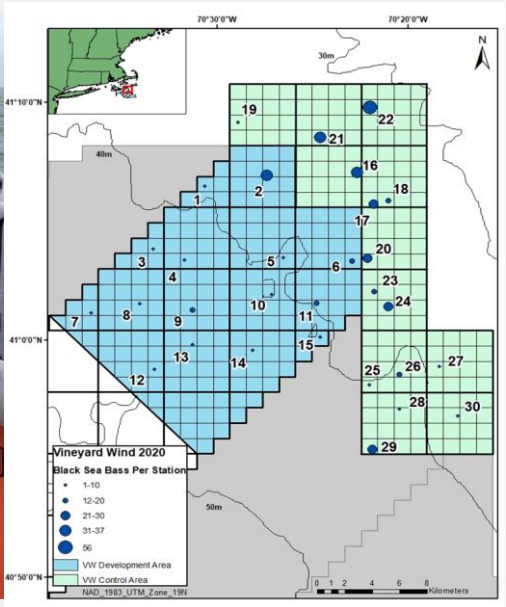


55

Larval Lobster Plankton Net

56

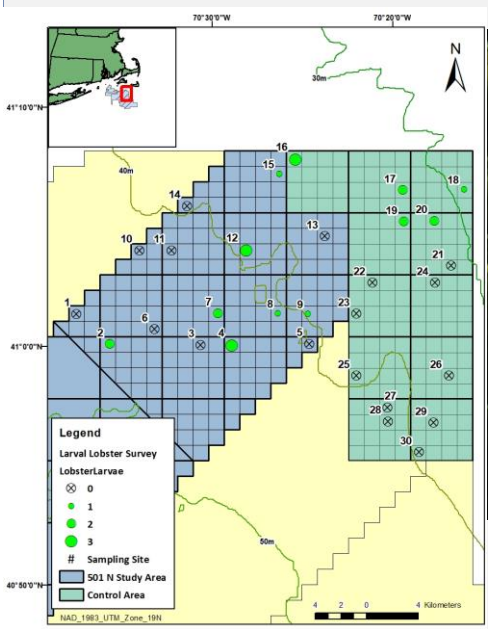
Larval measurements

Sampling measure	*SMAST*	*NMFS/DMF*
Net mouth	0.67m * 1.67m	1m * 2m
Net mesh	1300µm	970µm
Net length	6.7m	9m
Effective sampling depth	0.0m to 0.67m	0.0m to (0.5m – 0.67m)
Standard tow volume	1200-1500 m^3	3000 m^3
Vessel speed	4 knots	3.25 knots
Vessel size	17m	12m
Standard tow time	10-15 minutes	30 minutes

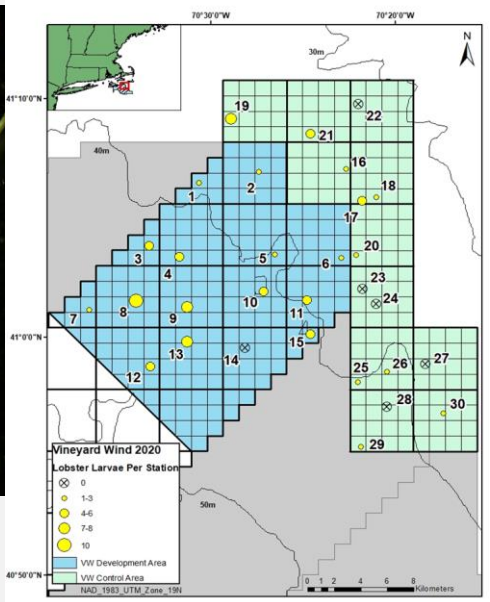
57

Lobster Larvae

2019

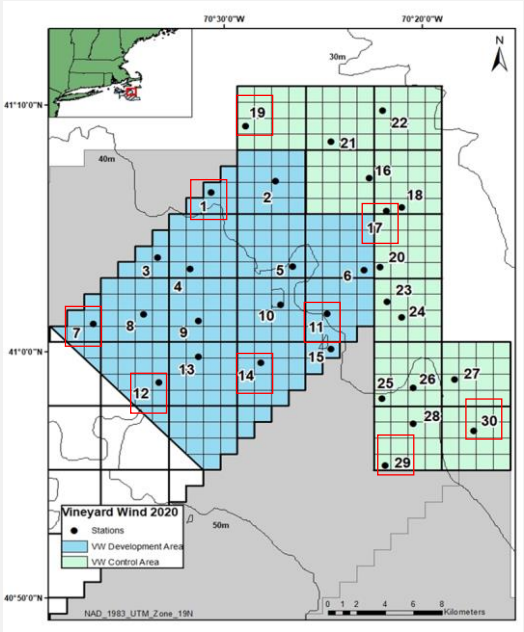


2020



58

Sensor Data

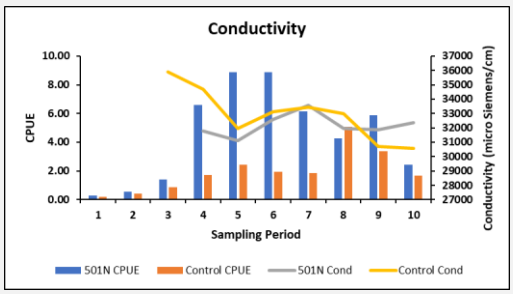


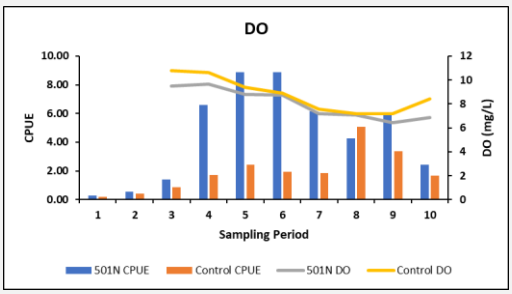
Conductivity, pH and DO sensors were placed at following stations for periods 3-10:

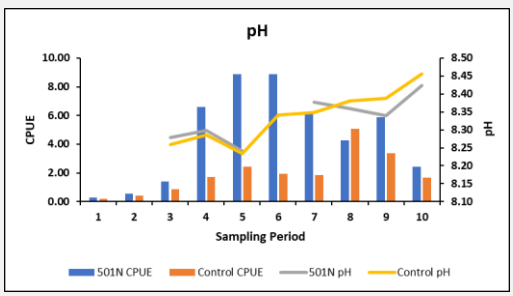
501N Area: ST 1, 7, 11, 12, and 14
Control Area: ST 17, 19, 29, 30

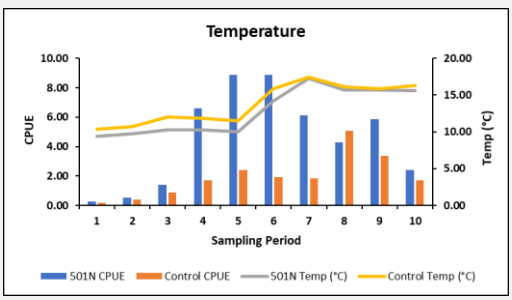
59

Sensor Data





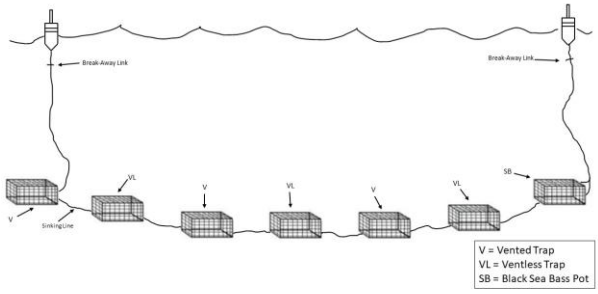


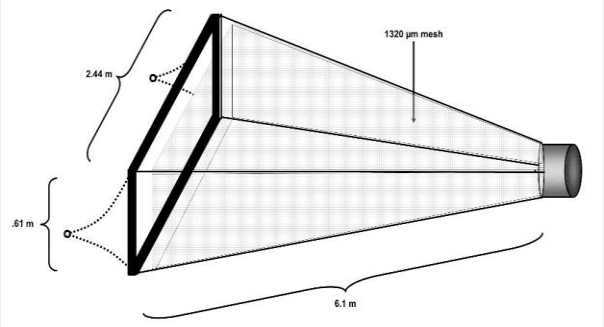


60

Overview

	2019			2020		
Species	n	x̄	SD	n	x̄	SD
Lobster	351	0.63	1.28	921	0.54	1.20
Lobster Larvae	23	0.19	0.58	91	0.31	0.95
Jonah Crab	1918	3.71	6.43	3828	2.24	5.10
Black Sea Bass	264	1.47	4.44	456	1.59	3.48

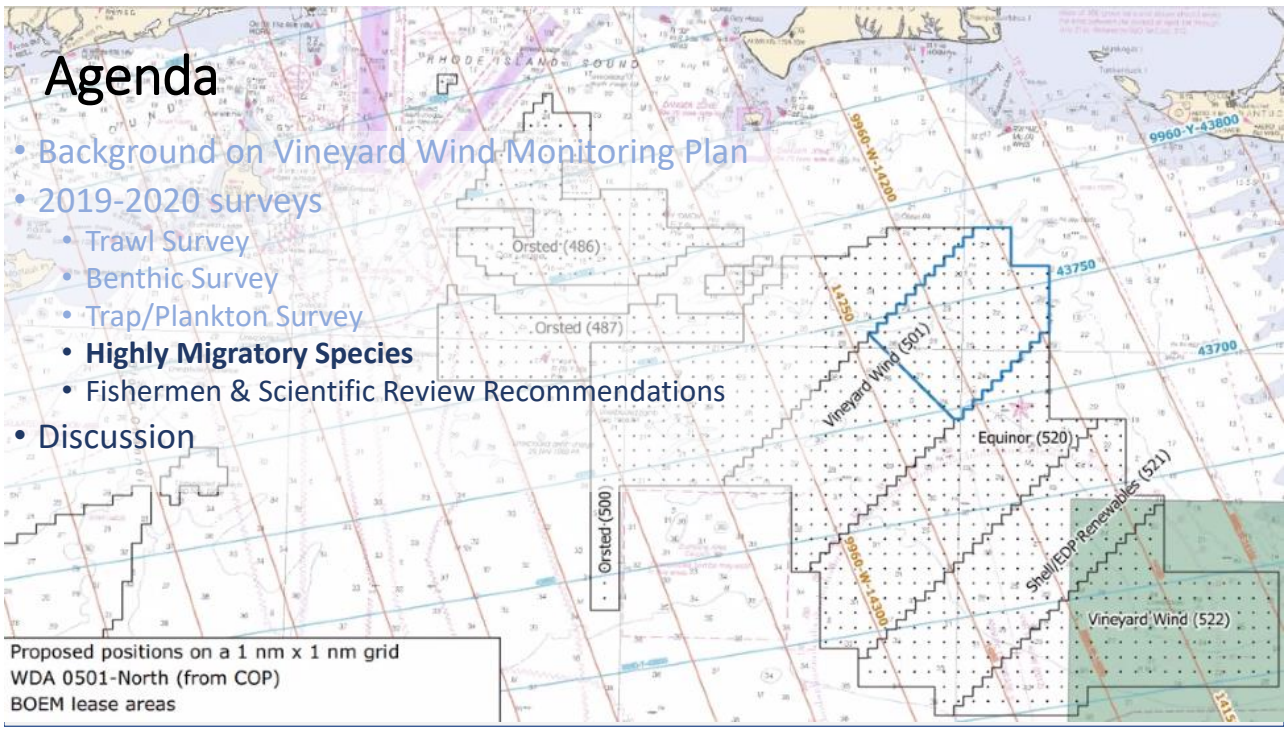




61

Agenda

- Background on Vineyard Wind Monitoring Plan
- 2019-2020 surveys
  - Trawl Survey
  - Benthic Survey
  - Trap/Plankton Survey
  - **Highly Migratory Species**
  - Fishermen & Scientific Review Recommendations
- Discussion



62

An assessment of baseline Highly Migratory Species (HMS) recreational fishing effort in southern New England and the associated wind energy areas

Principal investigators

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Data contributions from:

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

Cooperative Shark Tagging Program NOAA NMFS

American Littoral Society Coastal Conservation

The Billfish Foundation

Funding support from:

Vineyard Wind

63

Background and Justification

- HMS are the target of the largest recreational fishery in offshore southern New England
- Popular recreational fishing 'spots' fall within wind energy areas
- Limited data on recreational effort of HMS in the region
- No previous attempts to synthesize available data to document HMS fishing effort in wind energy areas

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

QuanTech Quantitative Technologies for Research and Analysis

Large Pelagics Survey

From Maine to Virginia, the Large Pelagics Survey (LPS) collects catch and effort data for tuna, sharks, billfishes, swordfish, and other offshore recreational species. Because trips targeting such highly valued species are relatively rare and require specific fishing methods, a specialized survey is needed to produce precise catch estimates to meet science and management needs.

The LPS consists of three surveys that are administered from June through October: the Large Pelagics Intercept Survey (LPIS), the Large Pelagics Telephone Survey (LPTS), and the Large Pelagics Biological Survey (LPBS). Estimates derived from the LPS are produced each month.

- The Large Pelagics Intercept Survey (LPIS) is a dockside intercept survey that collects information from anglers and for-hire operators returning from trips targeting large pelagic fish. Rather than intercepting individual anglers, the LPIS intercepts individual vessel representatives. It measures the number of fish that were caught, landed, released, and sold; the size of the fish that were landed; the number of anglers who fished; the length and location of their fishing trip; the fishing methods used; and the species targeted.

64

Goals

- Document the spatial distribution of recreational and for-hire fishing for HMS (tunas, sharks, marlins) in southern New England
- Document temporal shifts in effort for HMS and by species
- Document most popular target species, fishing tactics, and fishing locations in recent years

Approach

- Part 1: Survey recreational anglers and charterboat captains to characterize…
  - Where they're fishing and how much they're fishing there in a typical year
  - What they're fishing for
  - How they're fishing
- Part 2: Mine and analyze existing fisheries-dependent data to examine…
  - Spatial and temporal extent of HMS fishing effort by species or species group
- Synthesize all data to achieve a more comprehensive assessment of baseline recreational HMS effort

65

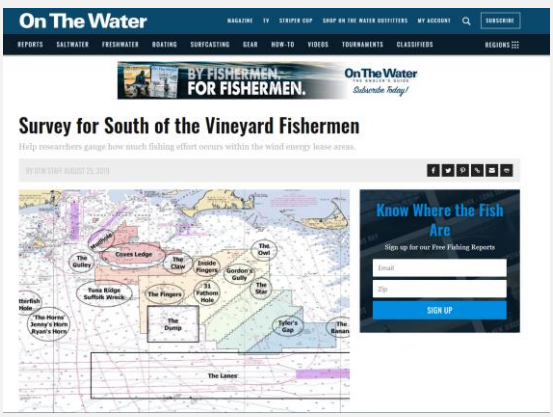
Part 1: Survey of Recreational Fishermen

Questions:

1) Where do you fish and how many days do you fish there in a typical year?
2) What species do you typically target?
3) What fishing methods do you use to target those species?
4) Are you a private angler or charterboat captain?

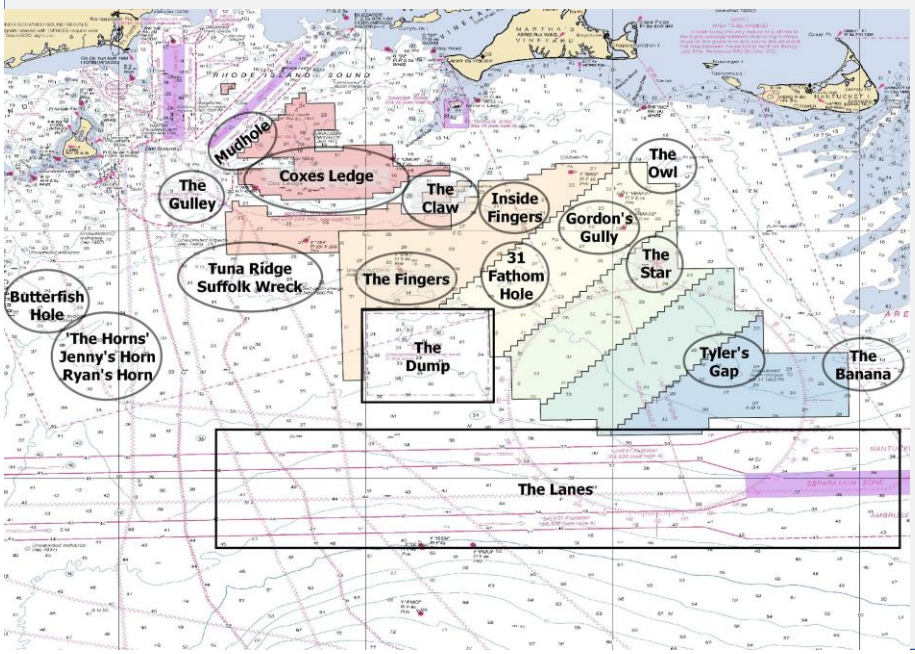
Online survey: August 23, 2019 to March 15, 2020

- Advertised through
  - NEAq Social Media
  - Online discussion forums
  - On the Water magazine
  - Fishermen's social media
  - Vineyard Wind website
  - Email correspondence



66

Q1: Where do you fish? How many days do you fish there?



'how many days do you fish these spots in a typical year'…

0 days
1-2 days
3-4 days
5-6 days
7-10 days
>10 days

67

Results Q1: Location and Magnitude of Effort

171 survey respondents
136 private anglers
34 charter/headboat captains

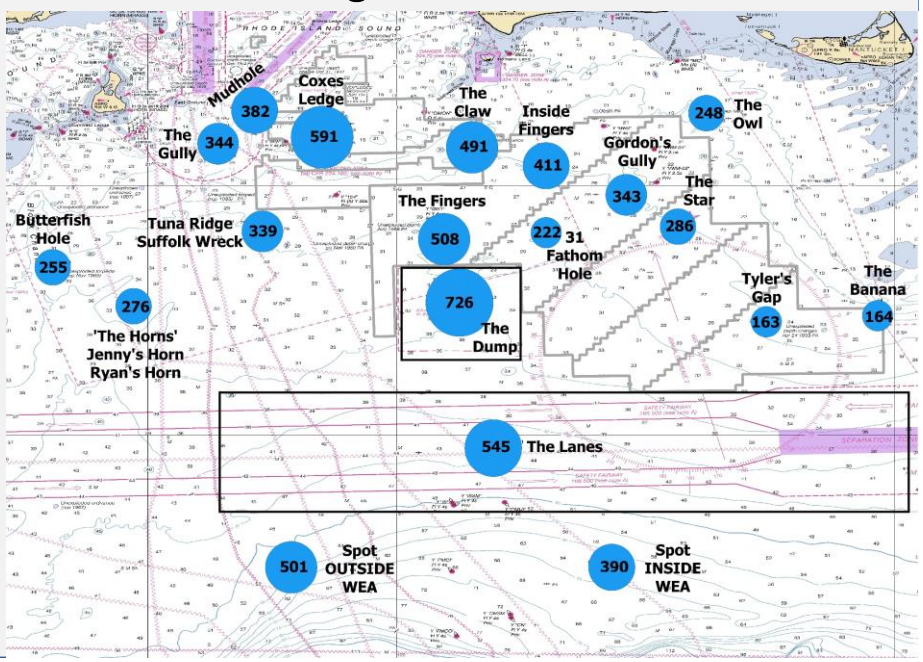
Numbers in circles = cumulative days fished per year

Private anglers:

Average = 37 ± 36 trips per year

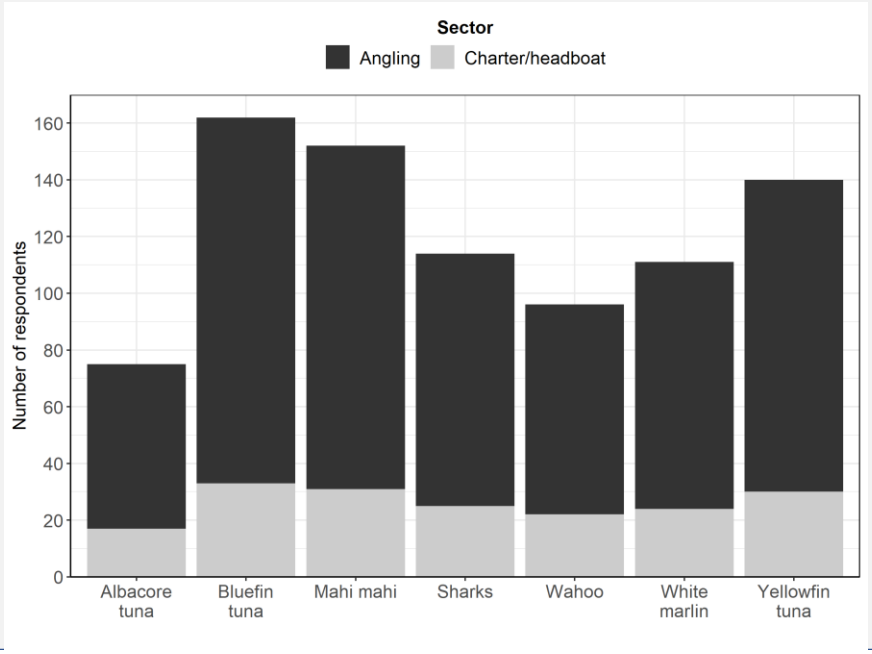
Charter:

Average = 65 ± 52 trips per year



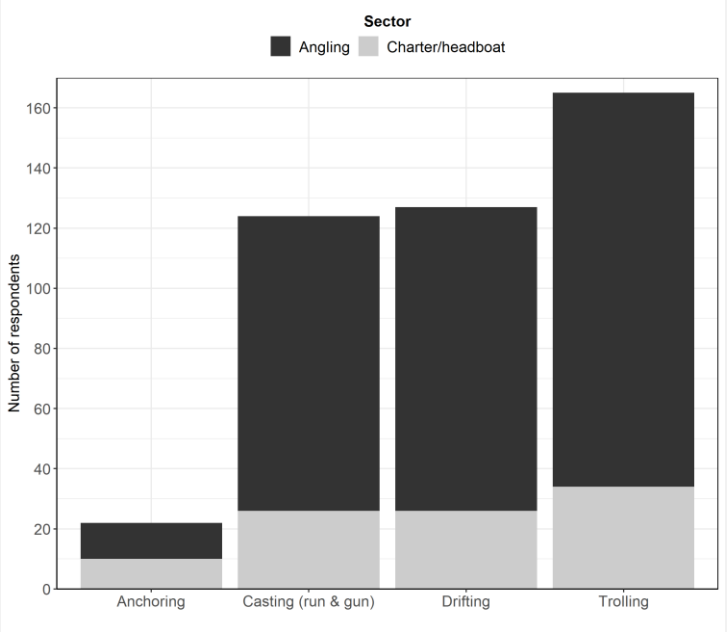
68

Results Q2: Species Targeted By Sector



69

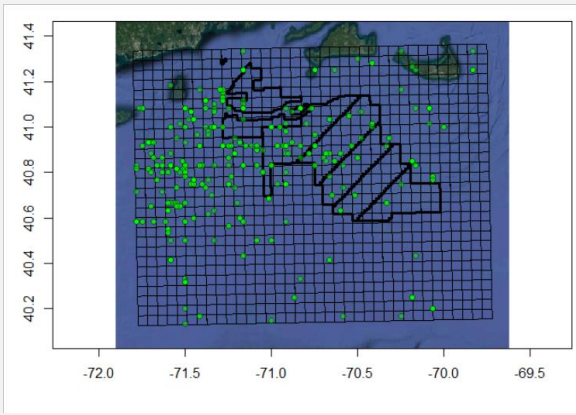
Results Q3: Fishing Method By Sector



70

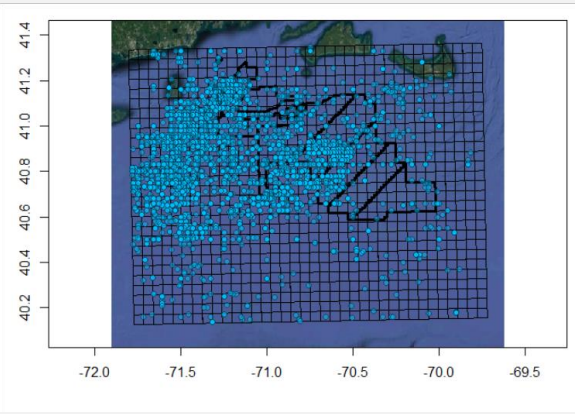
Part 2: Fishery-Dependent Data: Effort by Species/Species Group

Large Pelagics Survey (LPS)



3,152 records
22 species
2002 - 2018

Conventional Tagging Data (CTD)



11,268 records
12 species
1954 - 2019

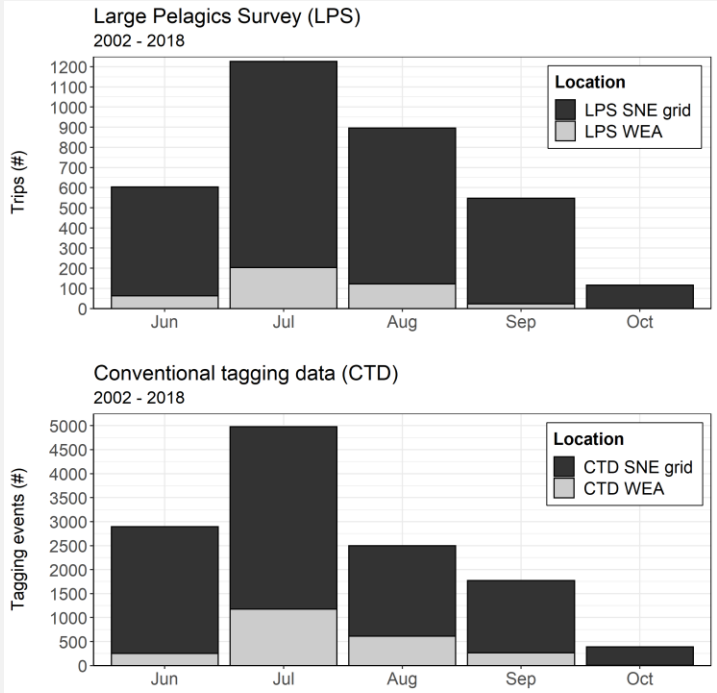
71

Fishery-Dependent Data Analysis

- Interpolate effort data on a grid of BOEM lease blocks
- Recreational fishing effort quantified using
  - HMS catch records from LPS Intercept Survey
  - Number of vessel trips from LPS Intercept Survey
  - Number of tagging events that occurred on rod and reel
- Aggregate catch (effort) data into groups
  - All HMS
  - Bluefin tuna
  - Sharks (mako, blue, thresher, sandbar, dusky, etc.)
  - Tropical pelagics (yellowfin tuna, albacore tuna, white marlin)
- Compare effort indices between
  - LPS Trips vs. Catch
  - Recent tagging effort (2002 – 2018) vs. full historical tagging effort
  - LPS Trips and tagging events from 2002 – 2018

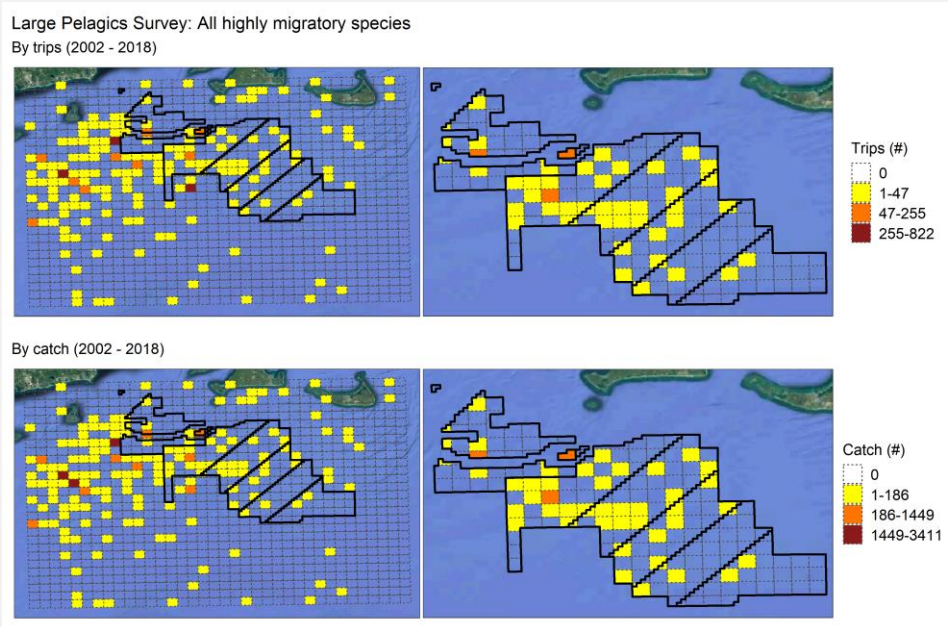
72

Timing of the Recreational HMS Fishery



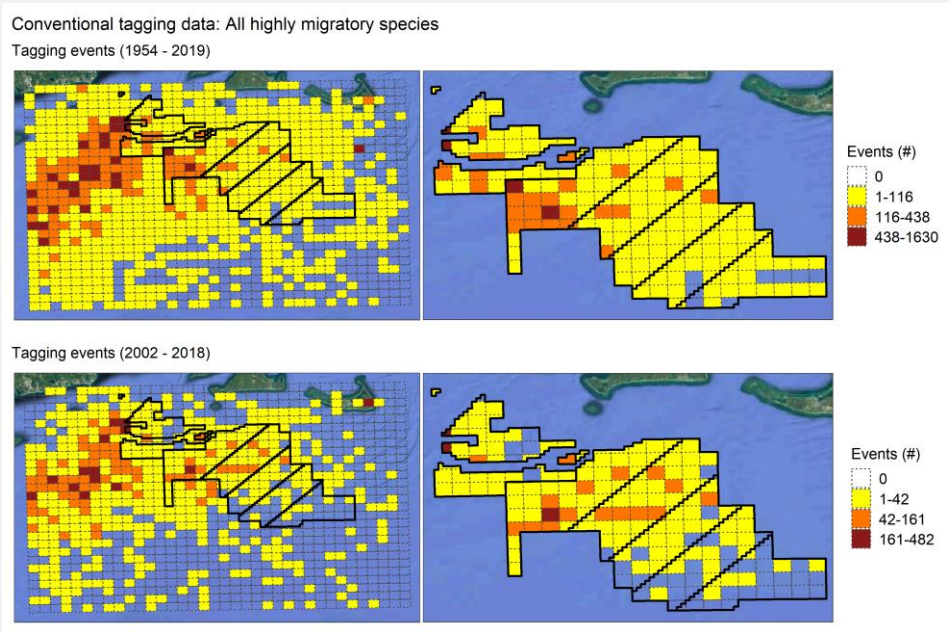
73

LPS Results: Trip vs. Catch Comparison



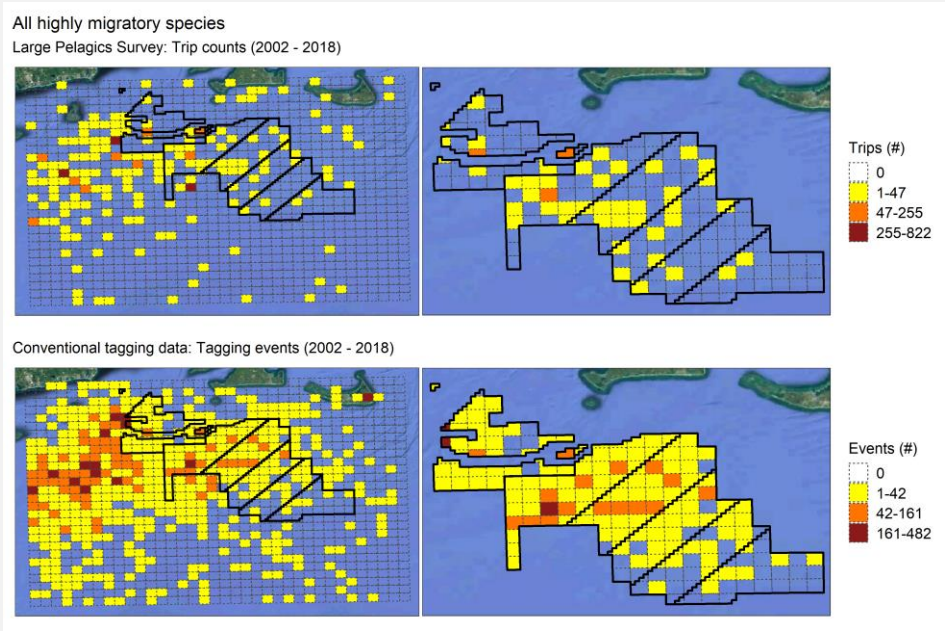
74

Tagging Events: Full vs. Recent (2002-2018) period



75

LPS Trips vs. Tagging Events (2002 – 2018)



76

Future Directions and Recommendations

- Continue to build the time series
  - Administer recreational fishermen survey annually (fall/early winter)
  - Incorporate LPS and tagging data beyond 2018 as it becomes available
  - Explore additional data sources (VTRs from charter vessels?, MRIP data?)
- Improve the quantity of data collected
  - Provide opportunity for respondents to provide more detailed data
    - What species do you target at each location?
    - What port/state are you fishing out of?
    - How fishing effort changed on a finer scale in response to surveying, construction, operation
- Improve quality of data collected
  - Achieve more real time monitoring in-season
    - Address lag (LPS data not available until >1 yr after a given fishing season)
  - Establish a recreational study fleet
    - Volunteer private and charter fishing vessels that keep detailed logs on fishing effort over time
    - Compare logs in pre-construction, construction, operations phases
  - Continue to conduct outreach with fishermen
  - Engage other offshore wind developers to design and implement regional monitoring strategy/framework

77

Fishermen & Scientific Advisory Group Recommendations

- General
  - More advanced statistical analyses may be needed for eventual impact analysis to account for other factors (e.g., date, depth, temperature, bottom type)
- Trawl Survey
  - Some refinement of NEAMAP net mensuration criteria is needed
  - Power analyses can be updated each year to consider number of stations
  - Spring, Summer & Fall surveys provide similar information
- Benthic survey
  - Presence and size of squid egg mops in spring could be valuable based on input from fishermen on appropriate timing
- Trap Survey
  - Migration data from tagging will be important for monitoring impacts
  - Should consider data from the lobster fishery in the area to interpret results
  - Analyses should consider soak time and bait
  - Analyze legal and sub-legal sized lobsters separately
- Larval survey
  - May need to refine sampling time
- Highly Migratory Species
  - A recreational study fleet would be ideal to improve data quality
  - Socio-economic data could be considered

78

Agenda

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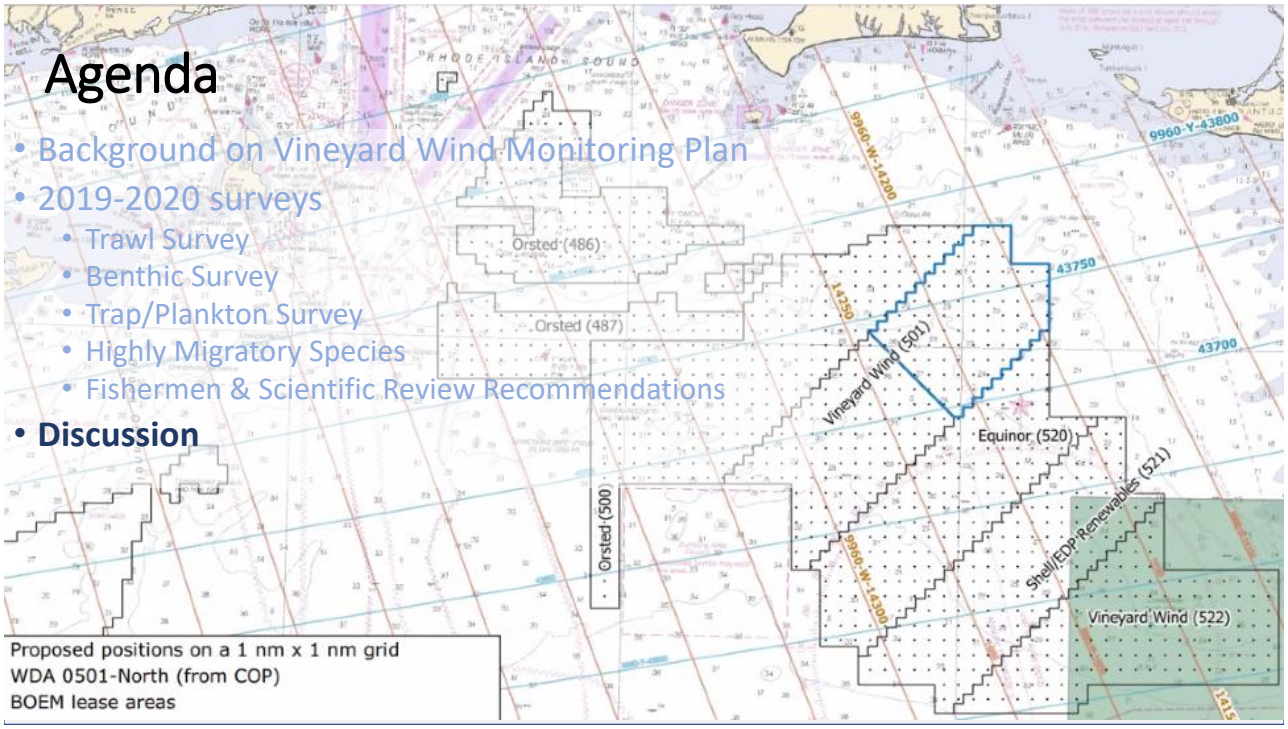

79