MANNA FISH FARMS

SUSTAINABLE MARINE AQUACULTURE

MANNA
FISH FARMS, INC.

RESPONSIBLY RAISED SEAFOOD

Kleinschmidt

Meeting Agenda

- Introductions and Overview
- Phased Construction and Production
- Net Pen Deployment
- Feed Information
- Siting Analysis
- Next Steps

Overview

- **MANNA FISH FARMS, INC.** will farm finfish for commercial sale and research in the U.S. Exclusive Economic Zone approximately 9 miles off the shore of Long Island, New York.
- In the U.S., currently over 91% of our seafood consumed is imported. Seafood is our second largest natural resource trade deficit, second only to oil. Wild fish stocks have been on the decline, and are level, at best. Sustainable fish farming will take pressure off wild stocks, while reducing the $ 15.5+ Billion U.S. trade deficit.
- Fingerlings will initially be purchased (Hudson Valley Farms as an example), then placed in the submerged net pens and fed through automated feed buoy, while secure at 40-60 feet below the ocean's surface in water depths of approximately 145 feet.

Overview

- The latest submersible net pen technologies have been designed to be more environmentally friendly and capable of withstanding the rigors of offshore farming in the open ocean, and automated technology has allowed for more efficient and sustainable production.
- The first pre-application meeting was held just almost 5 years ago on November 16, 2015. Much progress has occurred since to address stakeholder's concerns.
- **MANNA FISH FARMS** has also been working with regulators to implement a similar farm in the Gulf of Mexico, off Pensacola, Florida.

Scientific Advisors

Stony Brook University
Center for Advanced Technical Assistance – SPIR- NY State Strategic Partnership for Industrial Resurgence
- Dr. Imin Kao, Director SPIR

St. Joseph's College & The New School, NYC, NY
- Dr. Konstantine Rountos

University of Rhode Island
- Dr. Terence Bradley

University of Miami Rosenstiel School of Marine and Atmospheric Science
- Dr. Daniel Benetti

University of New Hampshire, School of Marine Science and Ocean Engineering
- Dr. Michael Chambers
- Dr. David Berlinsky

Stony Brook University CIEES – Center for Integrated Electrical Energy Systems
- Dr. Benjamin Hsiao, Director
- Dr. Alejandro Schrott
- Dr. Jeffrey Ge

University of Southern Mississippi
- Dr. Kelly Lucas

Mote Marine Lab
- Dr. Kevan Main

Advisors/Consultants

CFAARM, Center for Aquatic Animal Research & Management
Aquatic Veterinarian
- Dr. Stephen Frattini, DVM

Kleinschmidt Associates, Essex, Connecticut
- Chris Tomichek
- Tracy Maynard

UNH Sea Grant
- Dr. Michael Chambers

Blue Ocean
- Brian O'Hanlon

Kampachi Farm/The Velella Project
Velella Epsilon Project – Gulf of Mexico
- Neil Sims

StormSafe Submersible Cages
- Mike Meeker, Manna Fish Farms COO

Letters of Support Received

New York State Assembly

- Fred Thiele, Assemblyman
- Joseph Saladino, Assemblyman
- David G. McDonough, Assemblyman
- Andrew Raia, Assemblyman
- Chad Lupinacci, Assemblyman
- Michael Fitzpatrick, Assemblyman
- Anthony Palumbo, Assemblyman

County Legislature

- Bridget Fleming, Suffolk County Legislator
- Leslie Kennedy, Suffolk County Legislator
- Tom Cilmi, Suffolk County Legislator
- William J. Lindsay III

United States Congress

- Tim Bishop, former U.S. Congressman
- Lee Zeldin, United States Congressman

Town of Southampton

- Jay Schneiderman, Town Supervisor
- Anna Throne-Holst, Former Town Supervisor
- Christine Preston Scalera, Councilwoman

Town of Brookhaven

- Ed Romaine, Town Supervisor

County Executive

- Steven Bellone

United States Senate

- Kristen Gillibrand, United States Senator

Many more available at: https://mannafishfarms.com/letters-of-support/

Memberships/Collaborators

World Ocean Council, Board Member

National Aquaculture Association

United States Aquaculture Association

Global Aquaculture Alliance

The Ocean Stewards Institute, Board Member

Manna Ocean Foundation

Sea Grant New York

Sea Grant New Hampshire

MIT and MIT Sea Grant

Long Island Association

USM Sea Grant

Woods Hole Oceanographic Institute

Consultations/Permits

(based on National Sea Grant Law Center white paper, June 2014)

- NOAA/NMFS Authorization
  - Depends on species being cultured
  - Federally managed species would require a permit from NMFS
  - For non-managed species, NMFS role limited to ESA and EFH consultation
- §10 Rivers and Harbors Act
  - ACOE jurisdiction extends to seaward limit of OCS (200 nautical miles)
  - Required if obstruction to navigation
  - Triggers EA and possibly EIS if significant impacts expected
- §404 Clean Water Act
  - Only required if dredge/fill on bottom
- §402 Clean Water Act (NPDES)
  - EPA authorizes discharge of pollutants out to 200 nautical miles from point sources
  - Biological materials include escaped fish, excrement, waste feed
  - Required if harvest exceeds 100,000 lbs. annually
- USFDA approval

Consultations/Permits

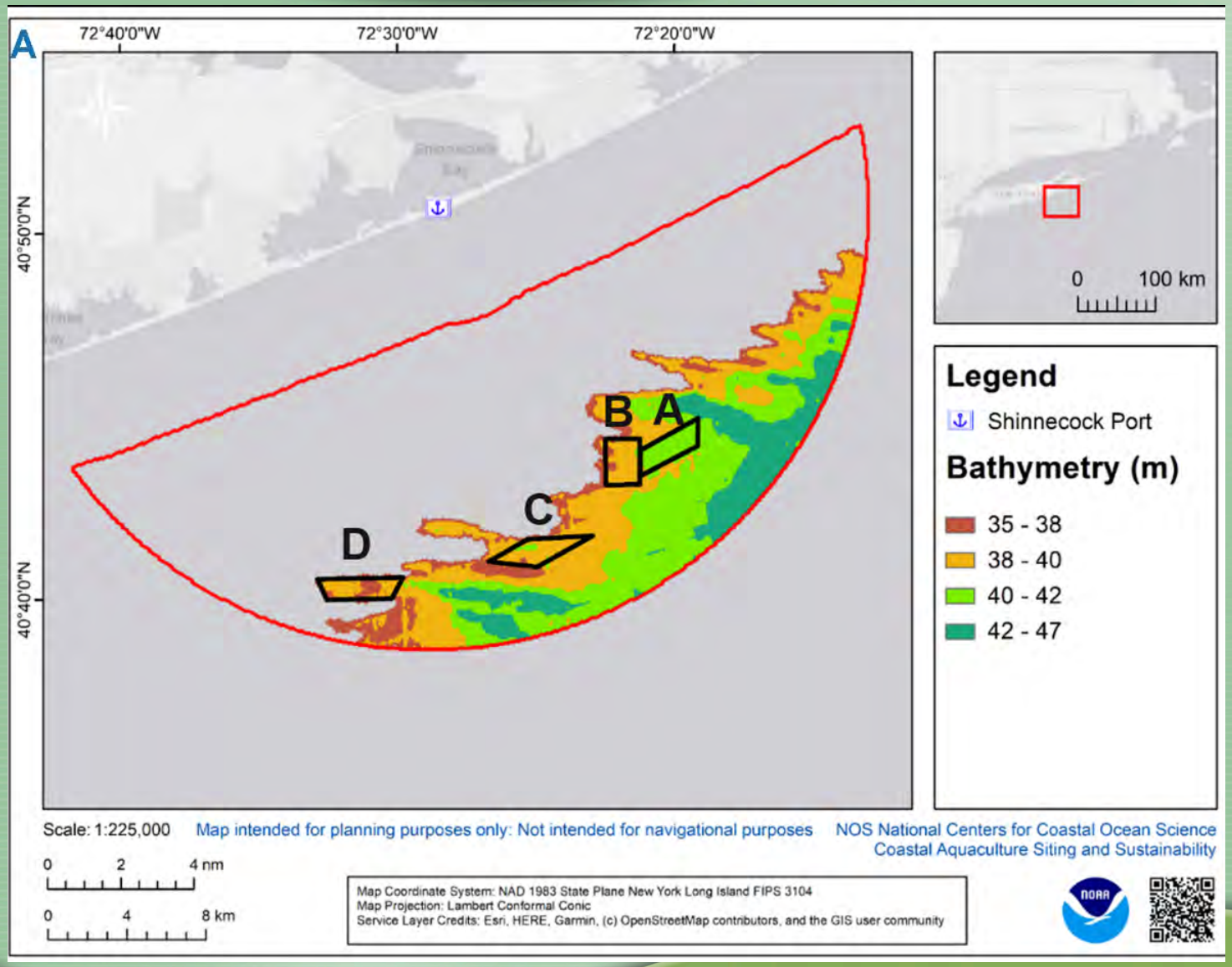
- National Environmental Policy Act
- §7 of ESA Consultation (ACOE to consult with NMFS and USFWS)
- Marine Mammal Protection Act
- EFH Consultation (ACOE to consult with NMFS)
- §106 National Historic Preservation Act Consultation
- USCG Consultation for buoys, lights, beacons, etc.
- USCG registration of the vessel is required (46 CFR 170 and 46 CFR 28)
- Coastal Zone Management Act
  - Certification that project is consistent with NY state program

Issues, Laws, and Agencies

Issues	Laws	Regulatory agencies
Fisheries management, protection of habitat, marine mammals, and endangered species	Magnuson-Stevens Fishery Conservation Management Act Marine Mammal Protection Act Endangered Species Act National Environmental Policy Act Coastal Zone Management Act National Marine Sanctuaries Act	NOAA (NMFS) NOAA (NMFS) NOAA (NMFS), FWS USEPA, NOAA (NMFS), USACE NOAA (National Ocean Service) NOAA (National Ocean Service)
Nutrient discharge	Clean Water Act, NPDES discharge permits Safe Drinking Water Act Marine Protection, Research, and Sanctuaries Act	USEPA, USACE USEPA USEPA, NOAA (NMFS), USACE
Siting, hazards to navigation, permitting and construction of structures, transporting product	Rivers and Harbors Act Lacey Act 14 U.S.C. 83 (marking structures in navigable waters) Outer Continental Shelf Lands Act	USACE FWS U.S. Coast Guard Bureau of Safety and Environmental Enforcement and Bureau of Ocean Energy Management
Seafood safety, feed ingredients, animal health, use of veterinary drugs	Federal Insecticide, Fungicide, and Rodenticide Act Federal Food, Drug, and Cosmetic Act Food Safety Modernization Act Hazard Analysis and Critical Control Points Program Surveillance and Monitoring Program	USEPA USFDA USFDA USFDA USFDA
Health management, best management practices	Animal Health Protection Act Virus Serum Toxin Act 9 CFR 101-124 (regulations on the spread of disease)	USDA (APHIS) USDA (APHIS) USDA (APHIS)
Escapes, broodstock management, monitoring and reporting	Magnuson-Stevens Fishery Conservation and Management Act State and local regulations with requirements for reporting and response	NOAA (NMFS) State and local agencies

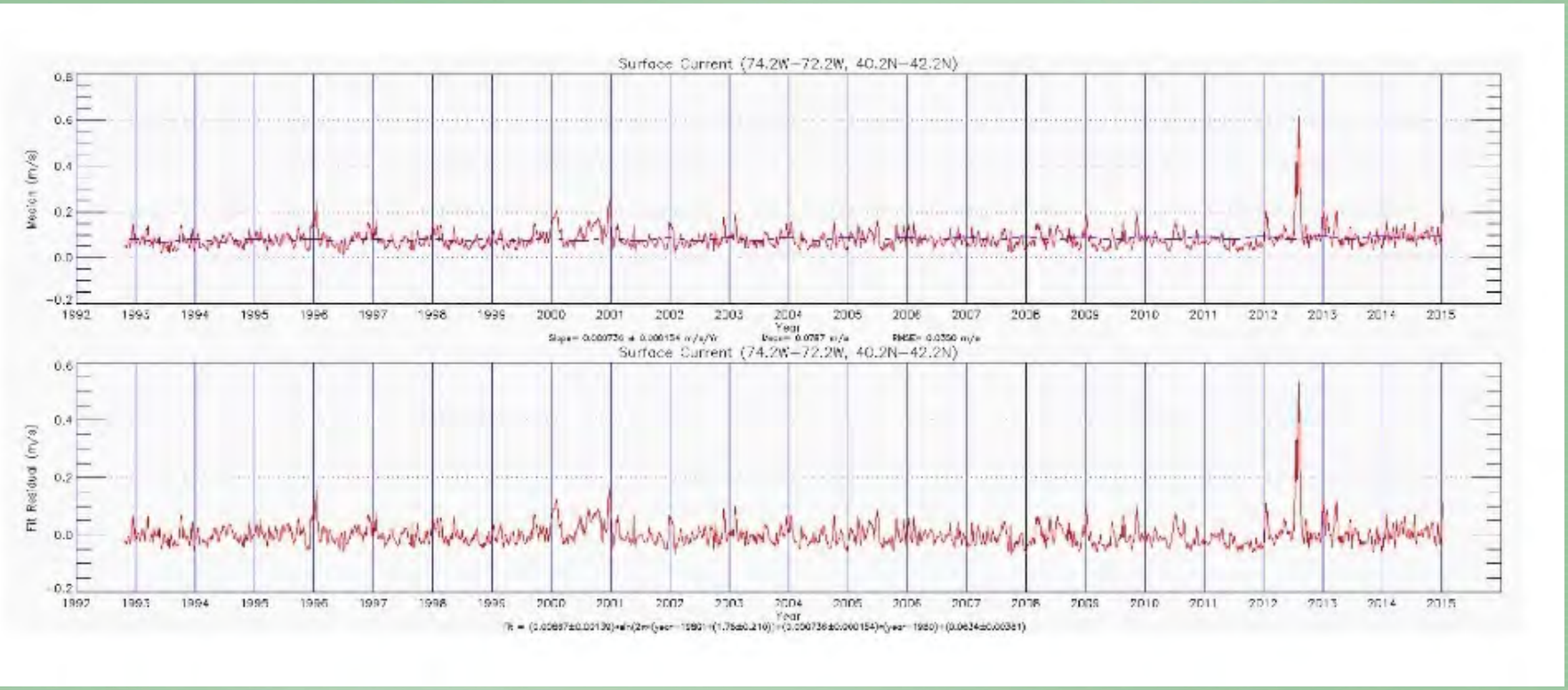
(Rust et al. 2014)

Location



The Offshore Marine Aquaculture Farm will occupy a total area of ~4 km^2 at a location ~9 nm from the Port of Shinnecock.

NY Surface Currents



Mean (1992 - 2015) = 0.0787 m/s

Phased Approach

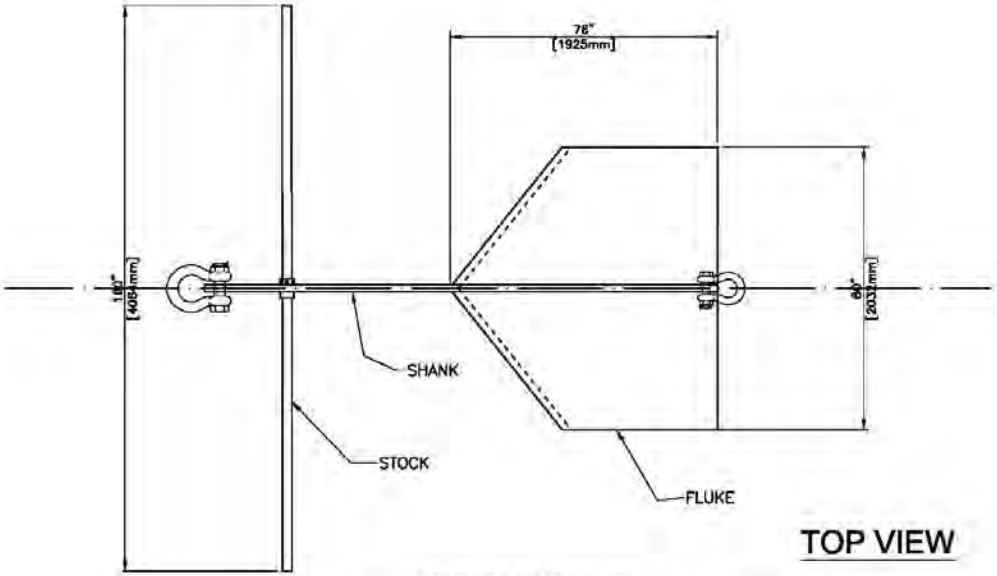
- **Phase 1** - approximately 50,000 steelhead trout fingerlings will be stocked in 2 pens for an anticipated harvest of less than 100,000 pounds.
- **Phase 2** – up to 4 additional submersible pens, for a total of 6.
- **Phase 3** – up to 4 additional submersible pens, for a total of 10.
- **Phase 4** – up to 4 additional submersible pens, for a total of 14.
- **Phase 5** – up to 4 additional submersible pens, for a total of 18.

Phased Approach

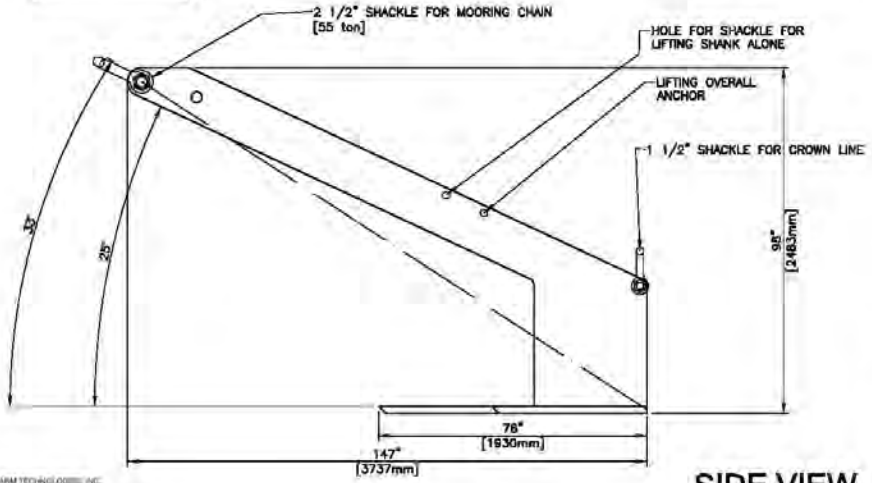
Implementation of the marine aquaculture facility will follow a five-phase approach, with Phase 1 consisting of deployment of a two net pens to demonstrate proof-of-concept.

Phase	Number of Net Pens	Number of Anchors	Type of Pen
1	2	16	StormSafe Submersible net pen
2	6	48	StormSafe Submersible net pen
3	10	80	StormSafe Submersible net pen
4	14	112	StormSafe Submersible net pen
5	18	144	StormSafe and/or others as may be developed

Anchoring Details



TOP VIEW



SIDE VIEW

OFT AQUACULTURE GRID ANCHOR
4400 lbs - 2000 kg

NO.	REVISION	DATE	DESIGNED BY: STR DRAWN BY: STR CHECKED BY: - DATE REVISED: 7-25-12	OCEAN FARM TECHNOLOGIES, INC
				OFT AQUACULTURE GRID ANCHOR 4400 lbs - 1000 kg
			OCEAN FARM TECHNOLOGIES	52 Main Street P.O. Box 38 Morrill, Maine 04952 Phone: (207) 342-2407 FAX: (207) 433-1300 www.oceanfarmtech.com
				AGA1000 -1 REV. O

11x17 = FULL SCALE

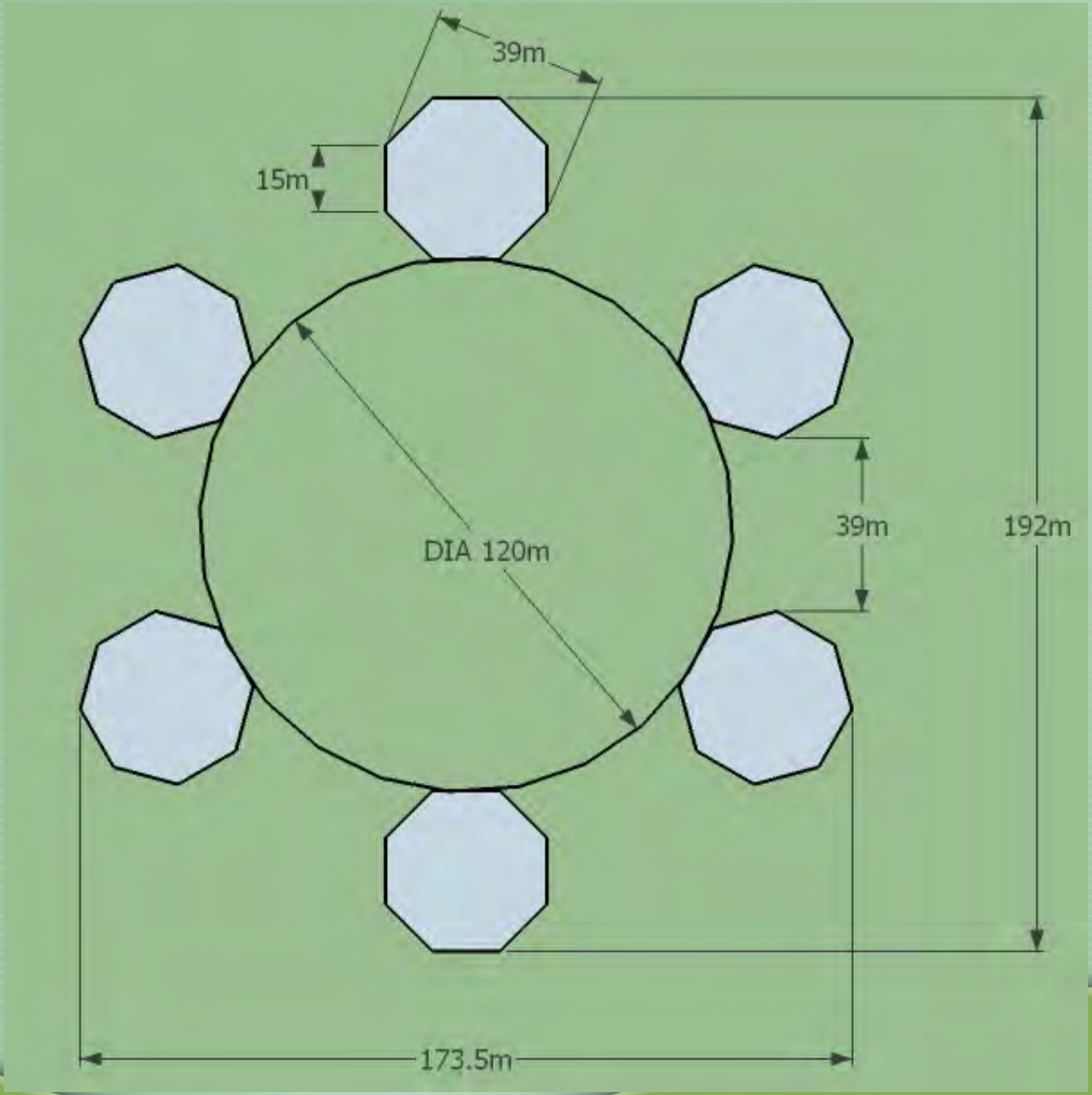
AUTOCAD 2011

StormSafe Submersible Pen

Six-sided StormSafe Submersible Pen

- Fully submersible to avoid storm and ice damage.
- A remotely operated airlift system can sink pen to any depth in under 2 minutes and then raise it when conditions become safe.
- The 45-ft (13.72 m) tall pen can be raised as much as halfway out of water for cleaning and maintenance.
- Six-sided or 8-sided spar design provides stability in rough, high wave conditions.
- Side flaps and upwell system to allow for protection against algae blooms and oil.

StormSafe Octopod Array



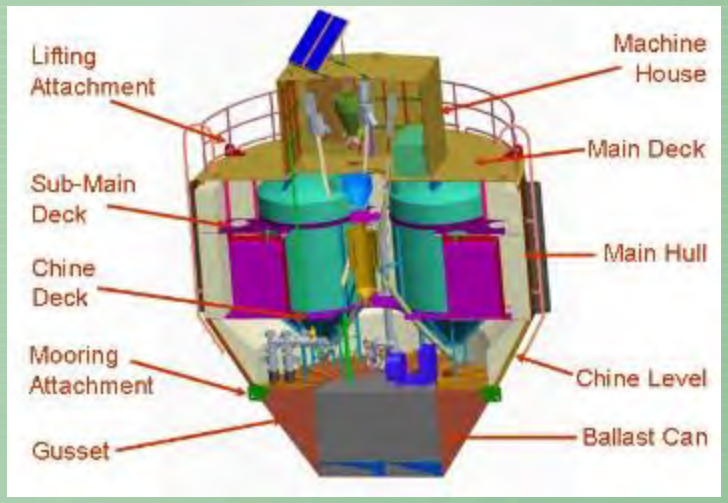
- Array footprint (including anchors) = 0.0625 km^2
- Each pen is anchored separately, with one anchor per vertical spar, for a total of 8 anchors per pen.
- At full build-out, 3 circular arrays of 6 pens each.

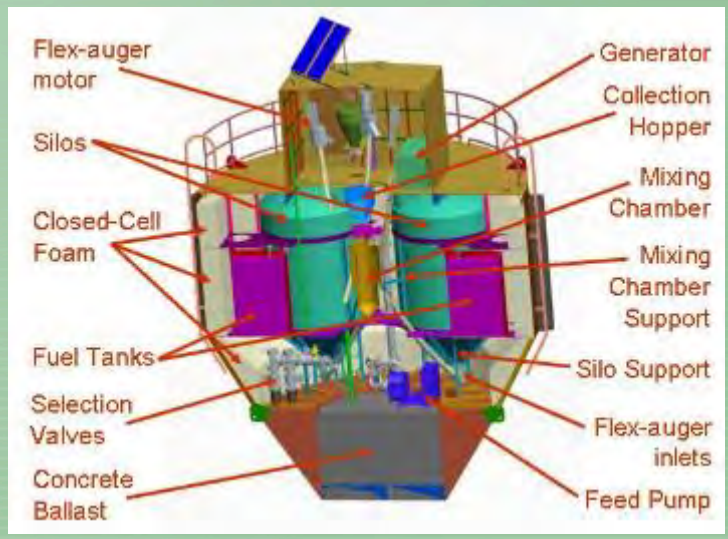
Automated Feed Buoy

- Automated feed buoy prototype was developed by Ocean Spar LLC, and the University of New Hampshire Open Ocean Aquaculture program.
- The buoy is comprised of a hull structure and internal and external water propelled feeding systems, holding 20 tons of feed.
- The 60-ton automated feed buoy is powered by solar and a diesel generator.
- The buoy is capable of remote operation using wireless communications to initiate feed delivery and receive information to ensure the proper quantity of feed is dispensed. Integration of renewable energy is currently being planned.
- Underwater cameras and robotics will be utilized to allow for real-time monitoring of activities in the pens, and to ensure pen safety and maintenance.

Feed Buoy

- The uppermost portion of the hull stores electronics, motors, and the diesel generator.
- The main hull below the machine house contains feed storage and the internal and external feeding systems, including the mixing chamber, four separate storage silos that can feed four separate submerged pods.
- Four mechanical flex-augers transfer the feed through flexible pipes up to the central collection hopper.
- Below the hopper is the mixing chamber, where water is introduced to create a mixture, which is piped down centrally to the feed pump.
- The mixture is pumped through selection valves to one of four exits on the buoy bottom.
- The lowest section of the buoy, the ballast can, contains the concrete ballast used for maintaining stability of the buoy.
- Feed will comply with EPA Feed Monitoring and Management Guidelines (470 CFR 451.21).
- The fish will initially be fed US sustainably sourced fishmeal and fish oil.





Disease Protocols

Prevention:

- The location, operation, species selection and feed used are all designed to ensure safety and environmental sustainability and optimize fish health.

- Passive and Active Cleaning of the Pens:
    - Passive cleaning by surfacing the pens on a regular basis.
    - Active cleaning by brushing and pressure washing the pens.
    - Regular cleaning intervals will be determined after several weeks/month in the water as each site has unique fouling rates.
    - Cleaning will be documented with before and after photographs from the crew and logs will be kept as well.

Control:

- Any disease issue will be responded to under the guidance of the farm's aquatic veterinary experts, in consultation with the state and federal aquaculture experts.

- Only FDA approved treatments will be used.

- Any dead fish will be removed by the staff, inspected for cause of death, logged and sent to approved landfill for disposal.

Storm Events

- Emergency Disaster Plan will be implemented, if conditions warrant.
- All net pens will be optimally positioned in the water column to maximize fish health and safety, with a submersible capacity up to 60 feet below the ocean surface.
- The net pens will remain submerged during a storm events.
- Storm energy greatly dissipates as a function of depth - 90% of the wave energy is dissipated at a depth of half of the surface wave's length.
- The moorings of the StormSafe net pens have been modeled by ocean engineering experts at the University of New Hampshire. Based upon careful study, the net pens are expected not to suffer any damage in major storms.
- The farm will use a 360° pan and tilt camera and underwater drones to inspect each anchor location regularly and always intensely after a major storm event. Also a regular, periodic video inspection of the grid system and pens will be conducted and logged.

Details

Protection from Public:

- The system can be submerged to approximately 40-60 feet or more. This will deter potential trespassers.

- Security equipment will transmit video, sonar and radar data 24/7 from site to shore. Other confidential security measures planned.

Escaped Fish:

- Fish do not generally escape these submersible pens, and if they do, escaped fish typically stay near. Steelhead trout will be sterile and are not expected to reproduce or survive outside the net pen.

- Running inventory of biomass will be kept via:
  - Stocking counts
  - Mortality counts
  - Harvest counts

Baseline Environmental Survey

- BES to consist in part of:
  - Sea floor survey to ensure site is clear of benthic and subsurface features
  - Hydrological measurements to model the directionality of water quality impacts and organic deposition on seabed
    - Based on guidance from Price and Morris 2013 (NOAA Technical Memo)
    - Parameters to monitor will include nitrogen, phosphorus, dissolved oxygen, temperature, salinity, turbidity, and heavy metals
- Designed to allow for robust comparison of before, during, and after fish farm establishment
- Transparency to be accomplished by posting data to website for public to access

Siting Analysis

NCCOS | NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

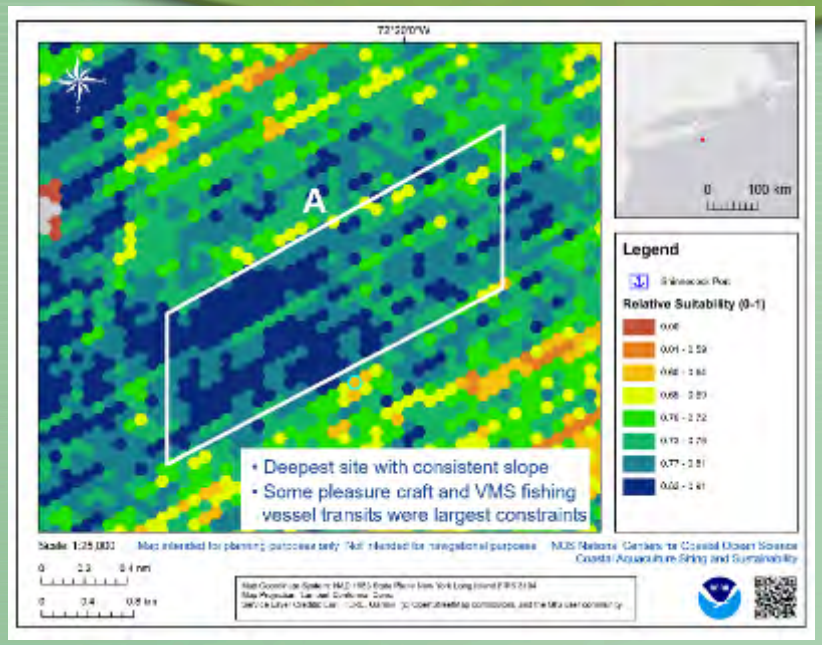
1305 East West Hwy, Rm 8110
Silver Spring, Maryland 20910
240.533.0300 | coastalscience.noaa.gov
@noaacoastalsci

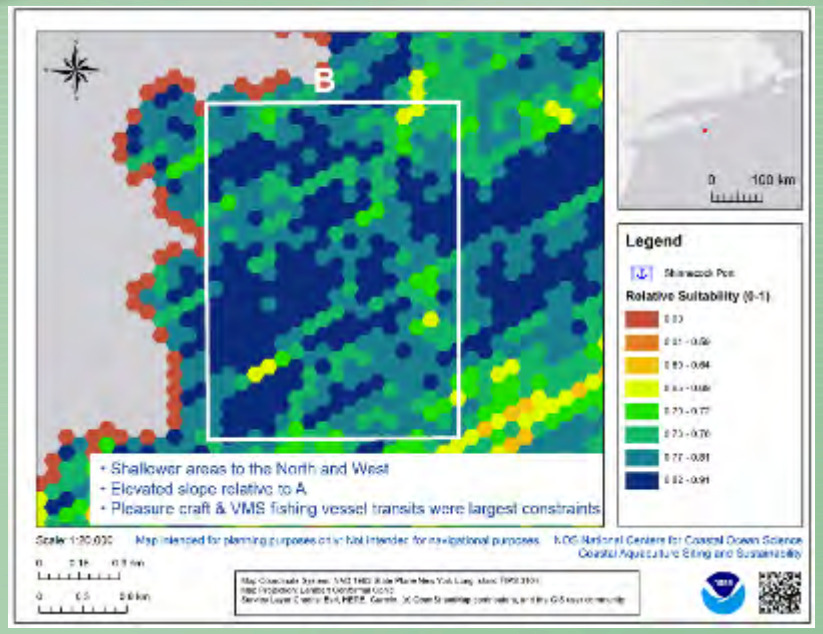
Siting Analysis for Manna Fish Farms, New York

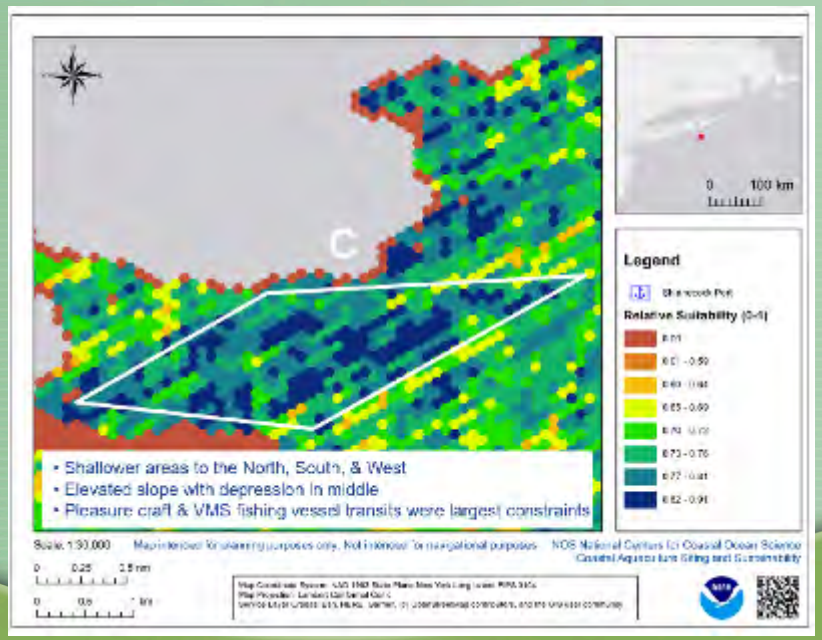
Revised Report, July 2020

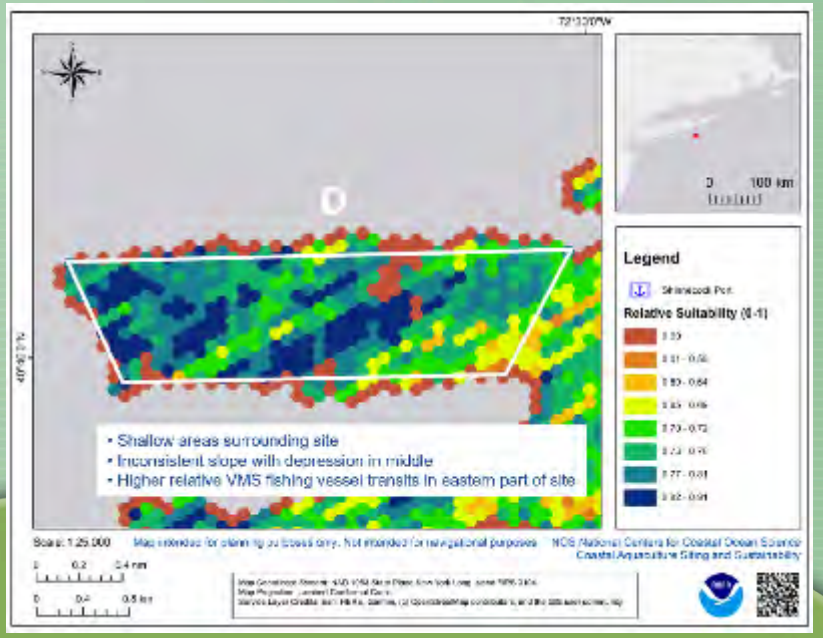
Lisa C. Wickliffe, Ph.D. [1], Jonathan A. Jossart, M.S.[1], Kenneth L. Riley, Ph.D. [2], and James A. Morris, Jr., Ph.D.[2]
[1]CSS, Inc. for NOAA NOS/NCCOS, Beaufort, NC
[2]NOAA NCCOS, Beaufort, NC

Site A Preferred









Next Steps

- Baseline Environmental Survey of Site A (***pending no agency objection***)
- Submit applications
- Continued stakeholder engagement

Thank You!

MANNA FISH FARMS
RESPONSIBLY RAISED AQUACULTURE

Donna Lanzetta, CEO
Manna Fish Farms, Inc.
22 Inlet Road West
Hampton Bays, New York 11946
631.653.9100

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Manna Fish Farm NY Site Suitability Analysis

Lisa C. Wickliffe[1], Jonathan A. Jossart[1], and James A. Morris, Jr.[2]

[1]CSS under contract to NOAA NOS NCCOS
[2]NOAA National Centers for Coastal Ocean Science

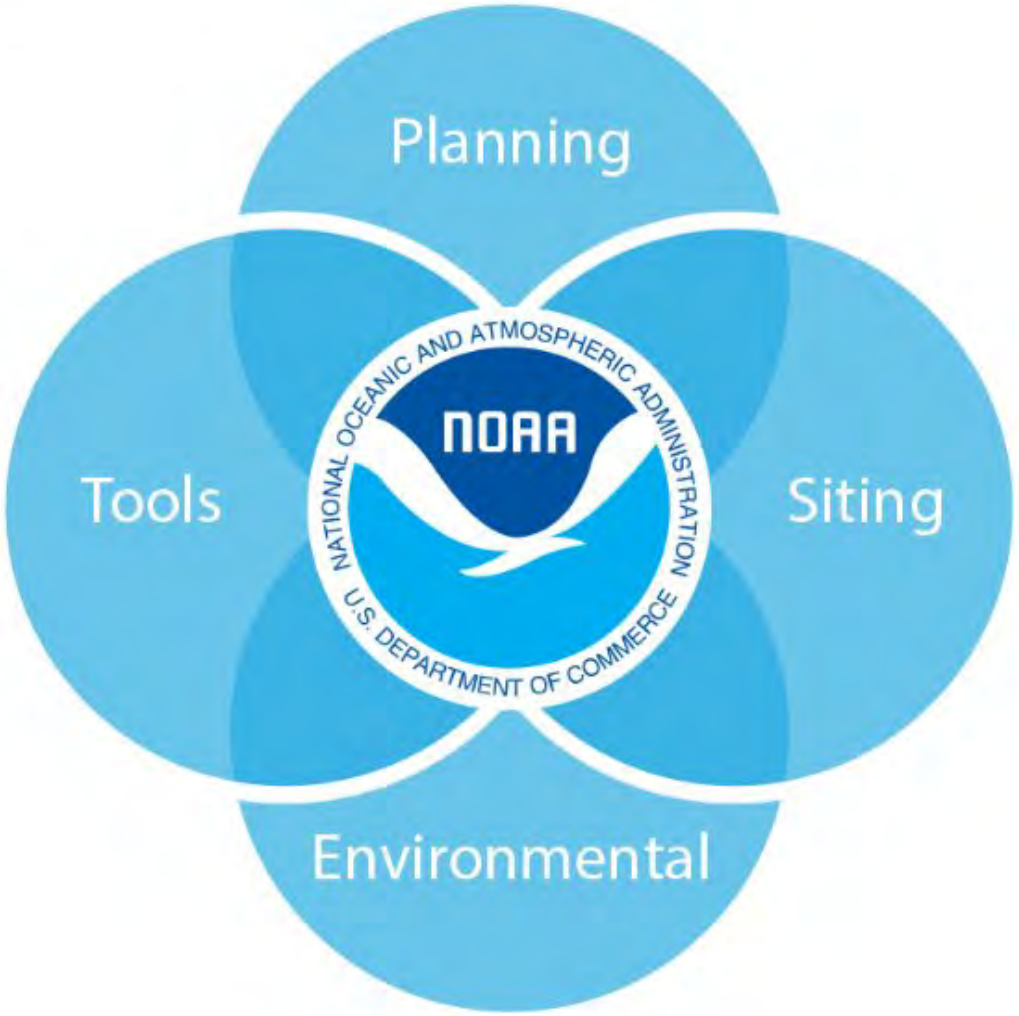
MANNA FISH FARMS, INC.

50 Years of Science, Service, and Stewardship

SCIENCE SERVING COASTAL COMMUNITIES

The NOS AquaPortfolio

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE



NCCOS | NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Permitting Services Portfolio

We have developed a blended research and services portfolio. Services inform science needs. Science improves the service and value.

Types of services

Spatial planning
Environmental modeling
Engineering review
Environmental science advice

Customers - All federal and state agencies involved

US Army Corps of Engineers®

MANNA Fish Farm Requirements

Max distance from port(s): ≤ 12 nautical miles from shore

Depth requirements: ~38 – 50 m (Cage at surface unless during storm event)

Ideal substrate: Mud, sand, or mixed sediment

Seawater temperature: ~10 °C – 25 °C (ideal: Striped Bass = 20 °C; Steelhead Trout = 16 °C)

Current velocity: <=0.5 m/s is optimal, <=0.8 m/s is suitable

Significant Wave Height: ≤ 3 m on average (cages may be sunk in extreme weather)

Max farm footprint (including anchorage): 3.88 km² (1.5 mi²)

Moorings: 4 ton concrete dead weight anchors and embedment anchors for more stability

Cage Type: Stormsafe Cage Design (Mike Meeker) (Surface Net Pen)

Atlantic Striped Bass

Photo: https://www.fishwatch.gov/profiles/atlantic-striped-bass

Steelhead Trout

Photo: Ken Hammond, USDA http://www.nmfs.noaa.gov/pr/species/fish/steelhead-trout.html

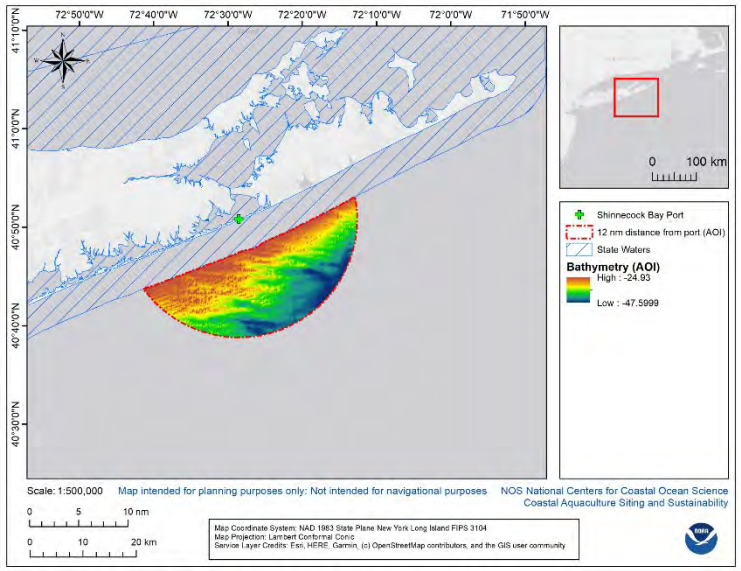
Black Sea Bass

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

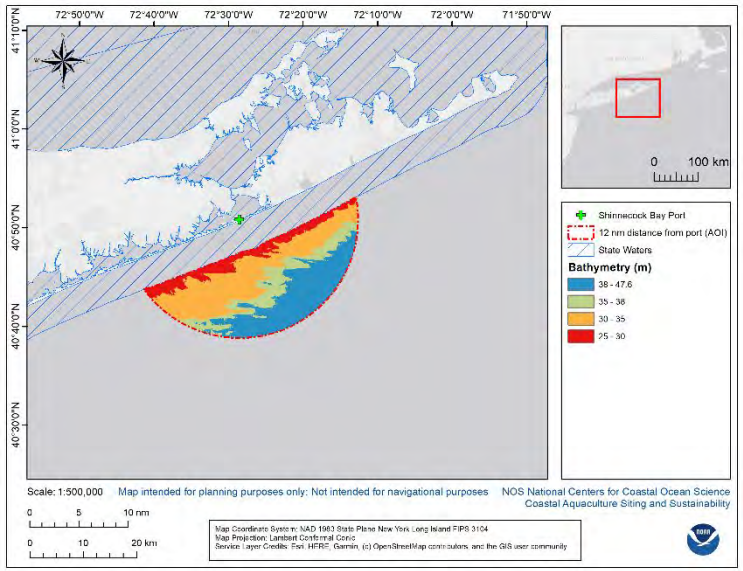
Defining the Study Area:

Bathymetry at 10m resolution used to Refine Study Area

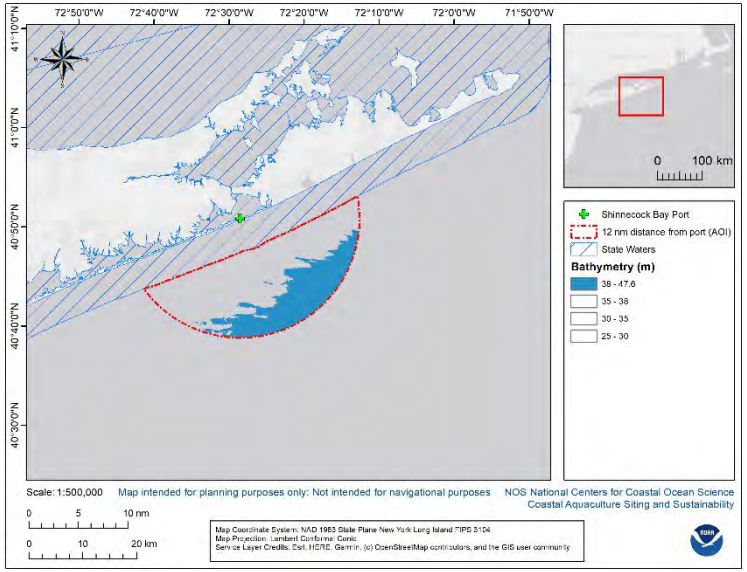
Bathymetry (AOI)



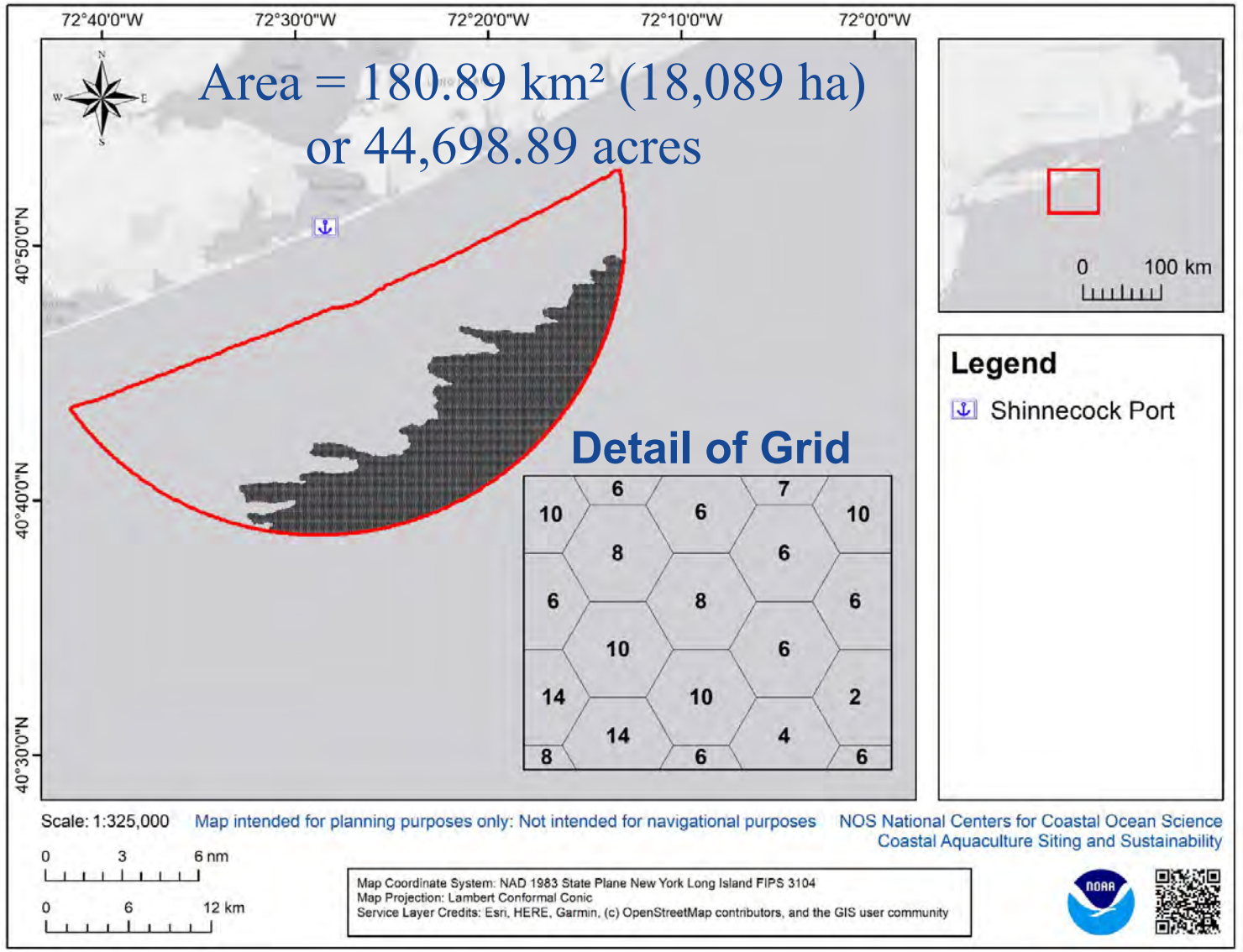
Classified



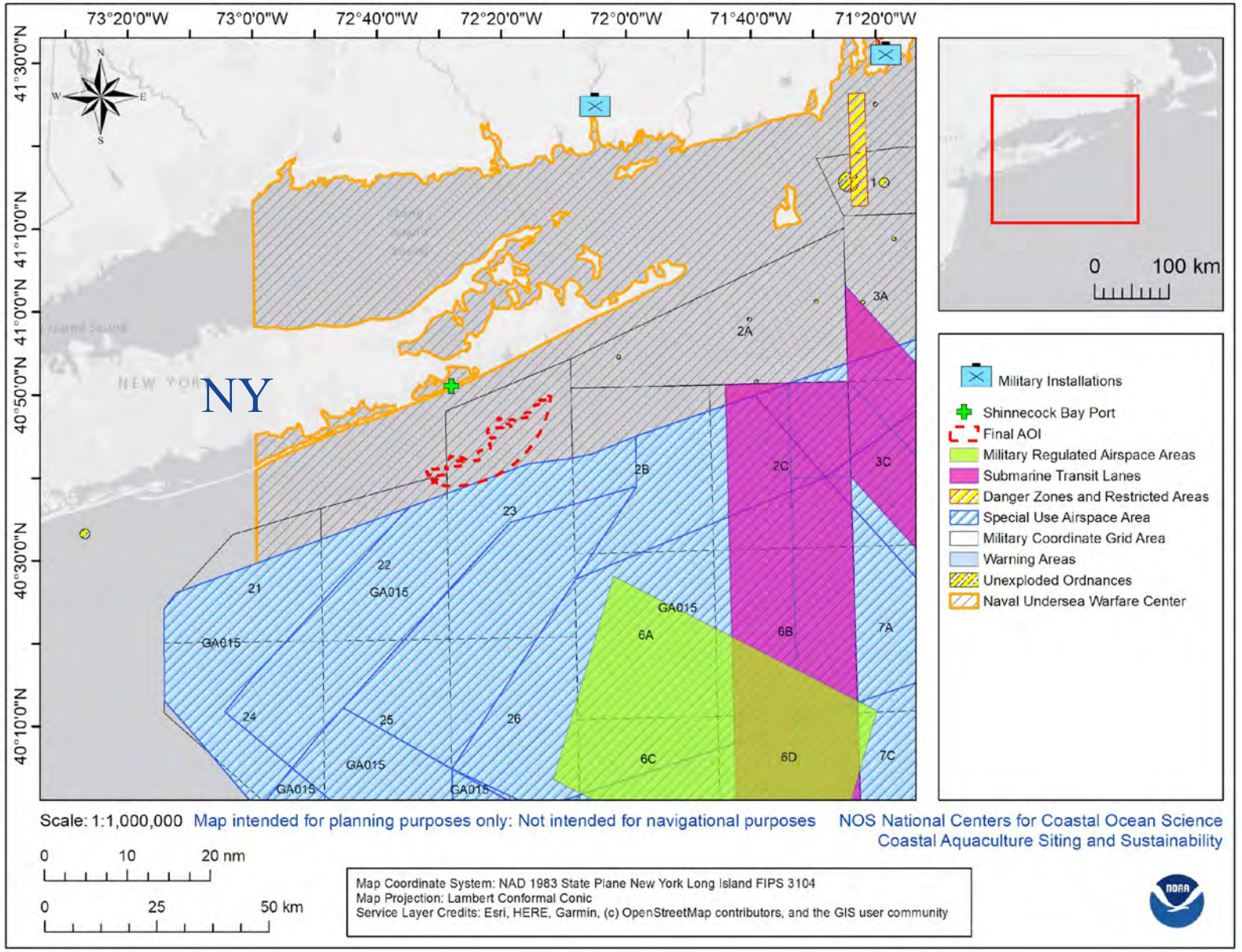
Usable depth for project



Defining the Study Area: 1 ha Hexagonal Grid Created

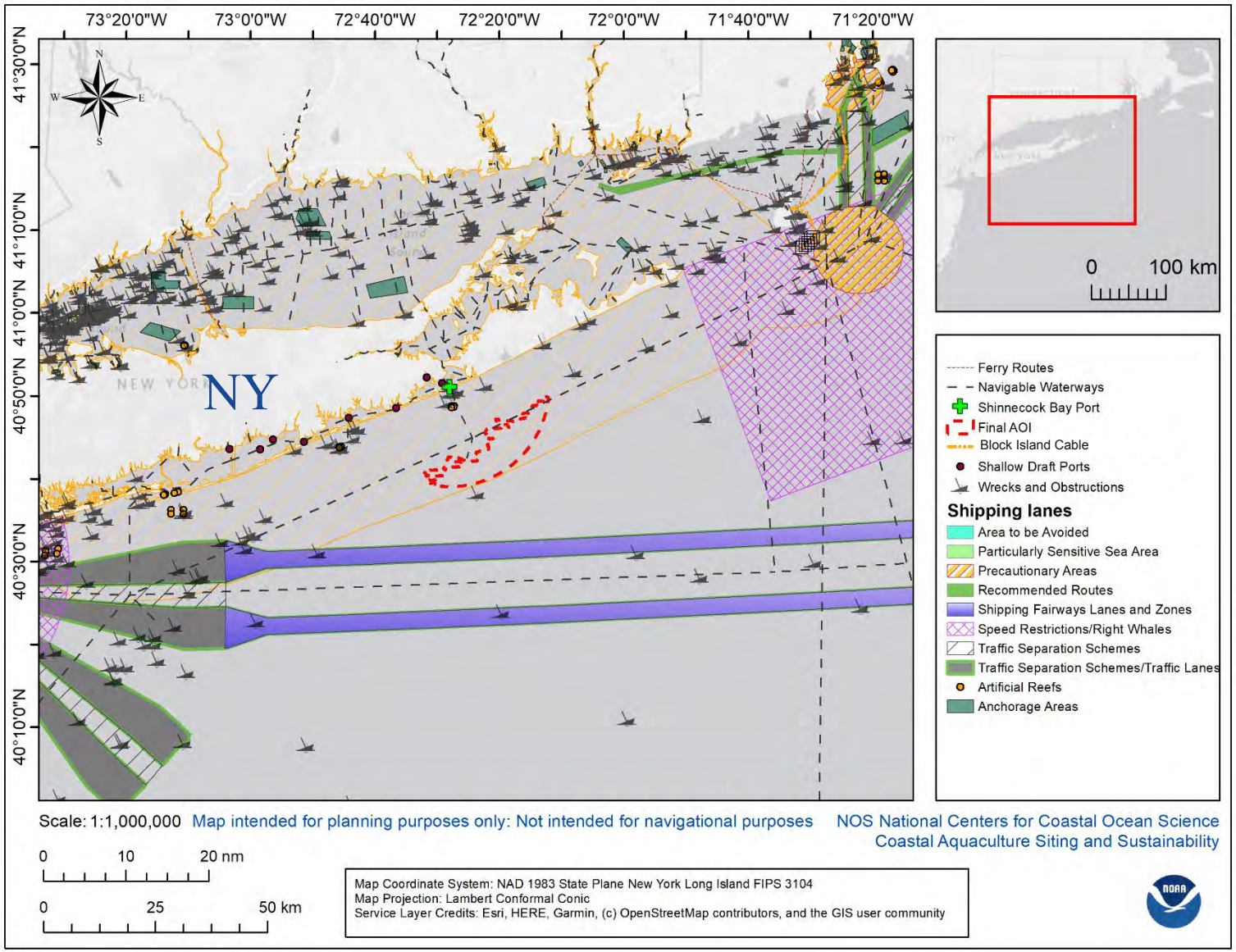


Examples of the Ocean Neighborhood: National Security Considerations



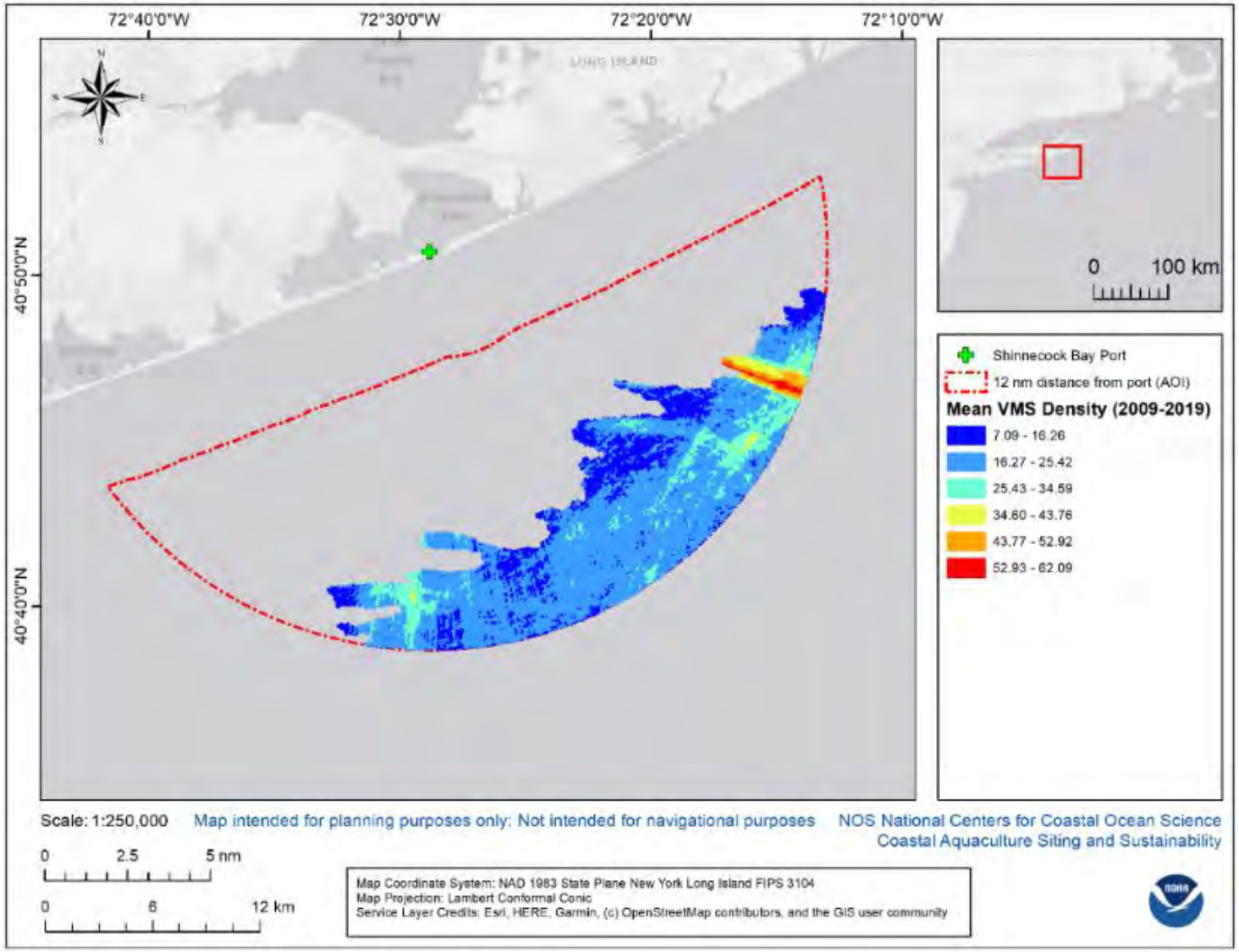
AOI intersects Narragansett OPAREA 23 and 22, NUWC, and no intersect with SUAS or Warning Areas

Ocean Neighborhood: Transportation Infrastructure



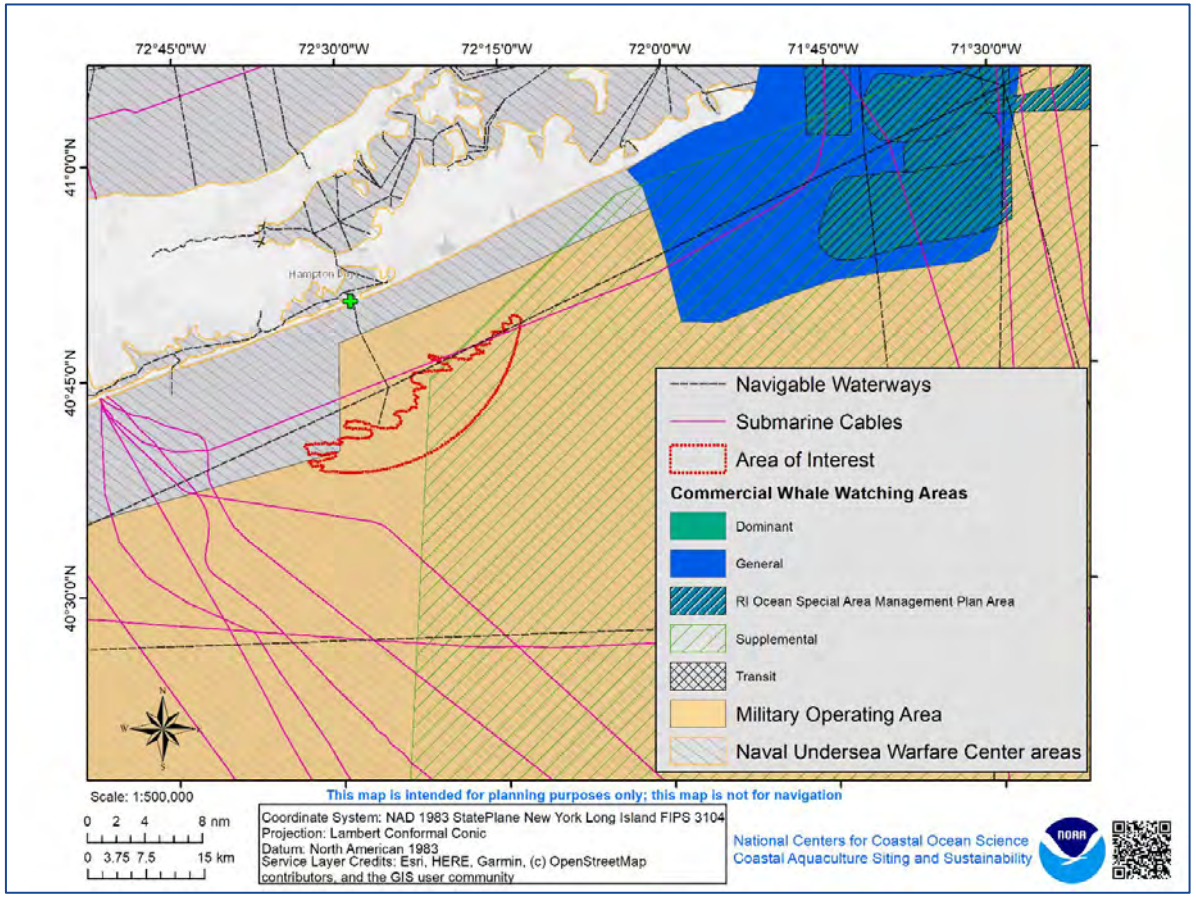
AOI intersects
Safety
Regulated
Areas

Fishing Industry (VMS 11-yr avg)



Data Layers in Suitability Model

Discrete data with interaction & in model

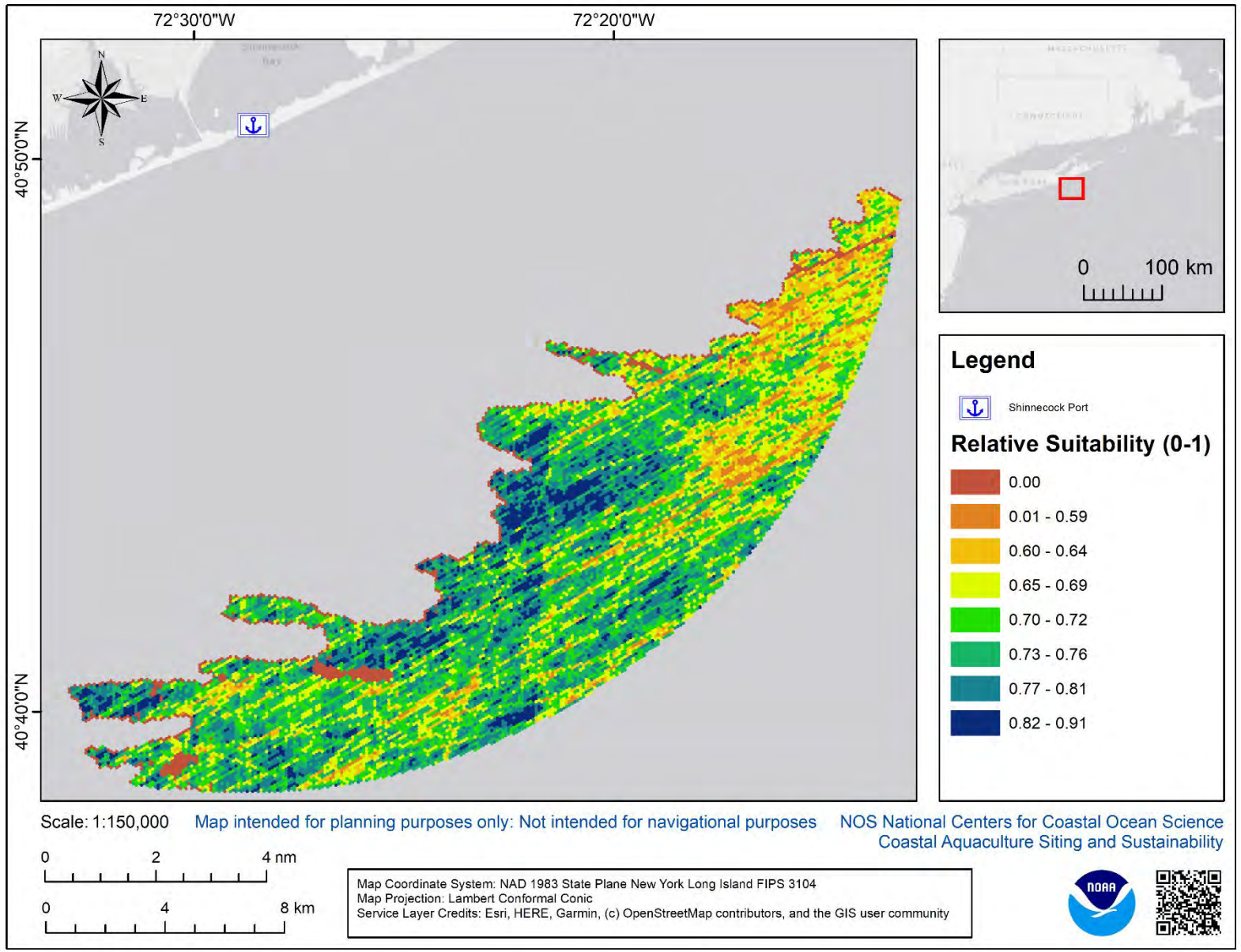


Continuous data in model

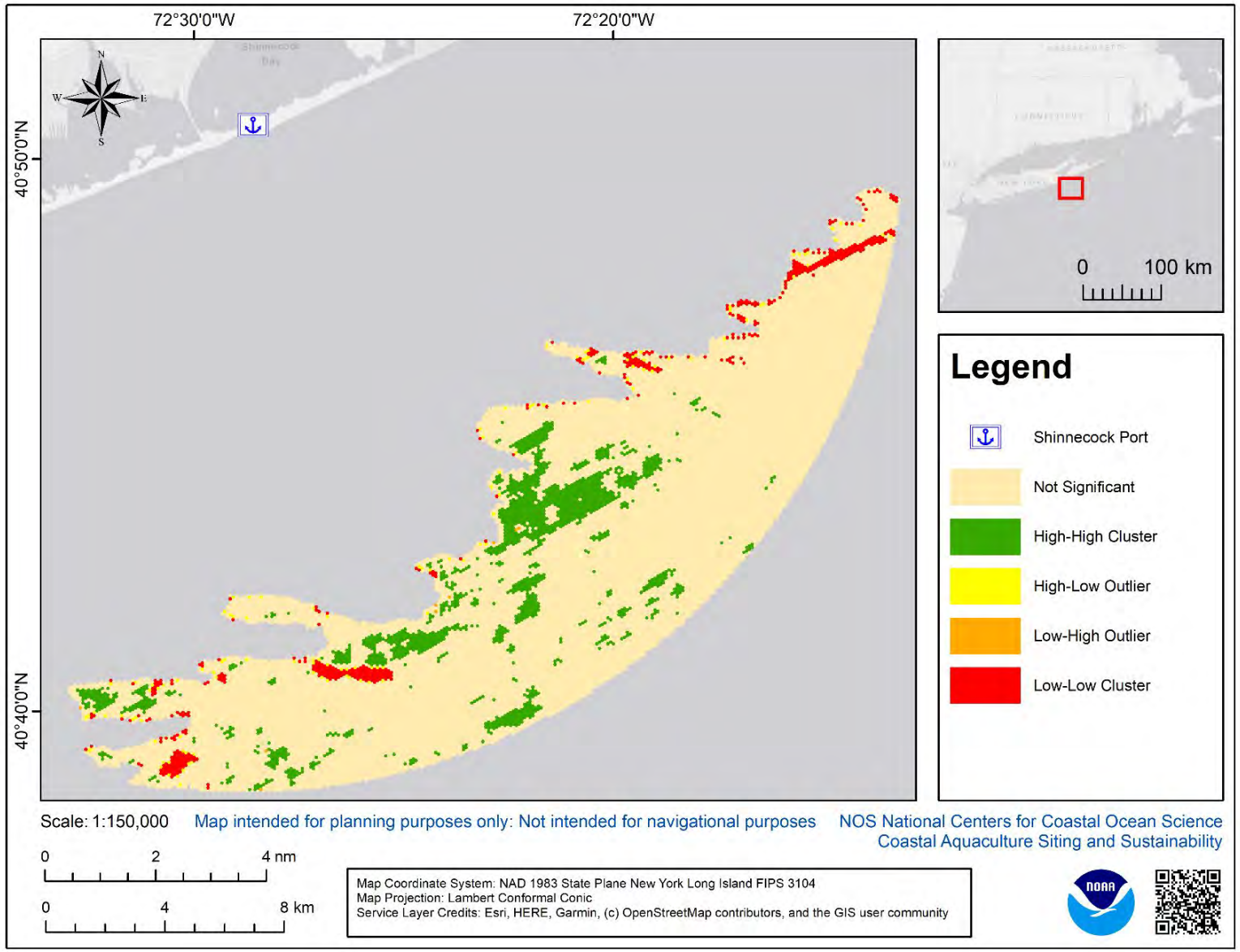
- AIS Vessel Transits
- VMS Fishing data
- Bathymetry
- Slope
- Sediment Grain Size

* Discrete data layers not included in the suitability analysis were for a multitude of reasons; e.g., they layer did not overlap or intersect the AOI, the layer did not have spatial or temporal coverage at a resolution appropriate for precision-siting, or because the nature of the interaction with aquaculture operations is not yet fully known – for instance certain fisheries management areas. **Over 300 data layers were assessed in total and can be viewed in Table A-1.

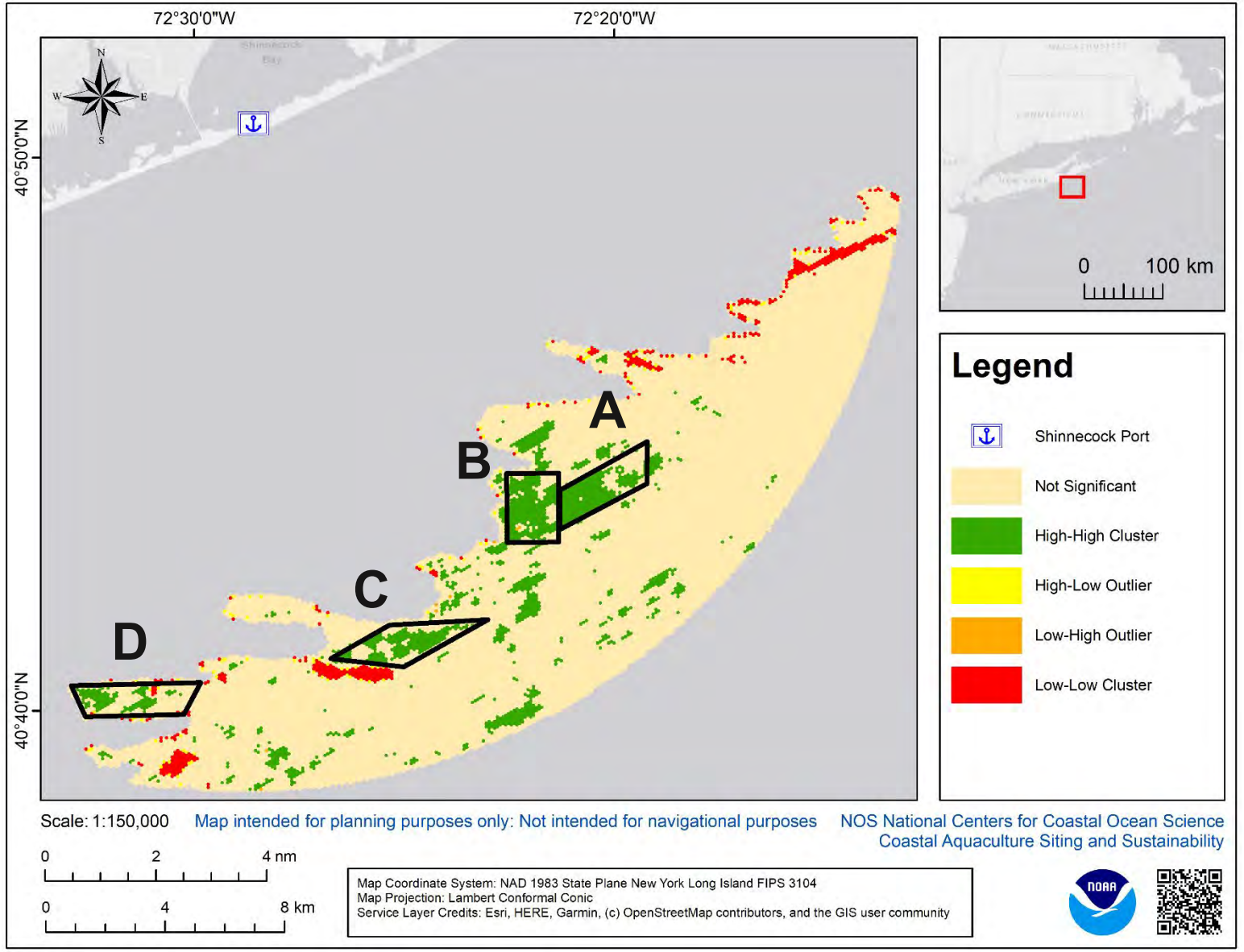
Final Results - Relative Suitability



Final Suitability – Cluster Analysis



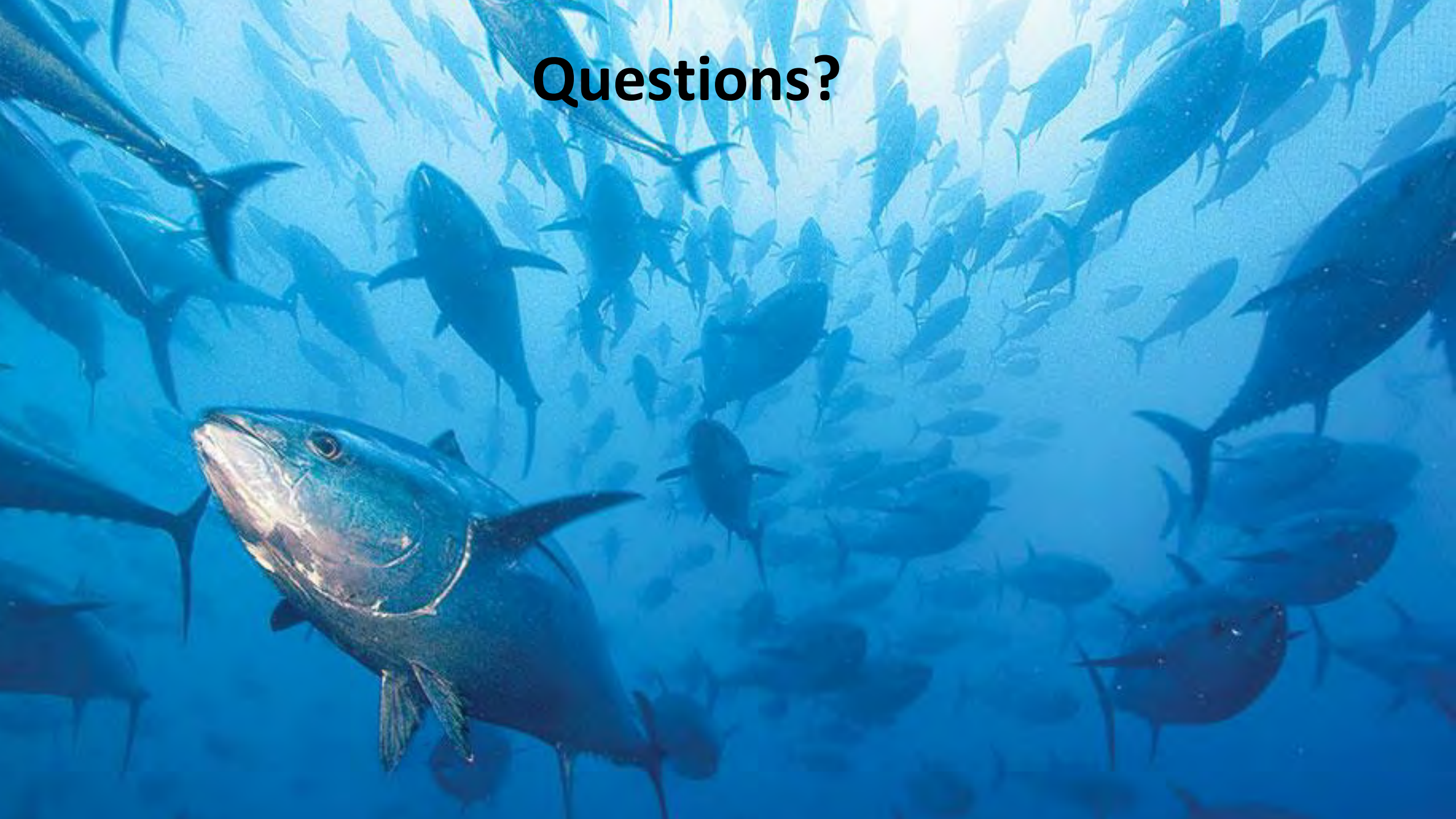
Final Suitability – Cluster Analysis



Alternative Site Comparison

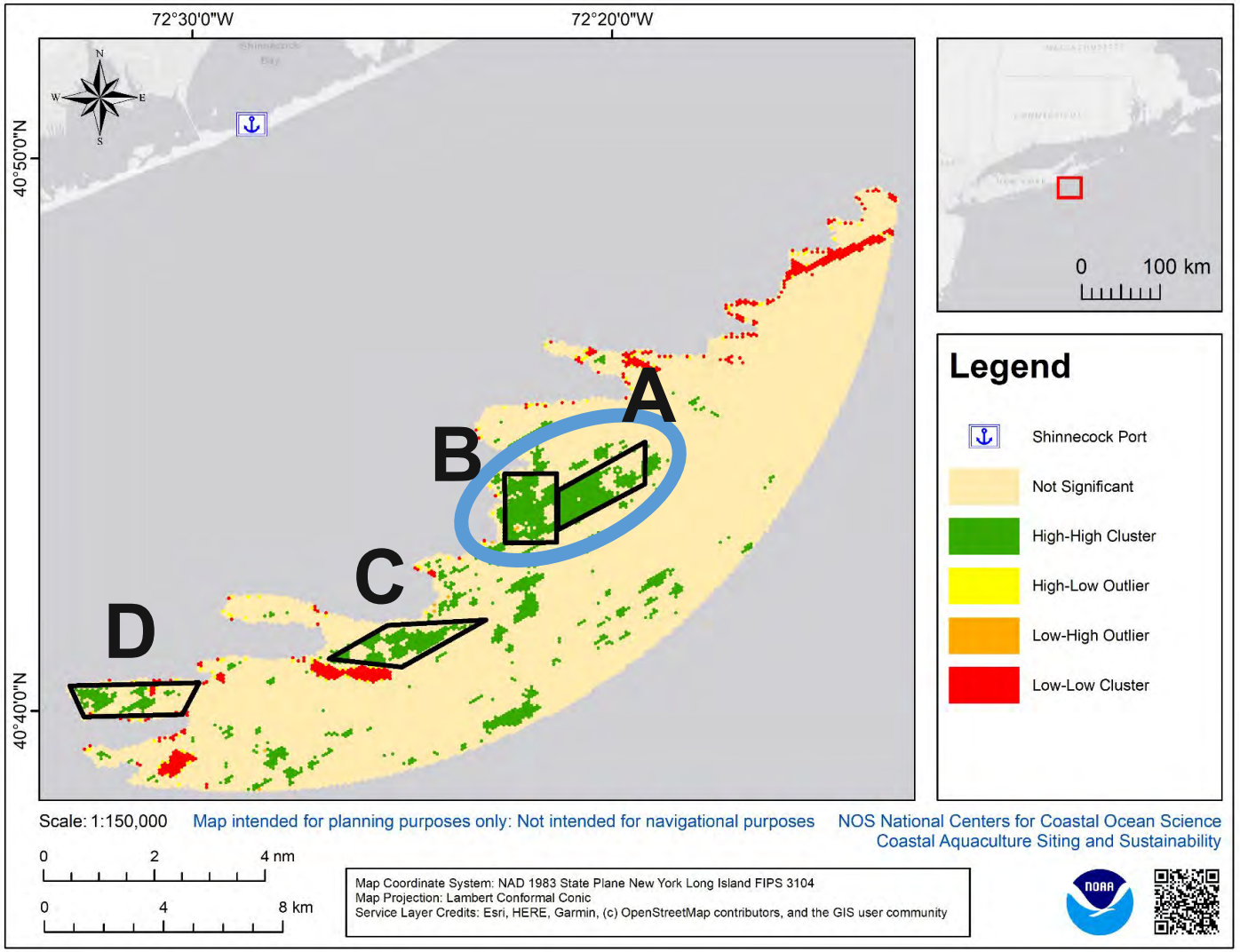
Parameter	Area A	Area B	Area C	Area D
Area (Acres) (one farm footprint)	396 ha	399 ha	402 ha	402 ha
Distance from Port (nm)	8.6	7.9	9.4	10.1
Mean Suitability Score (0-1)	0.78	0.79	0.78	0.70
Mean Bathymetry (m)	40.5	38.7	39	38.3
Bathymetry Range (m)	39 - 42	37- 40	37 - 41	37 - 39
Mean Slope (°)	0.08°	0.09°	0.18°	0.17°
Mean Sediment grain size (mm)	0.37	0.35	0.57	0.42
AIS 2017 Cargo Vessels (Total Transits in area 2017)	0	0	0	3
AIS 2017 Tanker Vessels (Total Transits in area 2017)	0	0	1	0
AIS 2017 Tug/Tow Vessels (Total Transits in area 2017)	3	7	2	8
AIS 2017 Pleasure/Sailing Vessels (Total Transits in area 2017)	48	50	54	18
AIS 2017 Passenger Vessels (Total Transits in area 2017)	5	6	3	8
AIS 2017 Other Vessels (Total Transits in area 2017)	34	29	27	23
AIS 2017 Fishing Vessels (Total Transits in area 2017)	43	58	91	80
VMS Traffic (2009-2019 Mean value of all cells in area)	16.63	15.73	17.03	20.84
Military Operating Area	Yes	Yes	Yes	No
Naval Undersea Warfare Area	Yes	Yes	Yes	Yes
Recreational Whale Watching	Yes	Yes	No	No
VTR Bottom Trawl Small 2011-2015 Effort	Low	Low	Low	Med
VTR Bottom Trawl Large 2011-2015 Effort	None	None	Low	Low
VTR Pots and Traps 2011-2015 Effort	None	None	None	None
VTR Longline 2011-2015 Effort	None	None	None	None
VTR Gillnet 2011-2015 Effort	Low	Low	Med	Low
VTR Sea Scallop Dredge 2011-2015 Effort	Med	Med	Low	None

Questions?

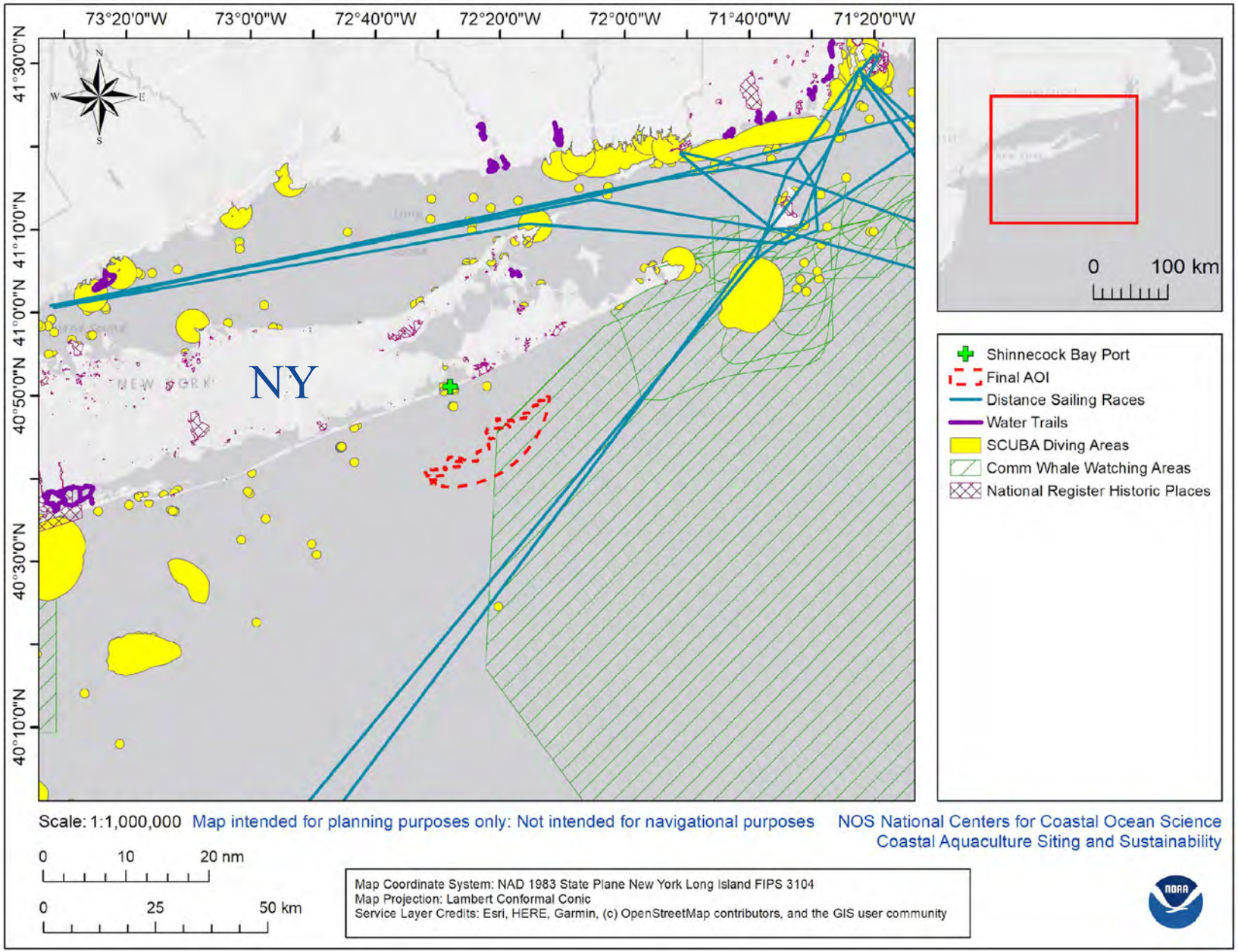


Conclusions

- Overall Site A would be the preferred choice
- Consistent depth and low slope factor
- Relatively low vessel traffic
- Fine tuning in area around Site A and B possible

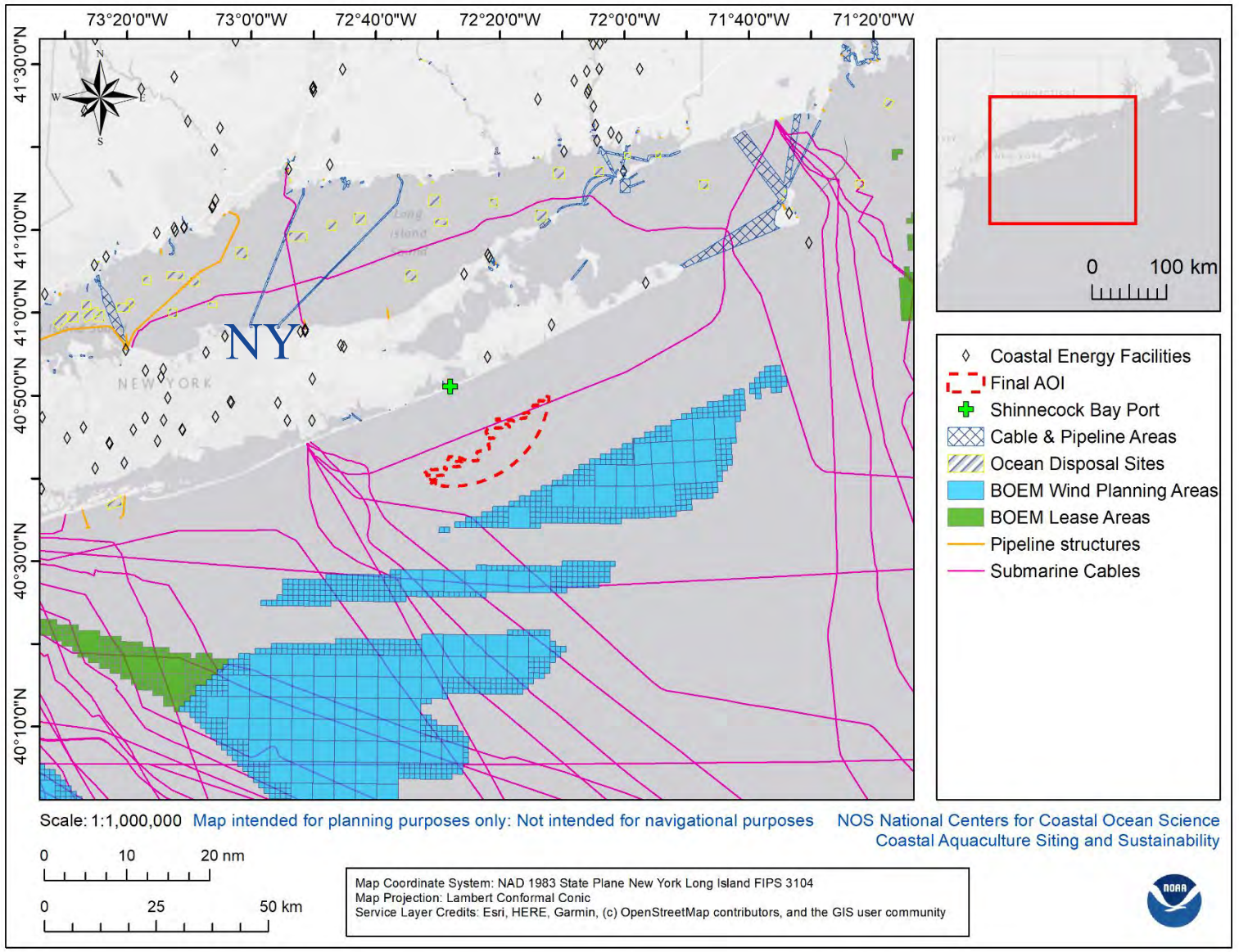


Ocean Neighborhood: Recreation and Culture



- AOI intersects Commercial Whale Watching Area

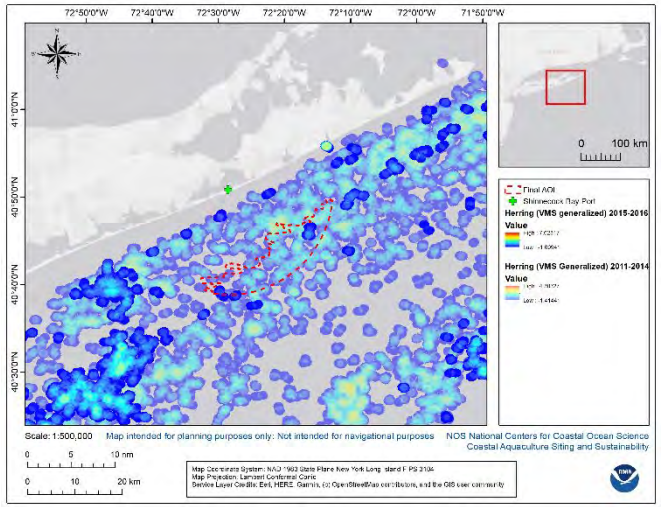
Ocean Neighborhood: Energy and Infrastructure



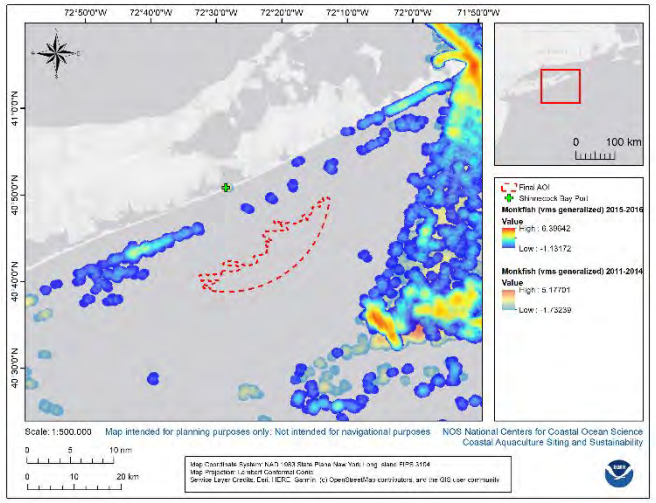
- AOI intersects submarine cable
- OCS-A 0512

Fishing Industry (VMS NROC)

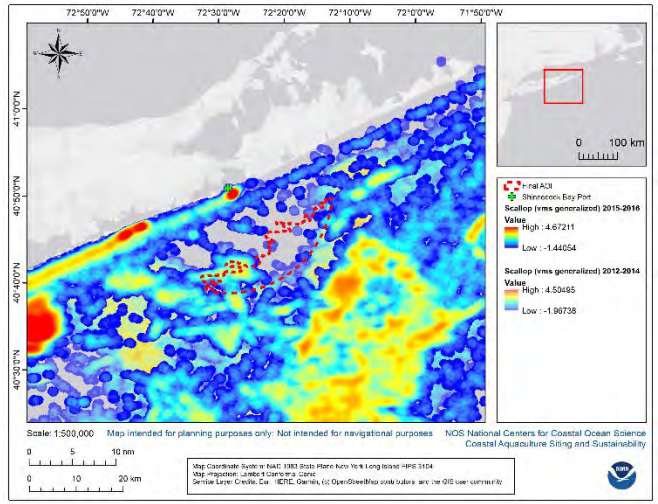
Herring (2011 to 2016)



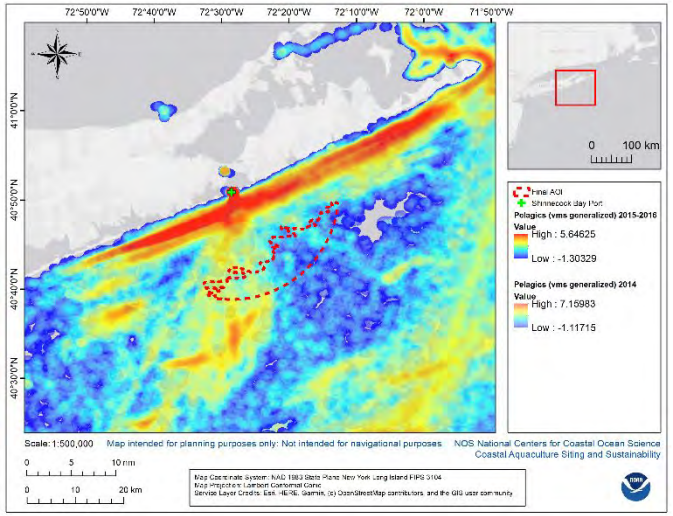
Monkfish (2011 to 2016)



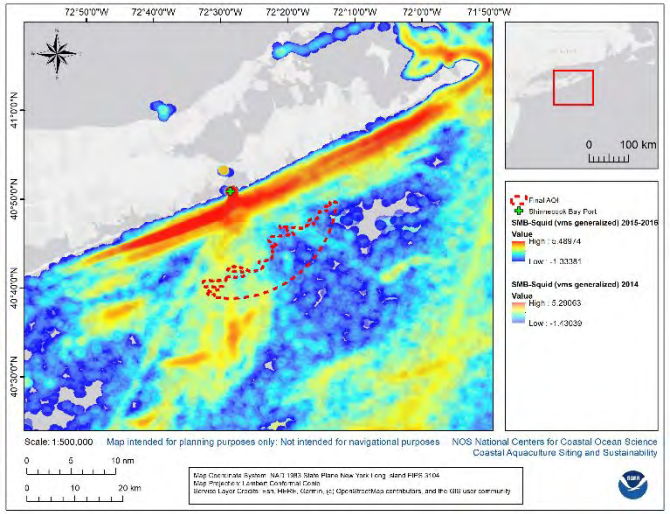
Sea Scallops (2012 to 2016)



Pelagics (2014 to 2016)



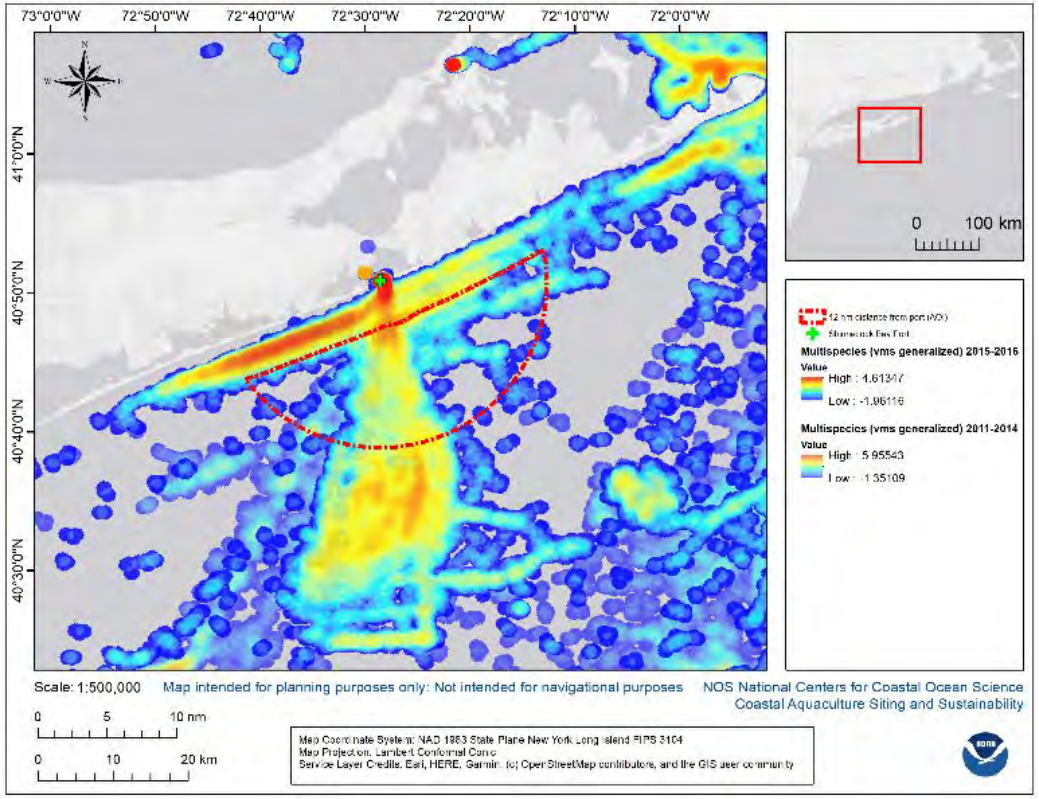
SBM - Squid (2014 to 2016)



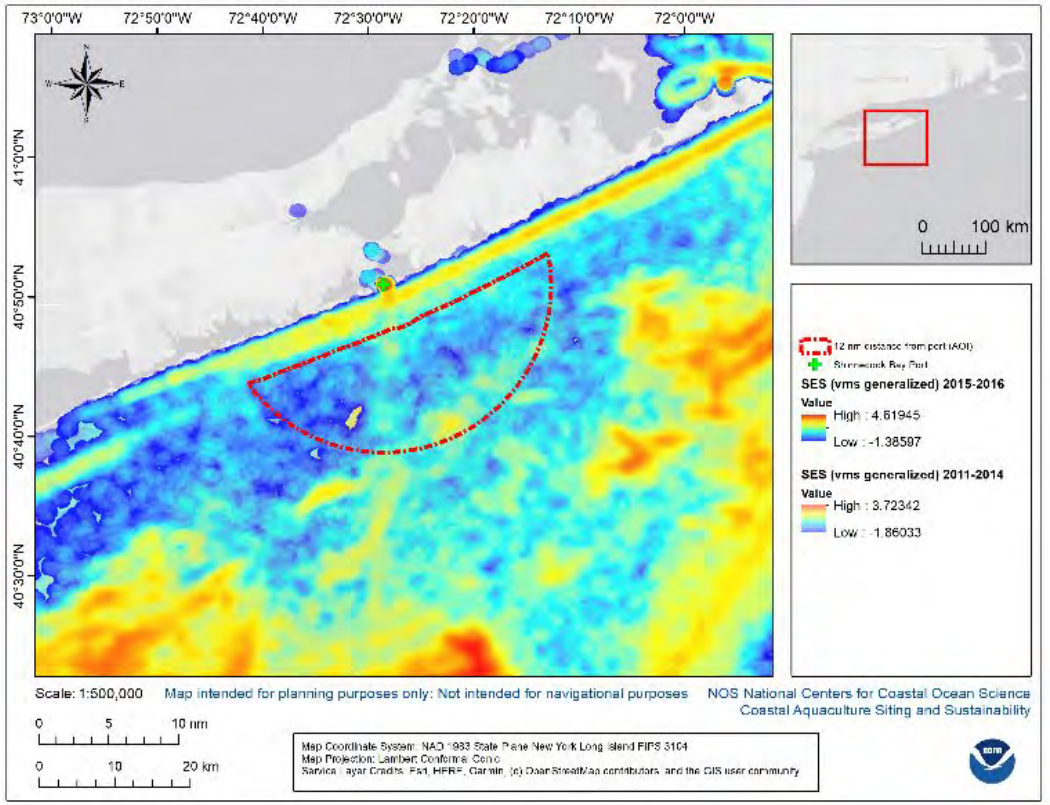
https://www.northeastoceandata.org/files/metadata/Themes/CommercialFishing/VMSCommercialFishingDensity.pdf

Fishing Industry (VMS NROC)

Multispecies Groundfish (2011 to 2016)



Sensitive Ecological Species (2011 to 2016)

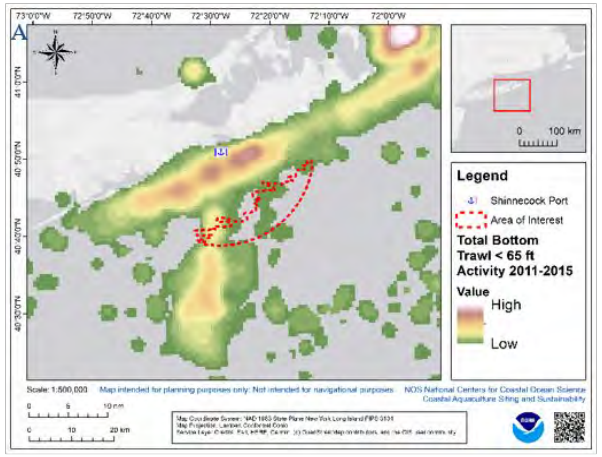


Cumulative spp. profiles

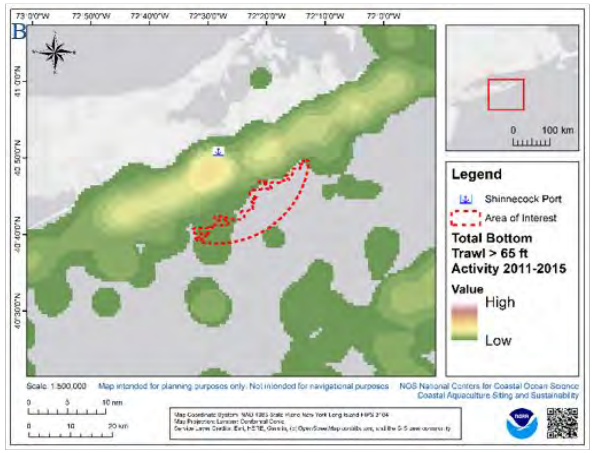
https://www.northeastoceandata.org/files/metadata/Themes/CommercialFishing/VMSCommercialFishingDensity.pdf

Fishing Industry (Comm. at Sea)

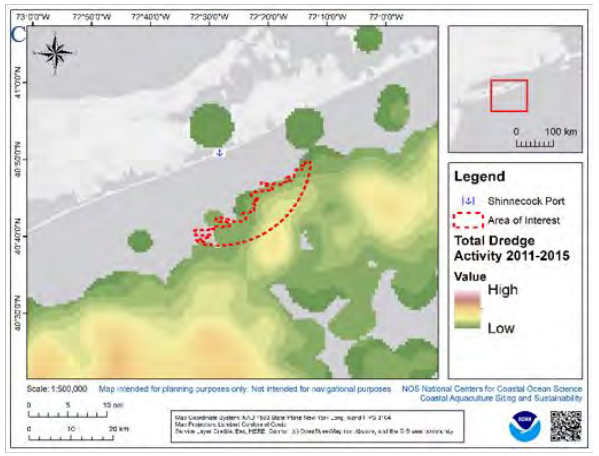
Bottom Trawl (<65 ft) (2011 to 2015)



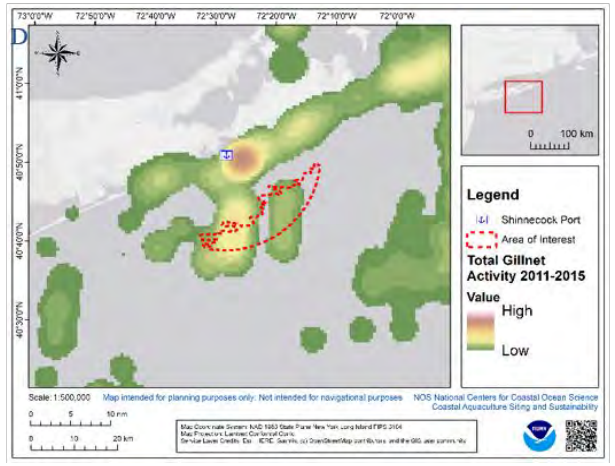
Bottom Trawl (>65 ft) (2011 to 2015)



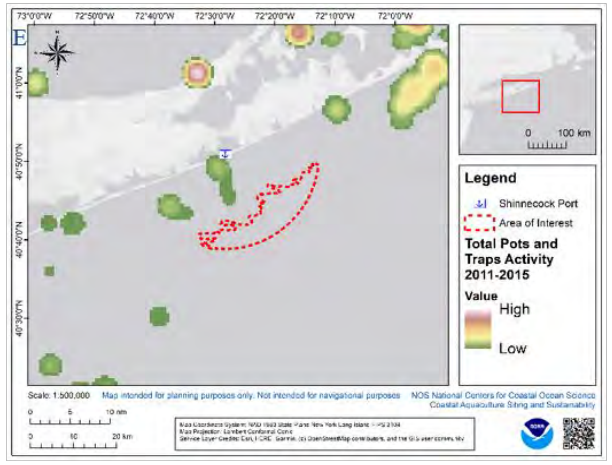
Sea Scallop Dredging (2012 to 2015)



Gillnet (2011 to 2015)

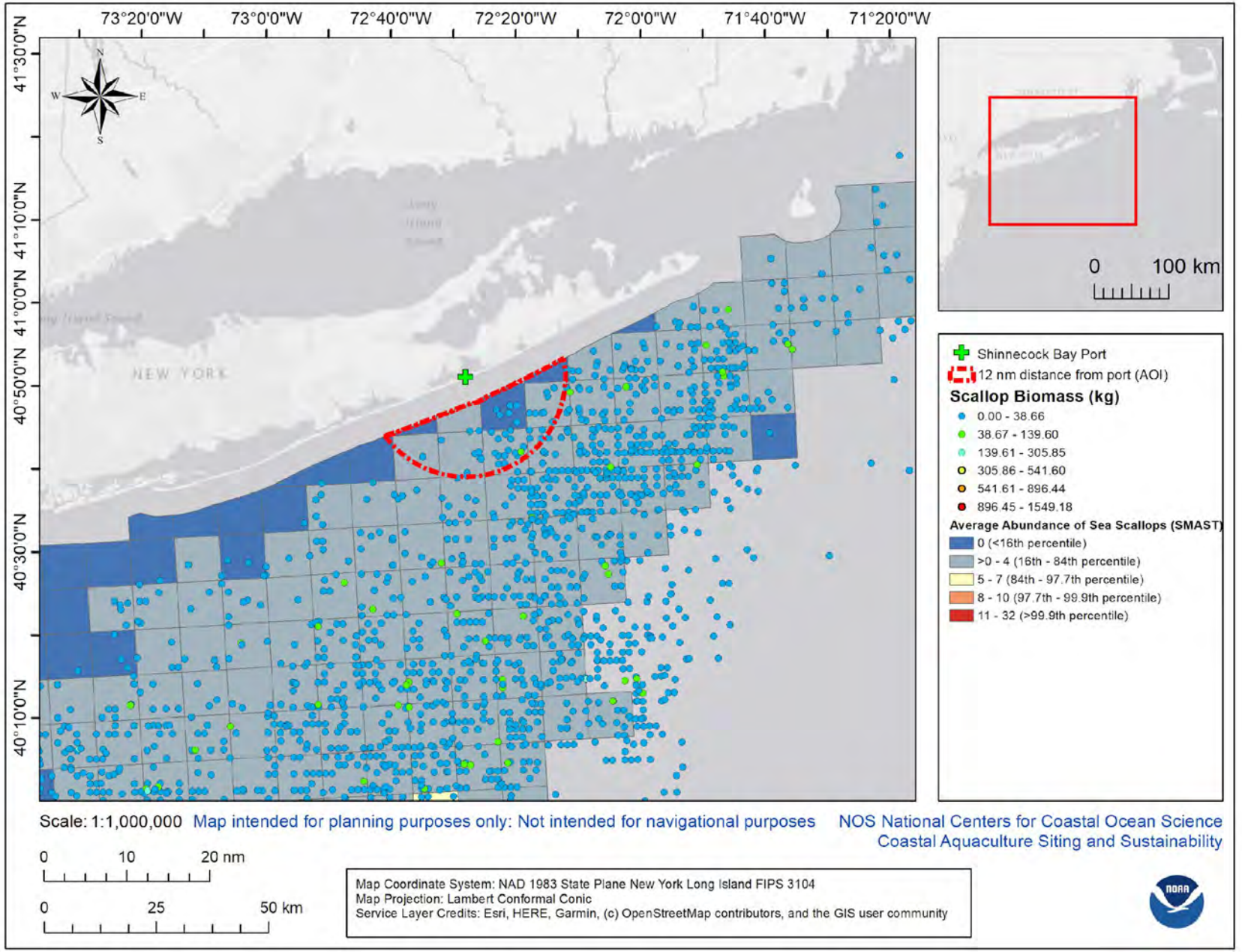


Traps & Pots (2011 to 2015)

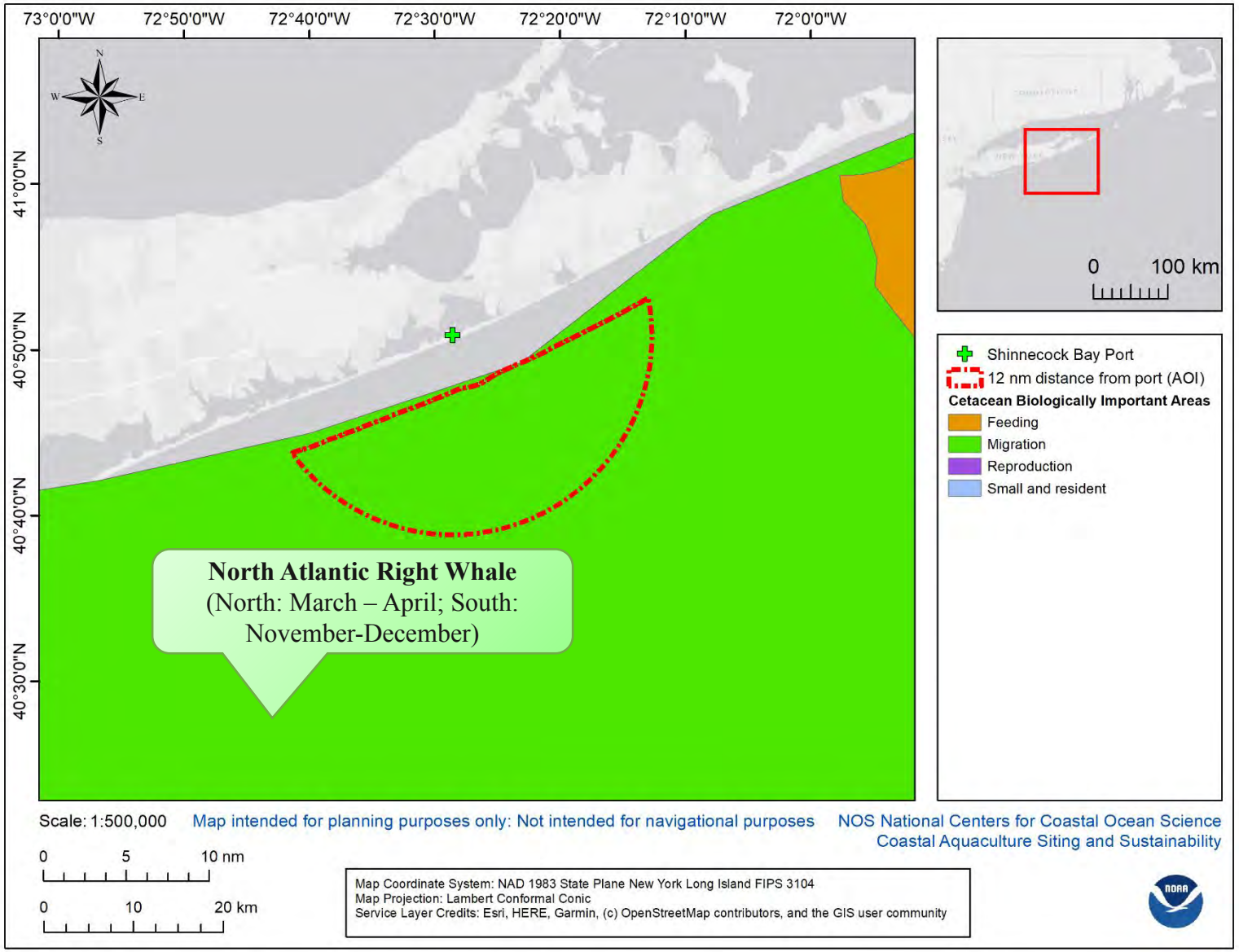


https://www.northeastoceandata.org/files/metadata/Themes/CommercialFishing/VMSCommercialFishingDensity.pdf

Alternative Sites Scallops



Protected Species – Cetacean BIAs



- No critical habitat in the AOI

Protected Species:

Modeled Cetacean density (MDAT: 10x10 km res)

Within AOI

- Low Atlantic Spotted Dolphin abundance
- Low Atlantic White-sided Dolphin abundance
- Low Beaked Whale abundance
- Low Blue Whale abundance
- Low Clymene Dolphin abundance
- Low False Killer Whale abundance
- Low Fin Whale abundance
- Low Fraser's Dolphin abundance
- Low Harbor Porpoise abundance
- Low Humpback Whale abundance
- Low Killer Whale abundance
- Low Kogia Whale abundance
- Low Melon-headed Whale abundance
- Low Minke Whale abundance
- Low North Atlantic Right Whale abundance (summer and winter months)
- Low Northern Bottlenose Whale abundance
- Low Pantropical Spotted Dolphin abundance
- Low Pilot Whale abundance
- Low Risso's Dolphin abundance (diet: squid)
- Low Rough-toothed Dolphin abundance
- Low Sei Whale abundance (spring/summer)
- Low Short-beaked Common Dolphin abundance
- Low Sperm Whale abundance
- Low Spinner Dolphin abundance
- Low Striped Dolphin abundance
- Low White Beaked Dolphin abundance

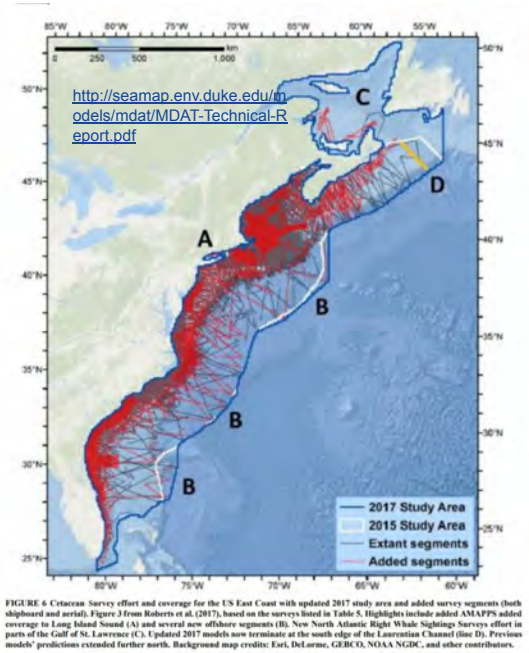


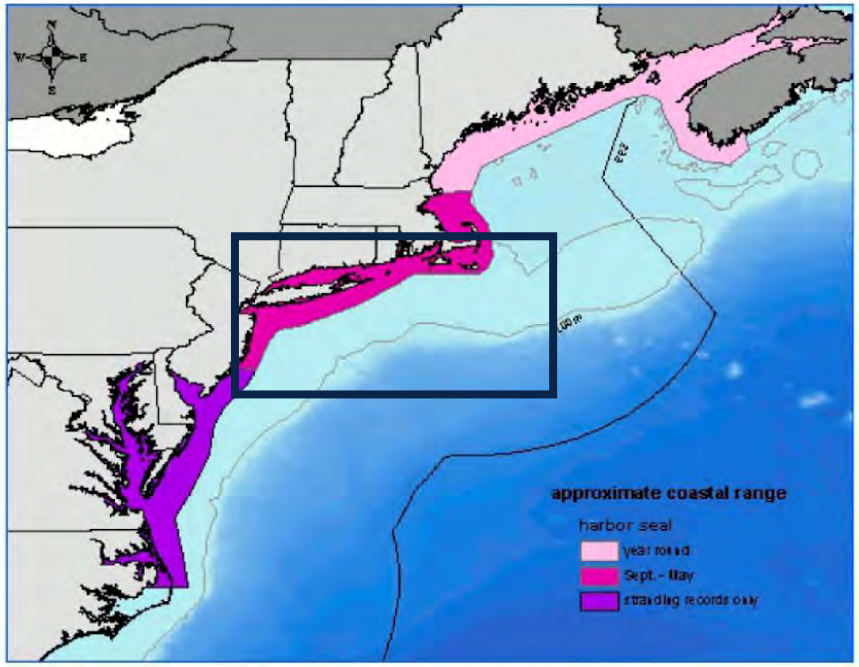
FIGURE 6 Cetacean Survey effort and coverage for the US East Coast with updated 2017 study area and added survey segments (both shipboard and aerial). Figure 3 from Roberts et al. (2017), based on the surveys listed in Table 5. Highlights include added AMAPPS added coverage to Long Island Sound (A) and several new offshore segments (B). New North Atlantic Right Whale Sightings Surveys effort in parts of the Gulf of St. Lawrence (C). Updated 2017 models now terminate at the south edge of the Laurentian Channel (line D). Previous models' predictions extended further north. Background map credits: Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors.

Here, we only assess overlap with protected species. It is up to the action agency to determine if a project needs ESA consultation. If the action agency (e.g., NMFS) determines that there is "no effect" to listed species or critical habitat, a consultation may not be required. If there may be an effect, consultation is required and an effects determination is then submitted[1].

[1] https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-no-effect-determinations-greater-atlantic-region

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Protected Species Considerations: Pinnipeds



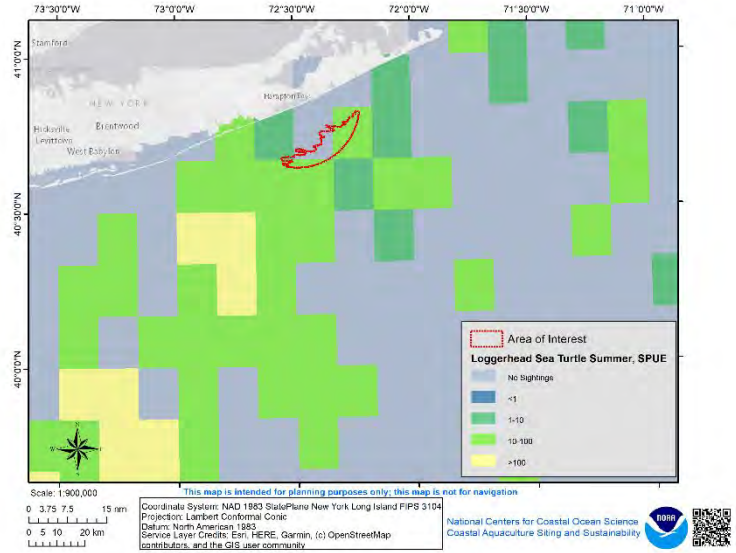
Harbor Seal | Gray Seal

https://www.nefsc.noaa.gov/ecosys/ecosystem-ecology/pinnipeds.html

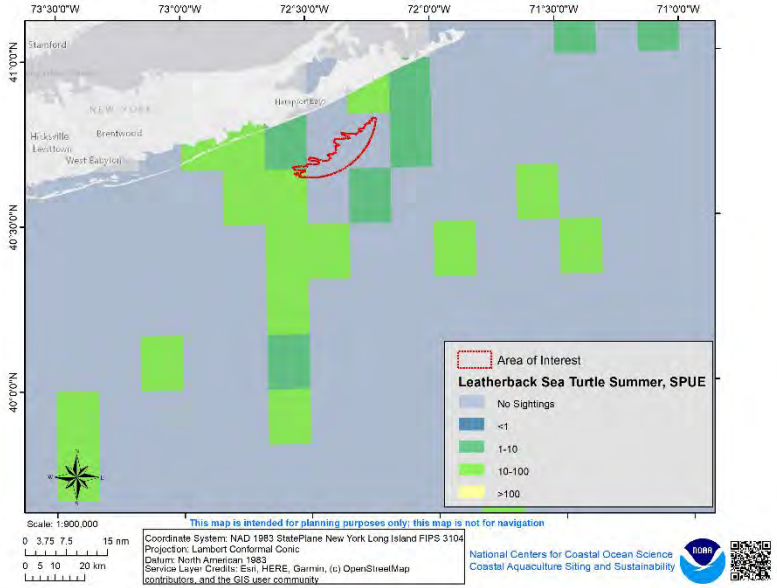
Protected Species Considerations: Sea Turtles



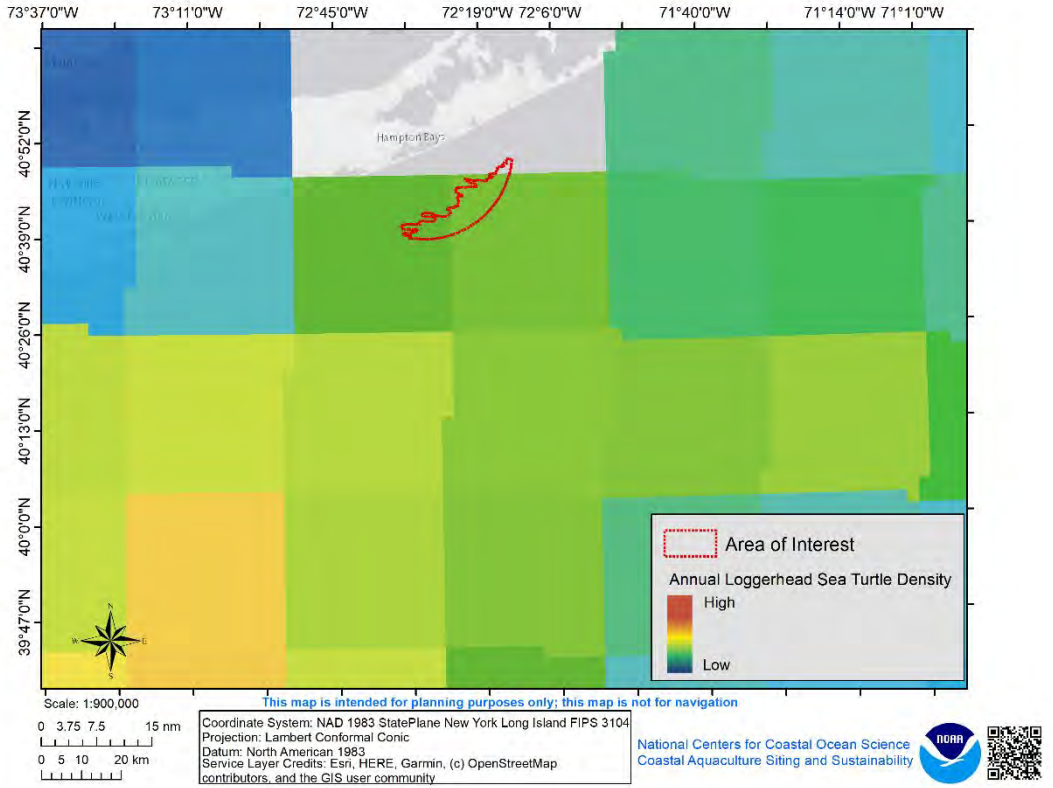

Loggerhead Sea Turtle



Leatherback Sea Turtle



Loggerhead Sea Turtle



NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Protected Species: Section 7 Consultation Areas in AOI

Section 7 Areas	Manna AOI
Atlantic Large Whales	
North Atlantic Right Whale	Yes
Fin Whale	Yes
Sei Whale	No
Sperm Whale	No
Blue Whale	No
Sea Turtles	
Green Sea Turtle	Yes
Loggerhead Sea Turtle	Yes
Kemp's Ridley Sea Turtle	Yes
Leatherback Sea Turtle	Yes
ESA Fisheries Species	
Atlantic Sturgeon	Yes
Shortnose Sturgeon	No
Offshore Atlantic Salmon	No

Habitat – Highly Migratory Species

- Albacore and Bluefin Tuna (juveniles)
- Skipjack (all life stages)
- Thresher shark (all life stages)
- Dusky shark (all life stages)
- Sandbar shark (all life stages)
- White shark (all life stages)
- Smoothhound (all life stages)
- Sand Tiger shark (all life stages)

Essential Fish Habitat

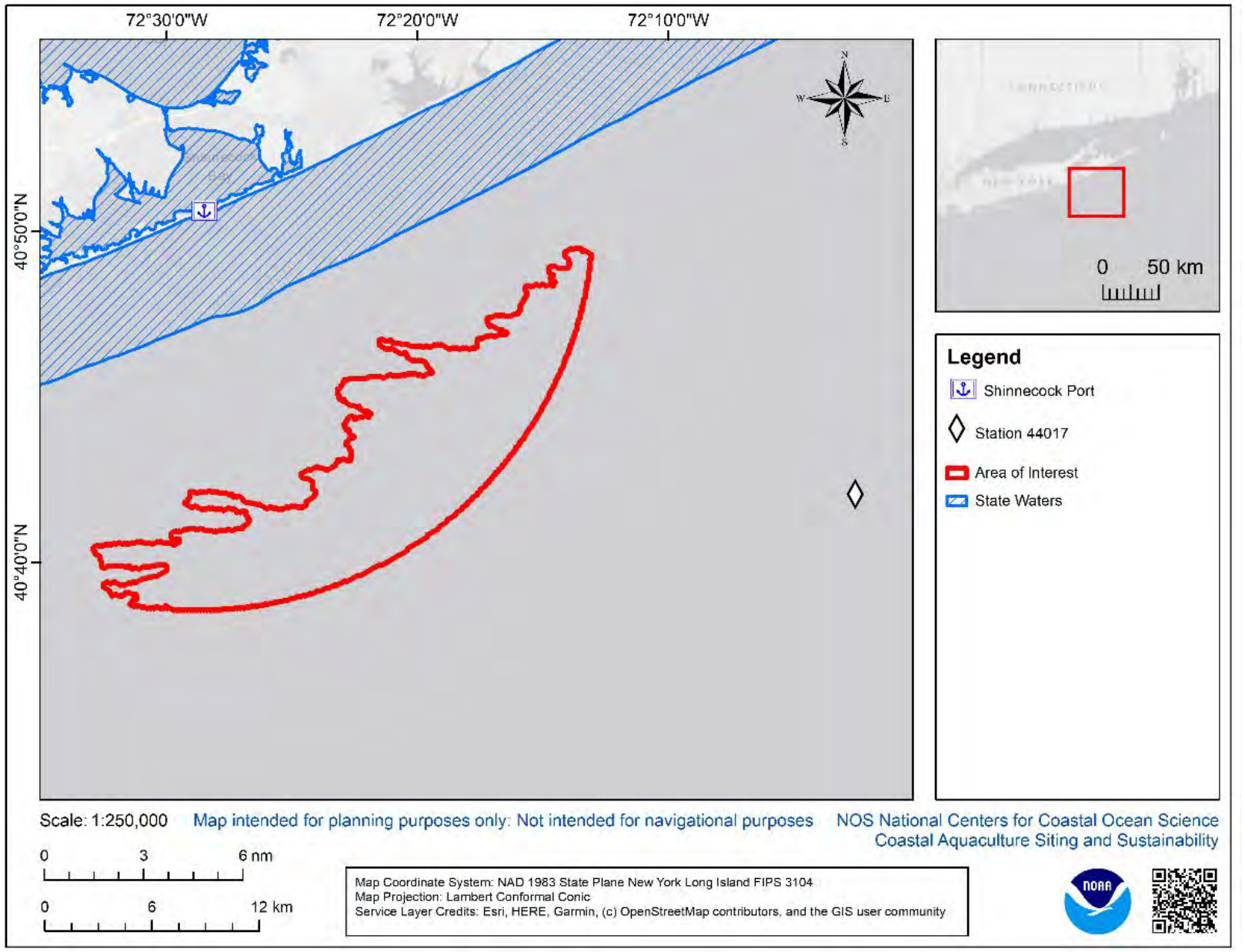
EFH Species in the AOI		
Atlantic Sea Scallop*	Summer Flounder (L, J, A)	Ocean Pout (E, L, A)
Black Sea Bass (J)	Witch Flounder (L)	Quahog (J, A)
Butterfish (E, L, J)	Windowpane Flounder (E, L, J, A)	Red Hake (E, L, J)
Little Skate (J)	Winter Flounder (E, L, J, A)	Scup (J, A)
Longfin Inshore squid*	Yellowtail Flounder (E, L, J, A)	Silver Hake (E, L, J, A)
Mackerel (E, L, J)	Spiny Dogfish (J)	

* Life stage data is not fully developed

Here, we only assess overlap with protected species. It is up to the action agency to determine if a project needs ESA consultation. If the action agency (e.g., NMFS) determines that there is "no effect" to listed species or critical habitat, a consultation may not be required. If there may be an effect, consultation is required and an effects determination is then submitted[1].

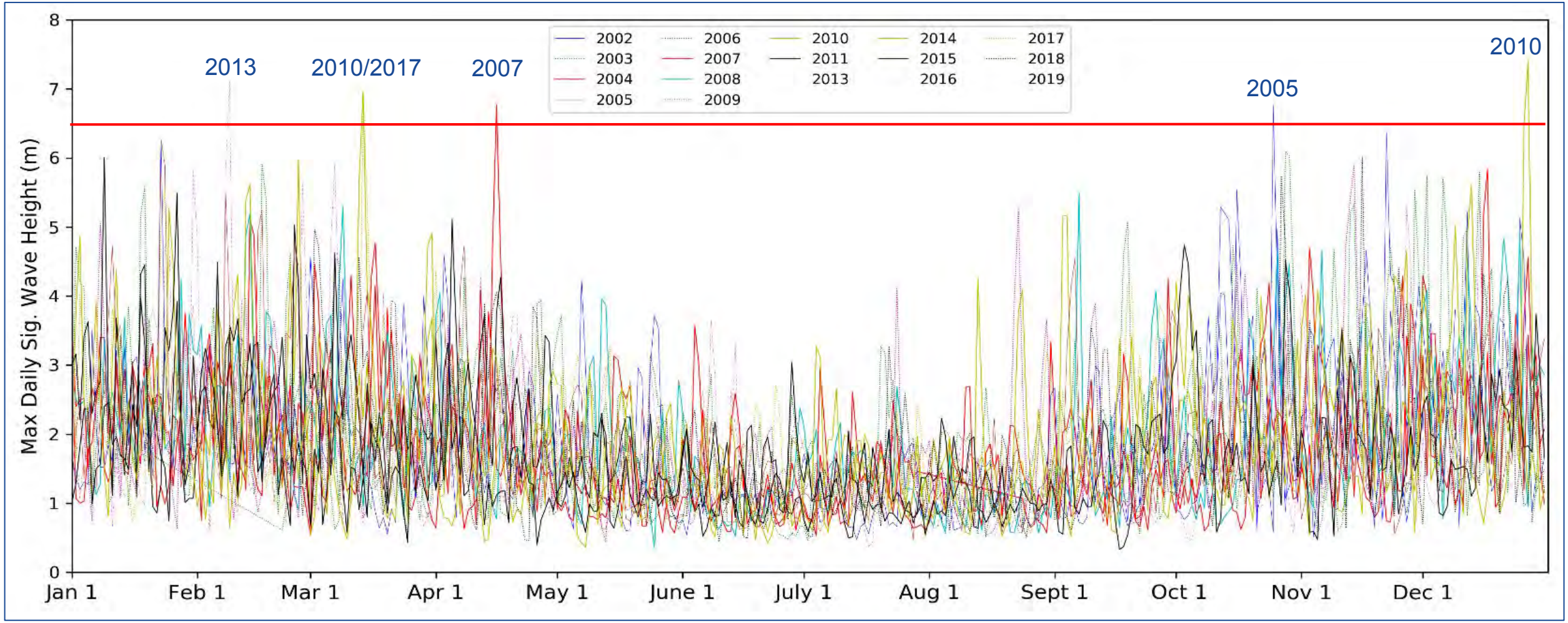
[1] https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-no-effect-determinations-greater-atlantic-region

Nearby Data Buoy (~10 nm)



NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Station 44017 – Sig. Wave Height



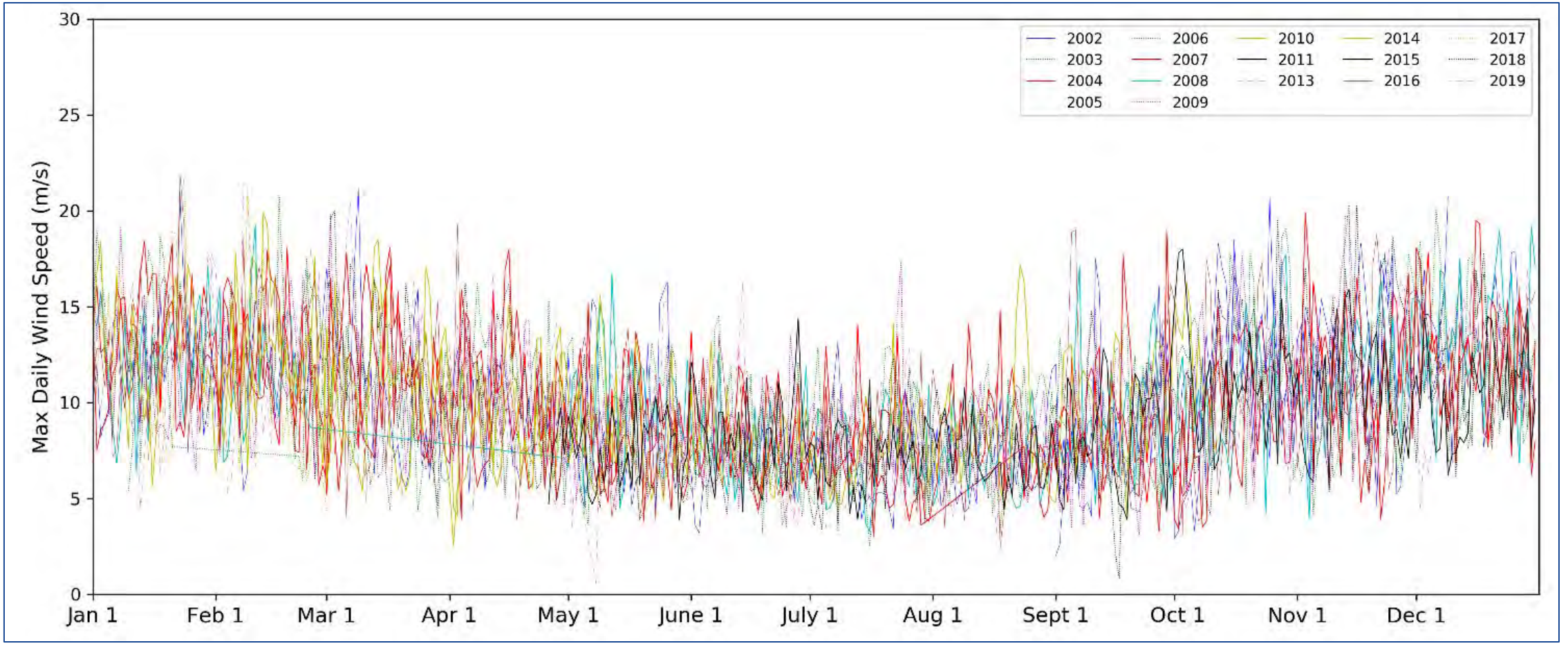
Station 44017 - Waves primarily come out of the East to Southwest, with the highest percent coming out of the Southeast.

	Significant Wave Height (m)										
Direction	0.0 - 0.5	0.5 - 1.0	1.0 - 1.5	1.5 - 2.0	2.0 - 2.5	2.5 - 3.0	3.0 - 3.5	3.5 - 4.0	4.0 - 4.5	4.5 - 5.0	> 5.0
N	0.02%	0.25%	0.22%	0.05%	0.02%	0.003%	0.002%				
NNE	0.08%	0.24%	0.19%	0.05%	0.02%	0.01%	0.00%	0.002%			0.003%
NE	0.10%	0.44%	0.45%	0.31%	0.09%	0.04%	0.01%	0.01%	0.01%	0.01%	0.01%
ENE	0.15%	0.68%	0.71%	0.64%	0.24%	0.14%	0.05%	0.03%	0.02%	0.01%	0.01%
E	0.45%	2.84%	2.35%	1.16%	0.62%	0.40%	0.25%	0.17%	0.06%	0.03%	0.01%
ESE	0.86%	5.74%	4.32%	1.70%	1.11%	0.58%	0.39%	0.18%	0.09%	0.05%	0.05%
SE	1.04%	6.70%	3.38%	1.68%	0.98%	0.55%	0.29%	0.18%	0.08%	0.06%	0.05%
SSE	0.80%	5.88%	3.92%	2.06%	1.19%	0.61%	0.37%	0.17%	0.12%	0.04%	0.02%
S	0.48%	5.04%	4.60%	2.41%	1.06%	0.63%	0.34%	0.10%	0.04%	0.02%	0.00%
SSW	0.28%	3.25%	3.32%	1.60%	0.71%	0.28%	0.10%	0.04%	0.01%	0.01%	0.01%
SW	0.20%	2.49%	2.22%	1.44%	0.81%	0.46%	0.15%	0.06%	0.02%	0.01%	0.01%
WSW	0.18%	1.64%	1.52%	0.88%	0.47%	0.25%	0.07%	0.01%	0.002%	0.005%	0.003%
W	0.06%	0.33%	0.27%	0.12%	0.05%	0.03%	0.01%	0.002%			0.002%
WNW	0.03%	0.31%	0.39%	0.24%	0.06%	0.04%	0.01%				
NW	0.02%	0.36%	0.49%	0.18%	0.05%	0.02%	0.01%			0.002%	
NNW	0.02%	0.32%	0.30%	0.11%	0.02%	0.003%	0.002%				

NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Station 44017 – Wind Speed (m/s)

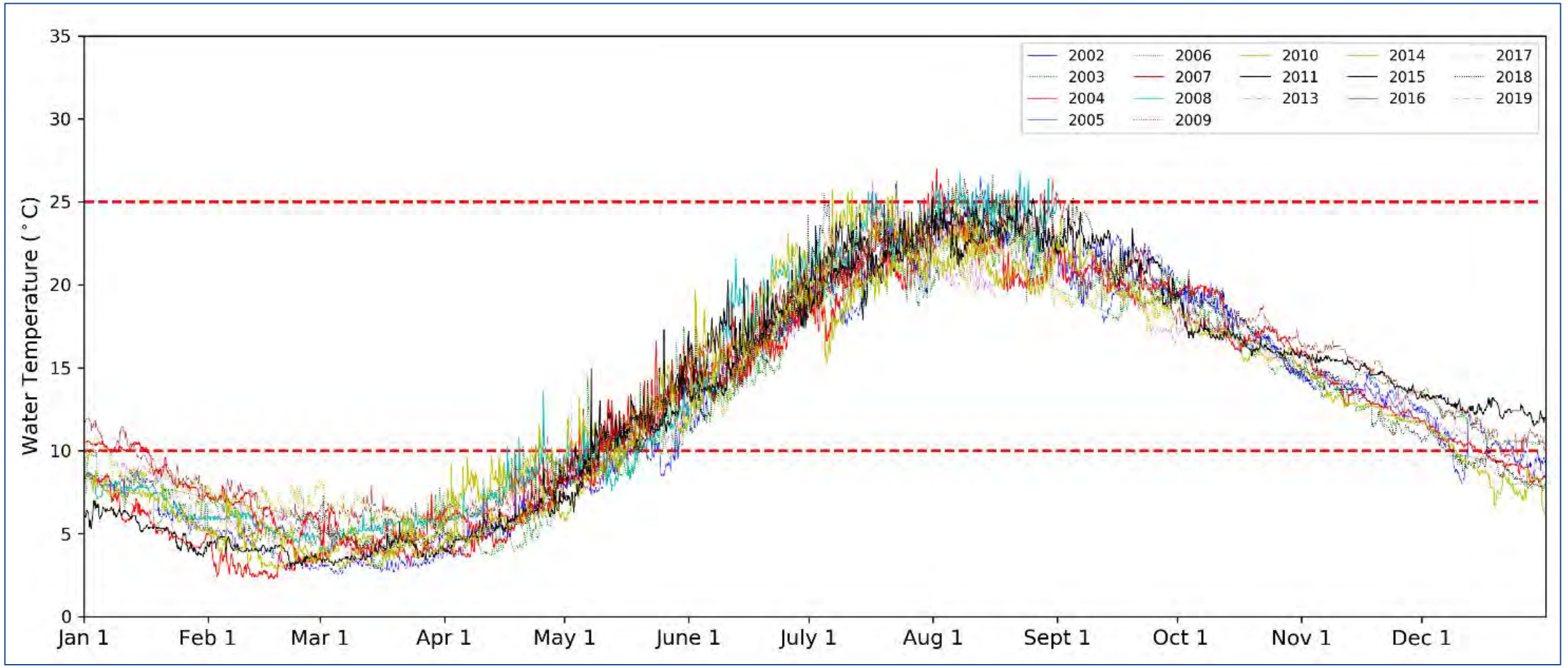
Maximum daily wind speeds from 2002 to 2019



NCCOS NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

Station 44017 – Temperature (°C)

Hourly water temperature at 0.6 m depth from 2002 to 2019



Suitability Analysis Data Processing

Data Sources
GARFO NMFS
Department of Defense
MarineCadastre.gov
MDAT/NEFSC
NOAA Current Predictions
State of New York
USGS
BOEM
USGS
CASS AquaData Catalog

Data Processing Measures
Database Organization in R or Excel
Geodatabase Creation
Interpolation of Continuous Data
Merging Shapefiles
Statistical Summaries in R
Trimming Shapefiles
Grid formation
Weighting schema
Run model & Sensitivity Anlaysis

Examples of Scoring for Suitability

Discrete data

Parameter / Data Layer	Inside cell Score	Outside cell Score	Data Source*
Military Operating Area	0.5	1	USN
Submarine Cable Areas	0	1	NOAA OCM
Sand Aliquots	0	1	USN
Recreational Whale Watching	0.5	1	NOAA OCM

* National Oceanic and Atmospheric Administration (NOAA), Office for Coastal Management (OCM), US Navy (USN)

Continuous data

Mean VMS vessel transits 2009 -2019	Score
0	1
<7.73	0.7
>= 7.73 and < 9.73	0.5
>= 9.73 and < 13.64	0.3
>= 13.64	0.1

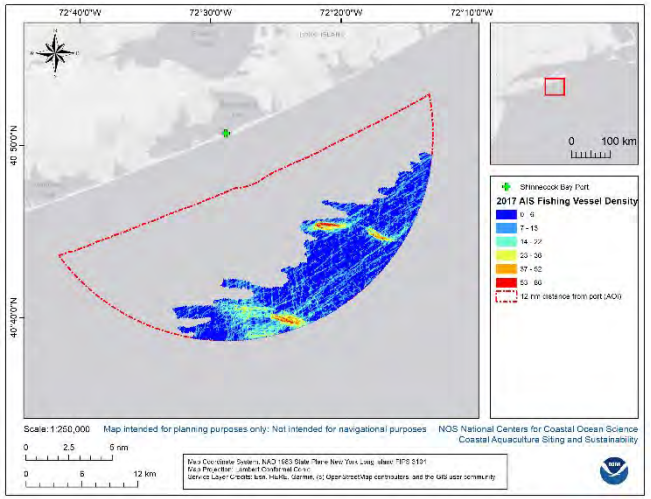
Data not Included in Model, but used in characterization

General Category	Data sets NOT used in suitability model*
Military	Special Use Air Space, Narragansett OPAREA 22 & 23, Military Regulated Air Space, submarine transit lane, unexploded ordnance, and Warning Areas
Transportation & Navigation	Shipwrecks, Areas to be avoided, speed restriction zones for the North Atlantic Right Whale, artificial reefs, anchorage areas, precautionary areas, traffic separation schemes, ferry routes
Fisheries Industry	Generalized Vessel Monitoring System (VMS) data (NEOD 2018) for Herring (2011 – 2016), Monkfish (2011-2016), Sea Scallops (2012- 2016), pelagic species (2014- 2016), and squid from the Squid-Mackerel-Butterfish complex; Generalized data using Vessel Trip Reports (VTR) to show different fishing gear types and effort over time; NEFSC's VTR-Observer Model; fisheries management areas
Energy & Infrastructure	BOEM wind planning and lease areas, pipelines (outfall structures), ocean disposal areas, cable and pipeline areas, and coastal energy facility locations
Natural Resources & EFH	Cetacean density (MDAT & NEFSC AMAPPS), seabird density, MDAT fish data
Recreation & Culture	Recreational SCUBA diving areas, long-distance sailing races, national historic locations

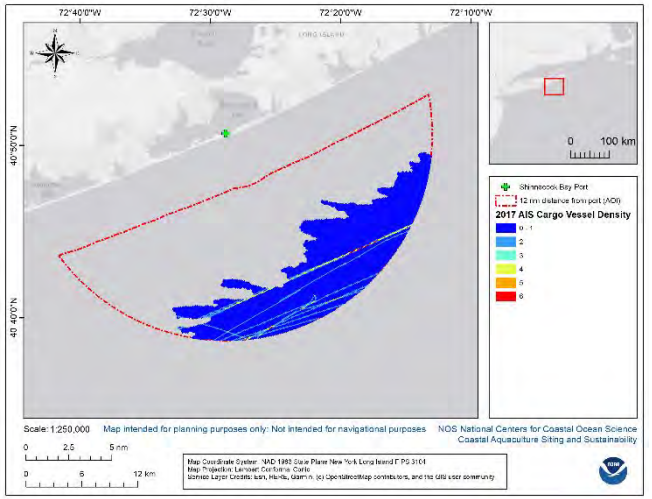
* These discrete data layers were not included in the suitability analysis for a multitude of reasons; e.g., they layer did not overlap or intersect the AOI, the layer did not have spatial or temporal coverage at a resolution appropriate for precision-siting, or because the nature of the interaction with aquaculture operations is not yet fully known – for instance certain fisheries management areas. **Over 300 data layers were assessed in total and can be viewed in Table A-1.

Ocean Neighborhood : AIS (2017) Data

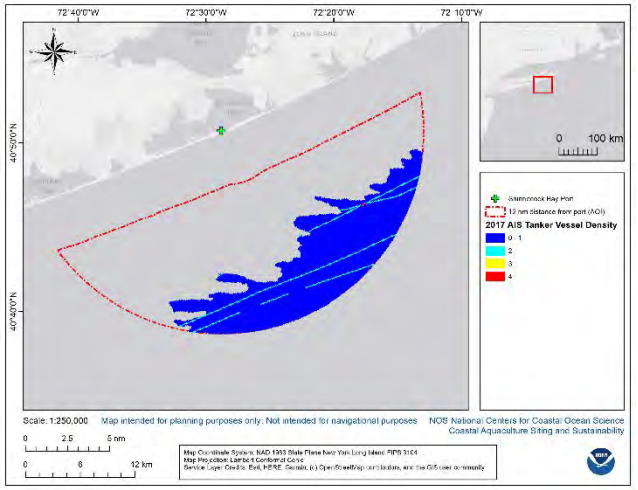
Fishing



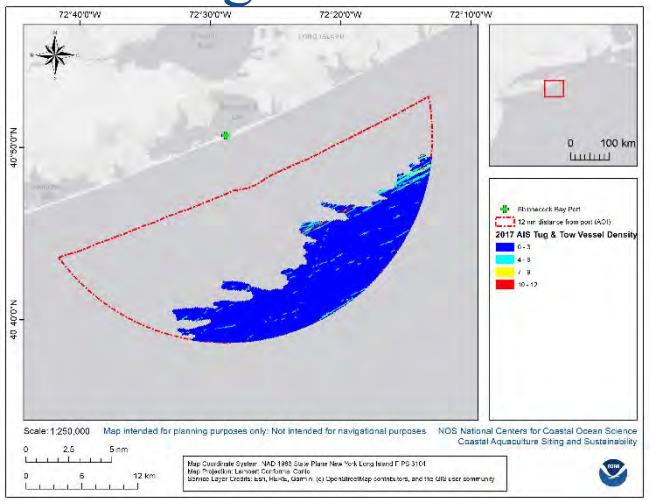
Cargo



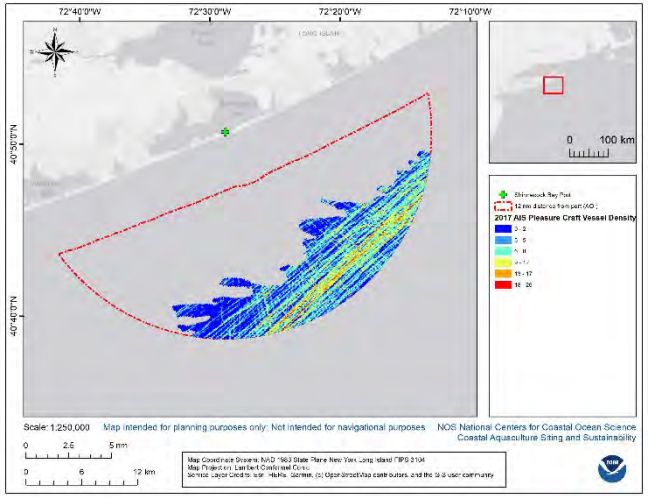
Tanker



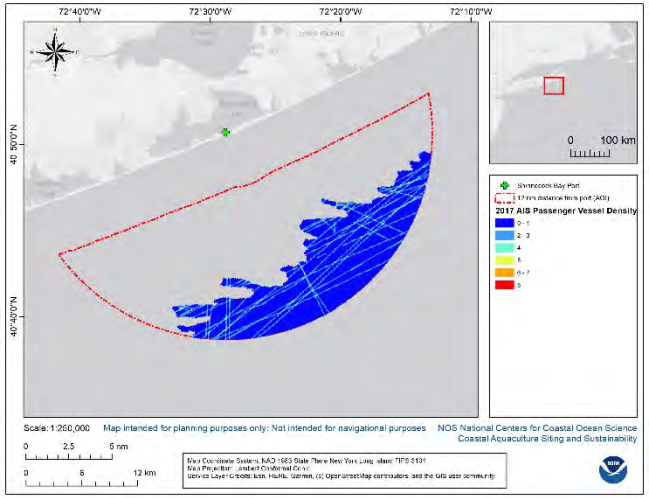
Tug and Tow



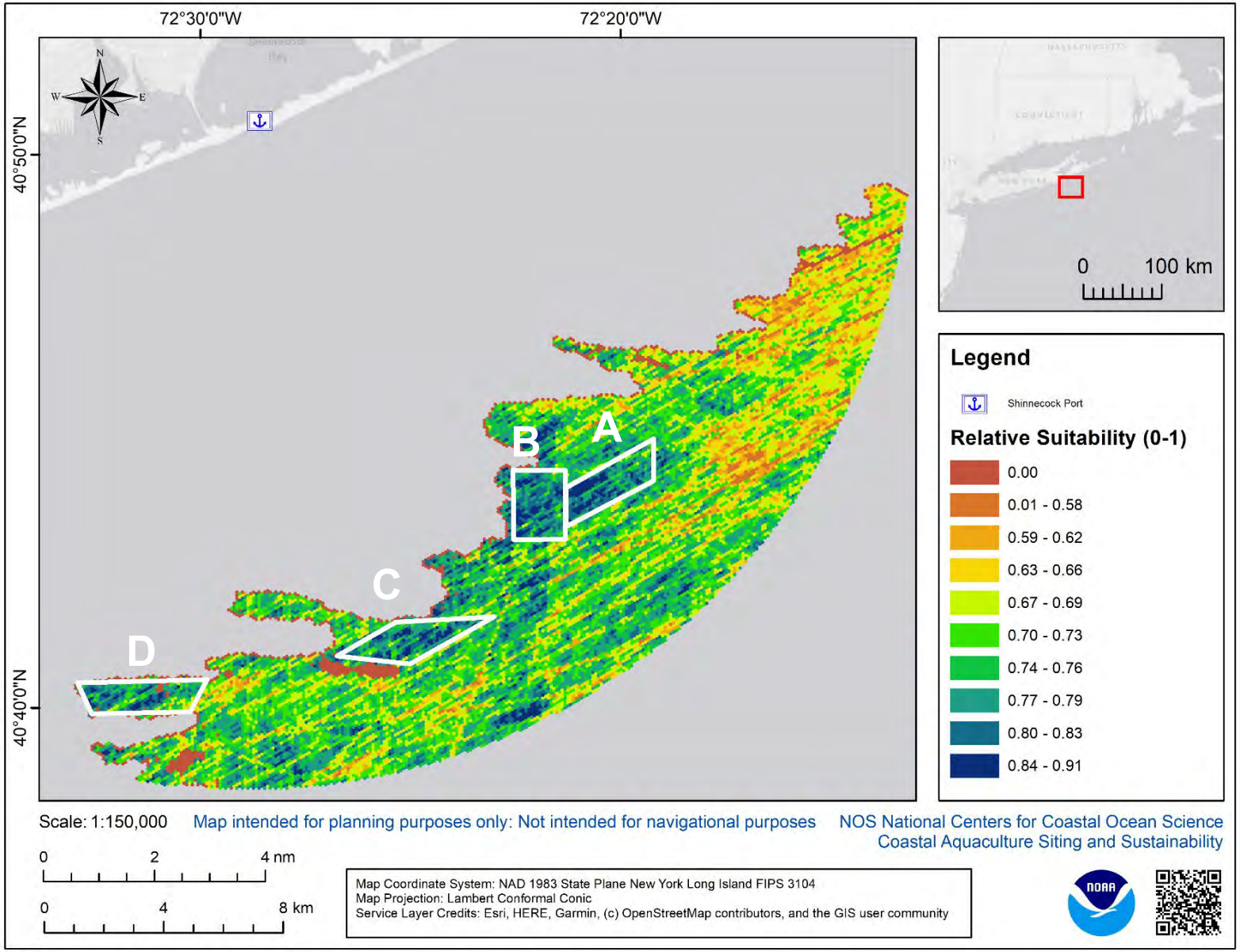
Pleasure Craft



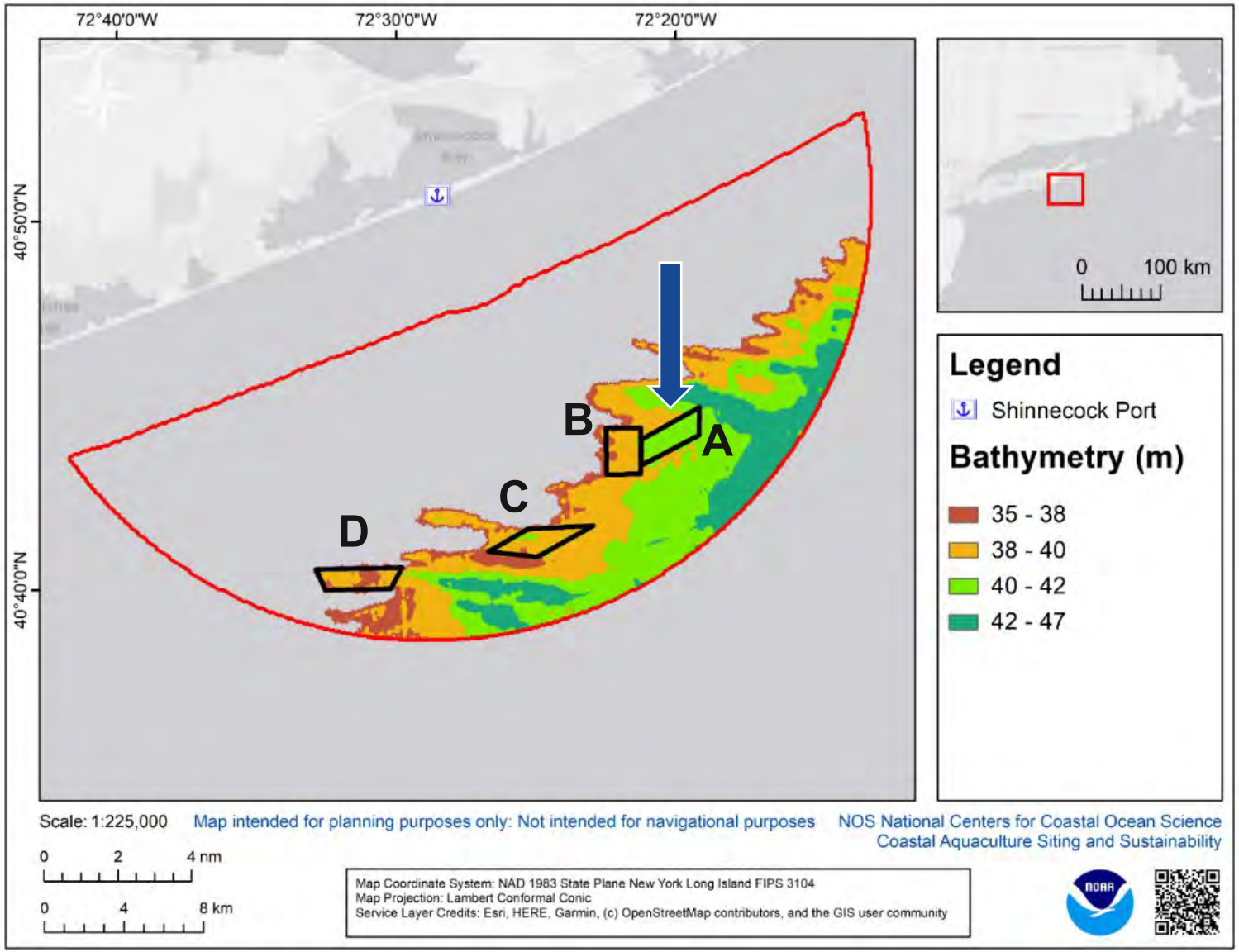
Passenger



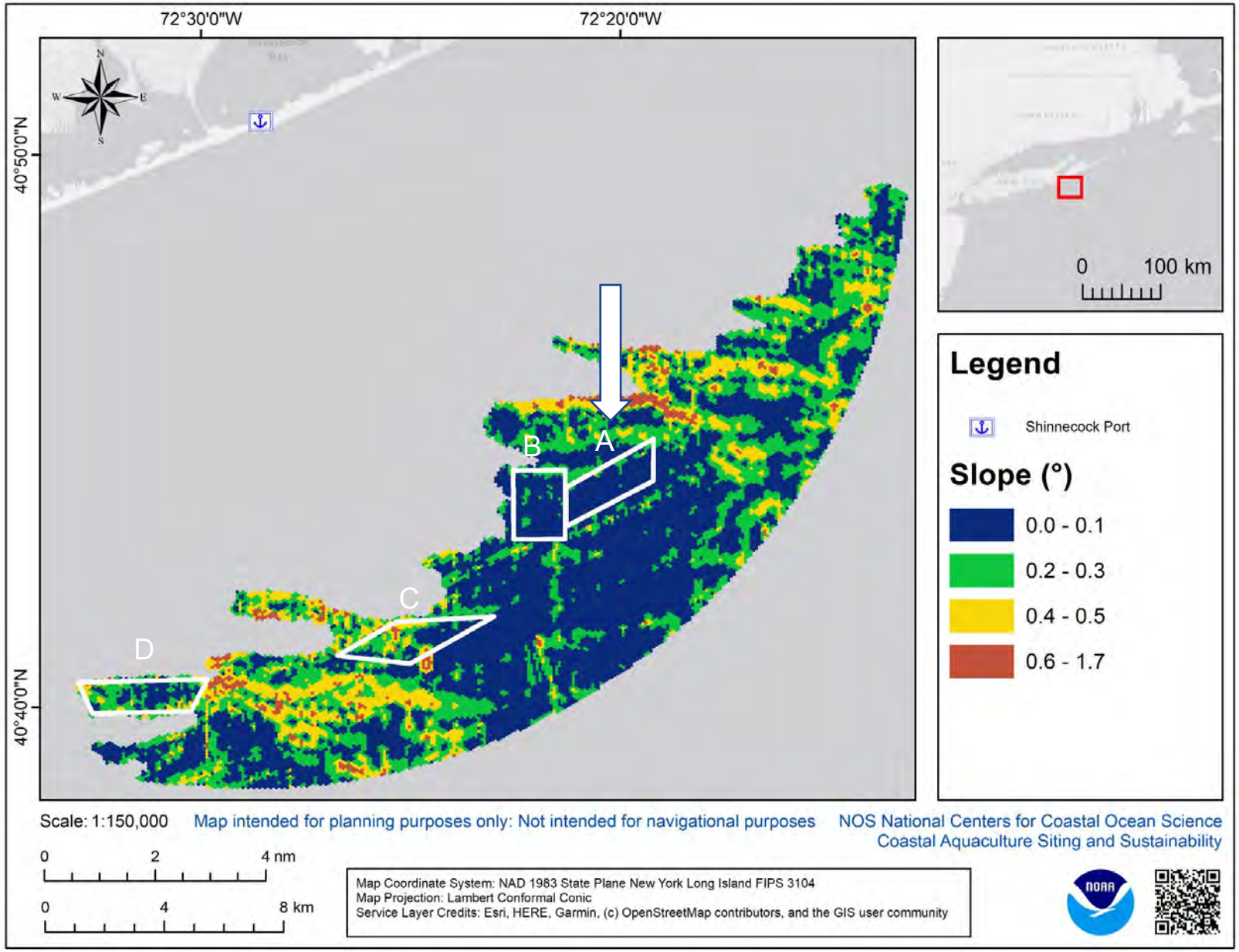
Final Suitability – Alternative Sites



Alternative Sites Bathymetry

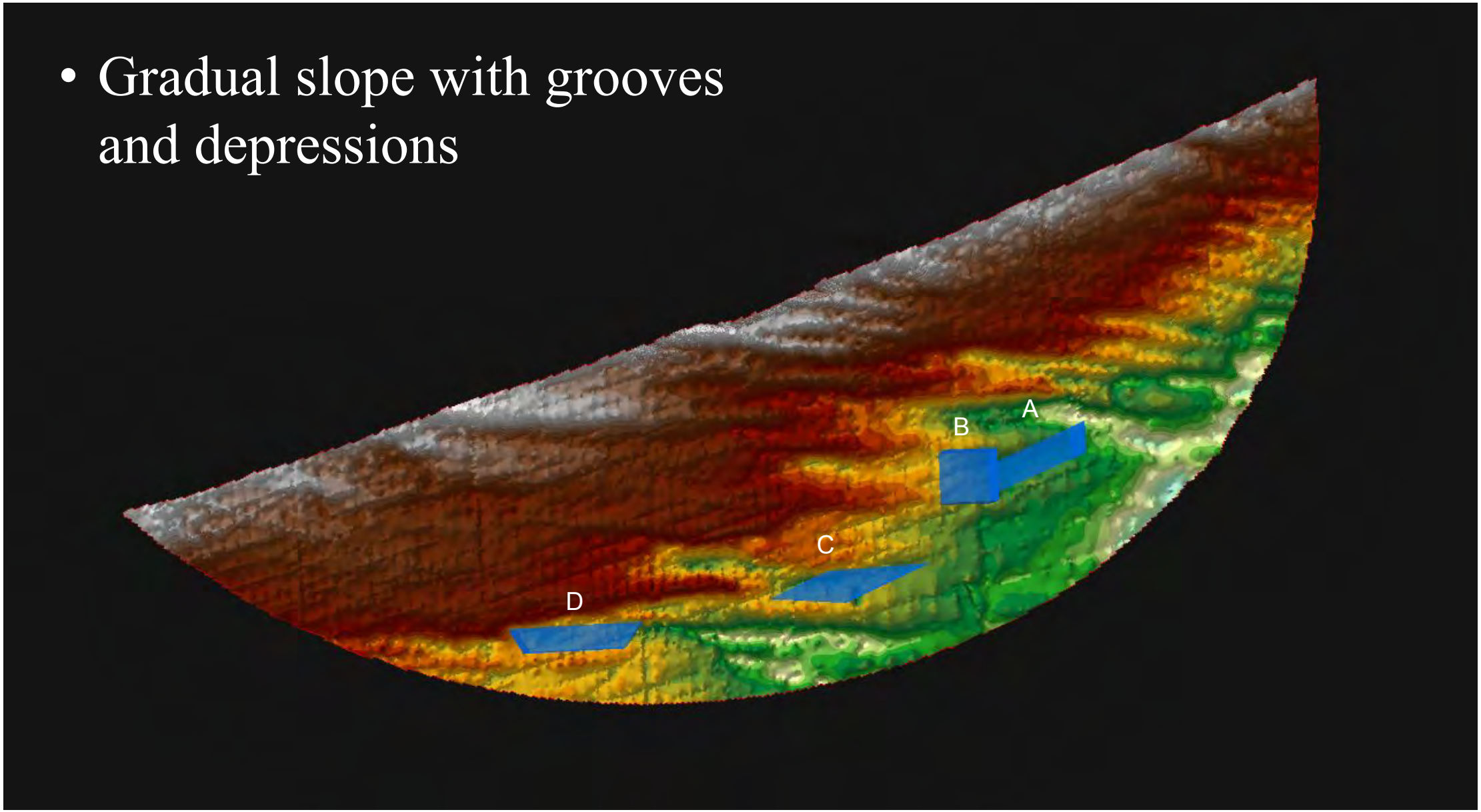


Alternative Sites Slope

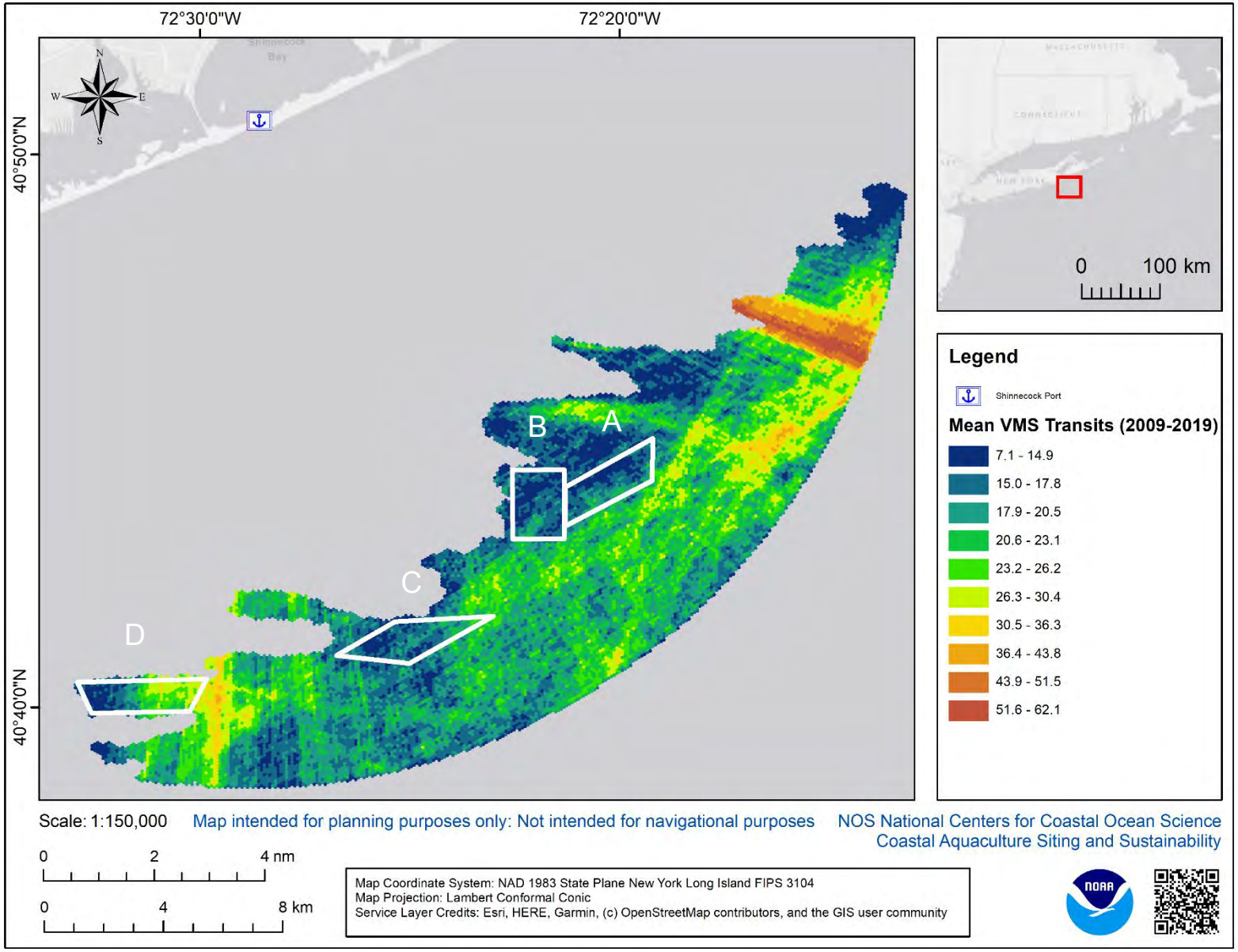


Alternative Sites – Bathymetry / Slope

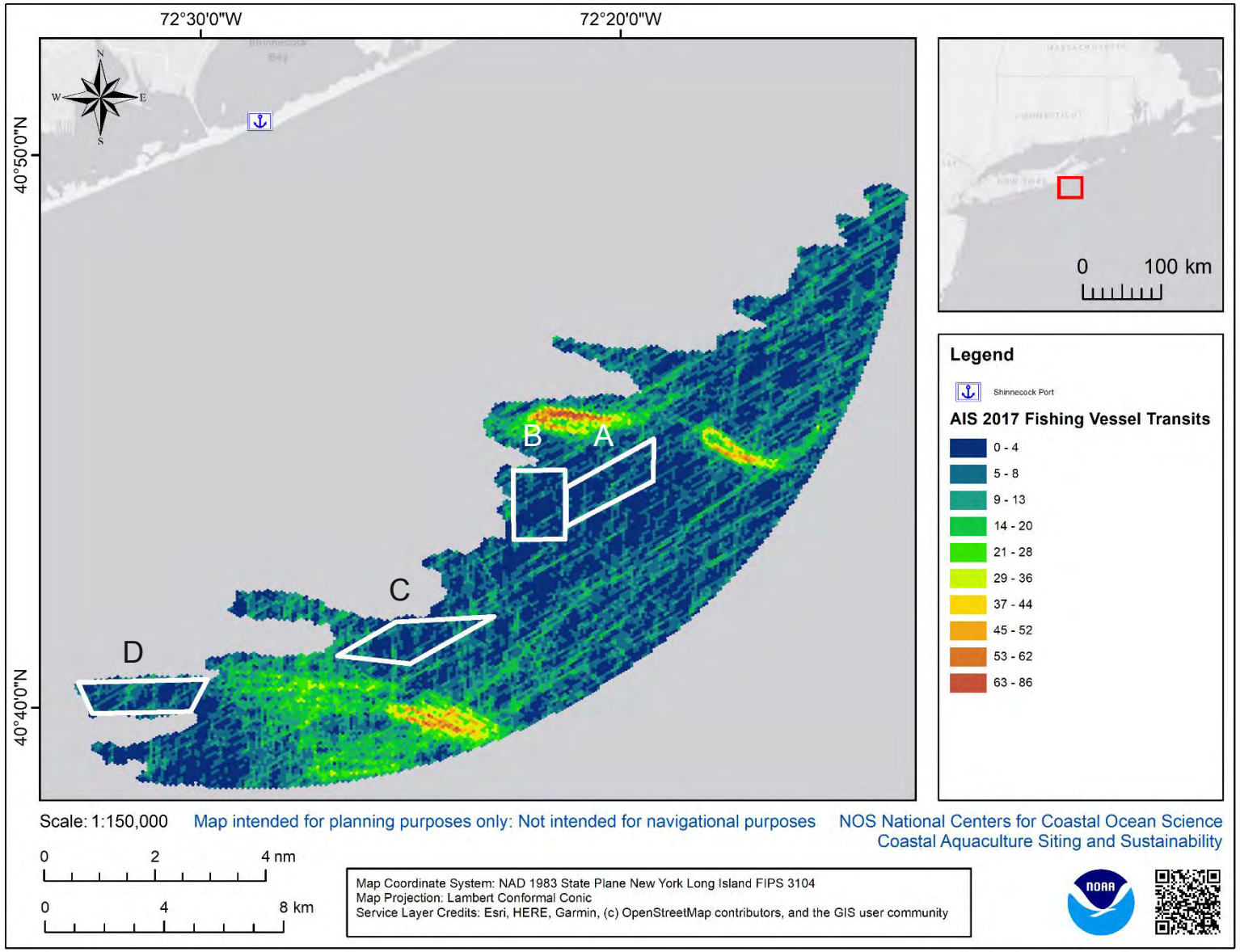
- Gradual slope with grooves and depressions



Alternative Sites VMS

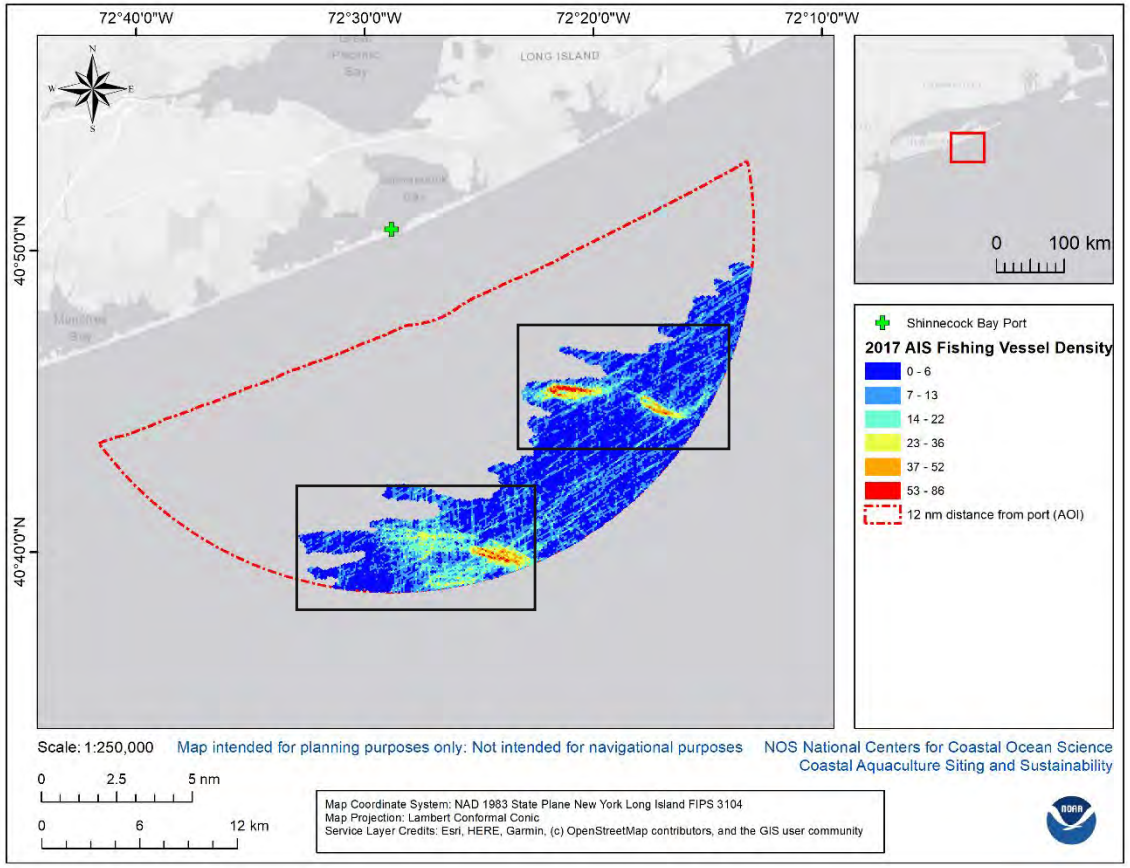


Alternative Sites Fishing AIS 2017

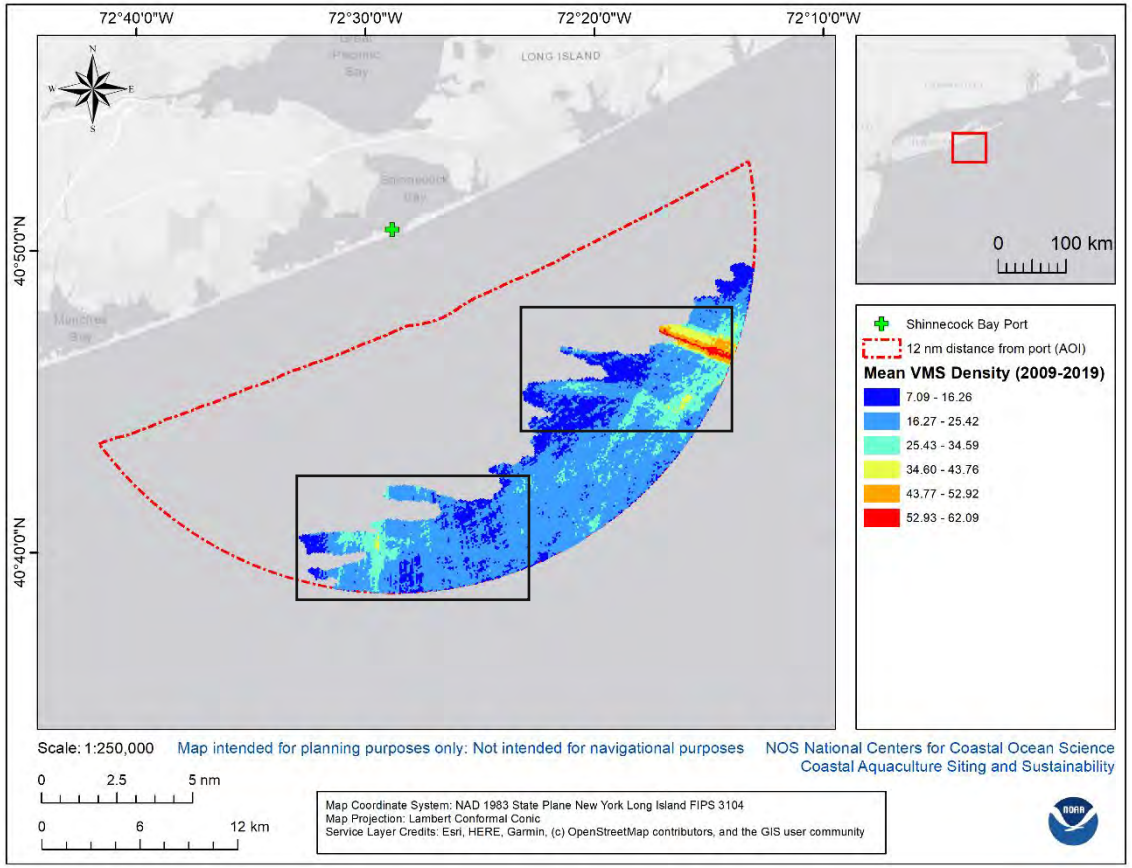


AIS (2017) Fishing and VMS Mean

AIS Fishing Vessel Density (2017)



VMS Mean Vessel Density (2009 – 2019)

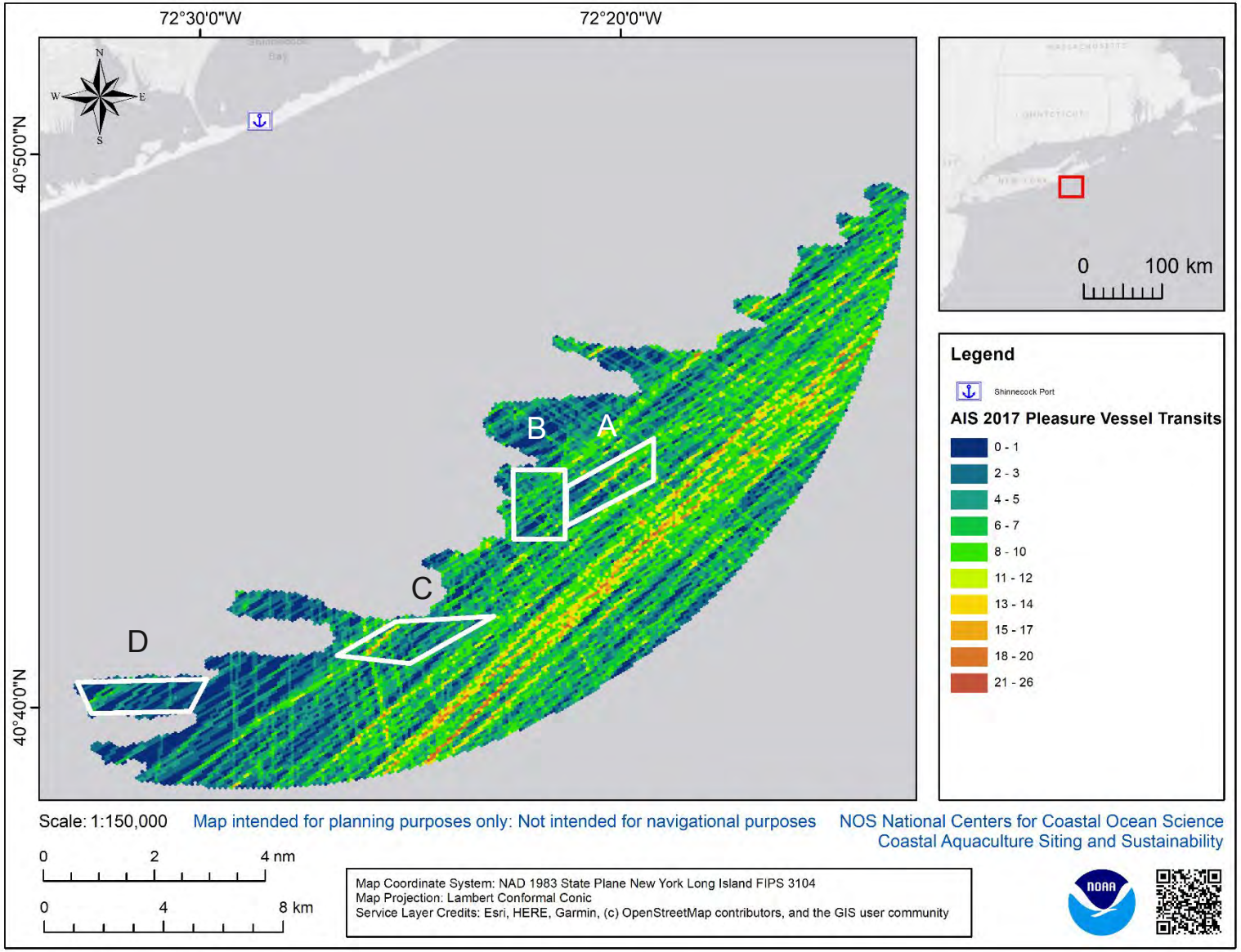


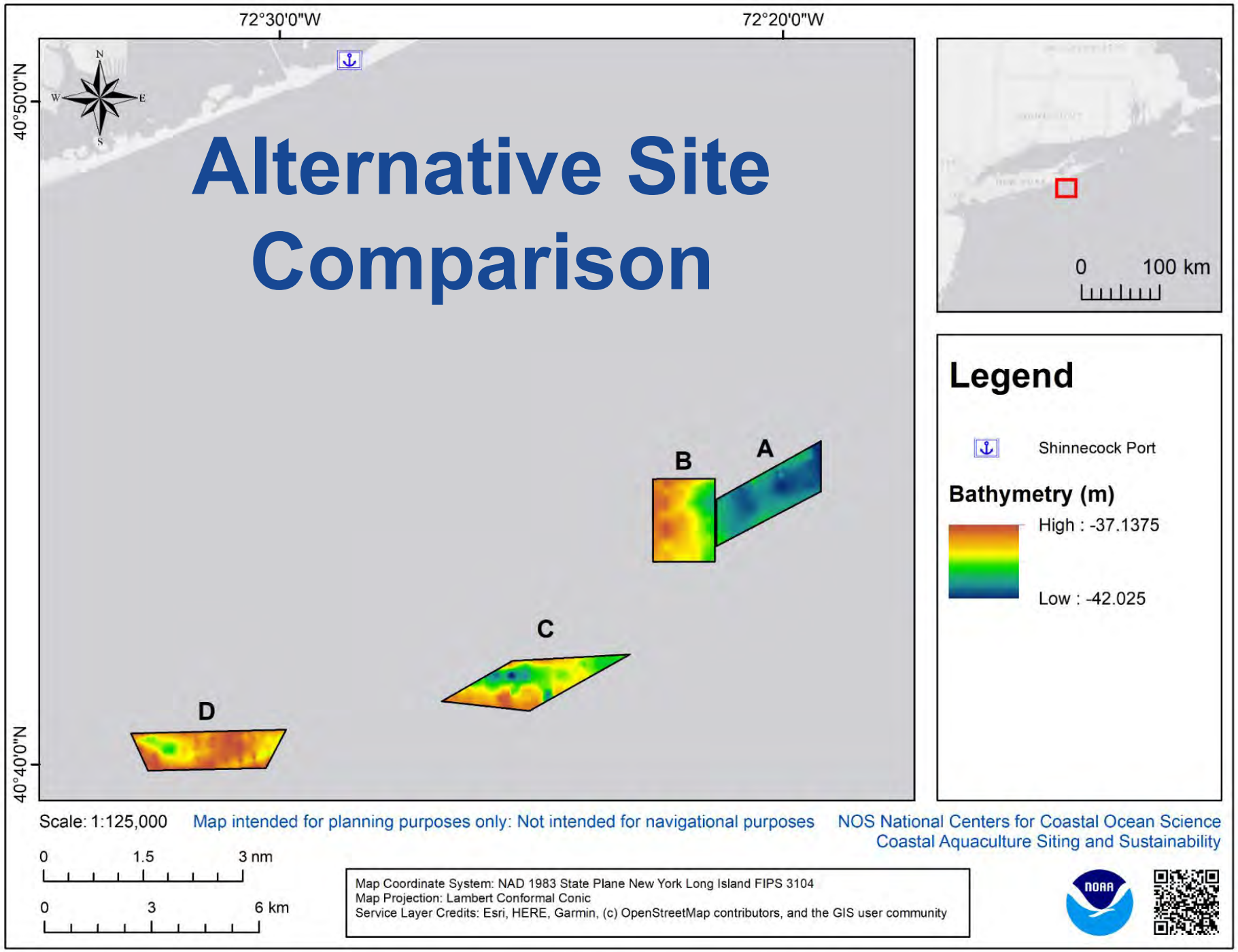
Fisheries Management Area Interactions

- Areas A, B, and C had 33 interactions and 86 where there were no interactions(some general and some more specific)
- D had 27 interactions and 92 instances where there were no interactions
- Each management area has different implications based on the type of management area (i.e., it may not be the number of management areas, but the management measures in each area)
- Require detailed characterization performed by regional NMFS office fisheries biologists and determination of how aquaculture operations may potentially impact those designated areas

Management Area	**Area A**	**Area B**	**Area C**	**Area D**
ALWTRP Regulated and Exempt Waters	Yes	Yes	Yes	Yes
Lobster Management Areas	Yes	Yes	Yes	Yes
Summer Flounder, Scup, Black Sea Bass Management Units	Yes	Yes	Yes	Yes
January-February River Herring Monitoring/Avoidance Sub-Area 3	Yes	Yes	Yes	No
Mar-April River Herring Monitoring-Avoidance Areas	Yes	Yes	Yes	No
Monkfish Fishery management Area	Yes	Yes	Yes	Yes
NE Multispecies Broad Stock Areas (SNE/MA Stock Area 4)	Yes	Yes	Yes	Yes
Cod, American Plaice, Yellowtail Flounder, Winter Flounder, Witch Flounder, White Hake, Pollock Stock Areas	Yes	Yes	Yes	Yes

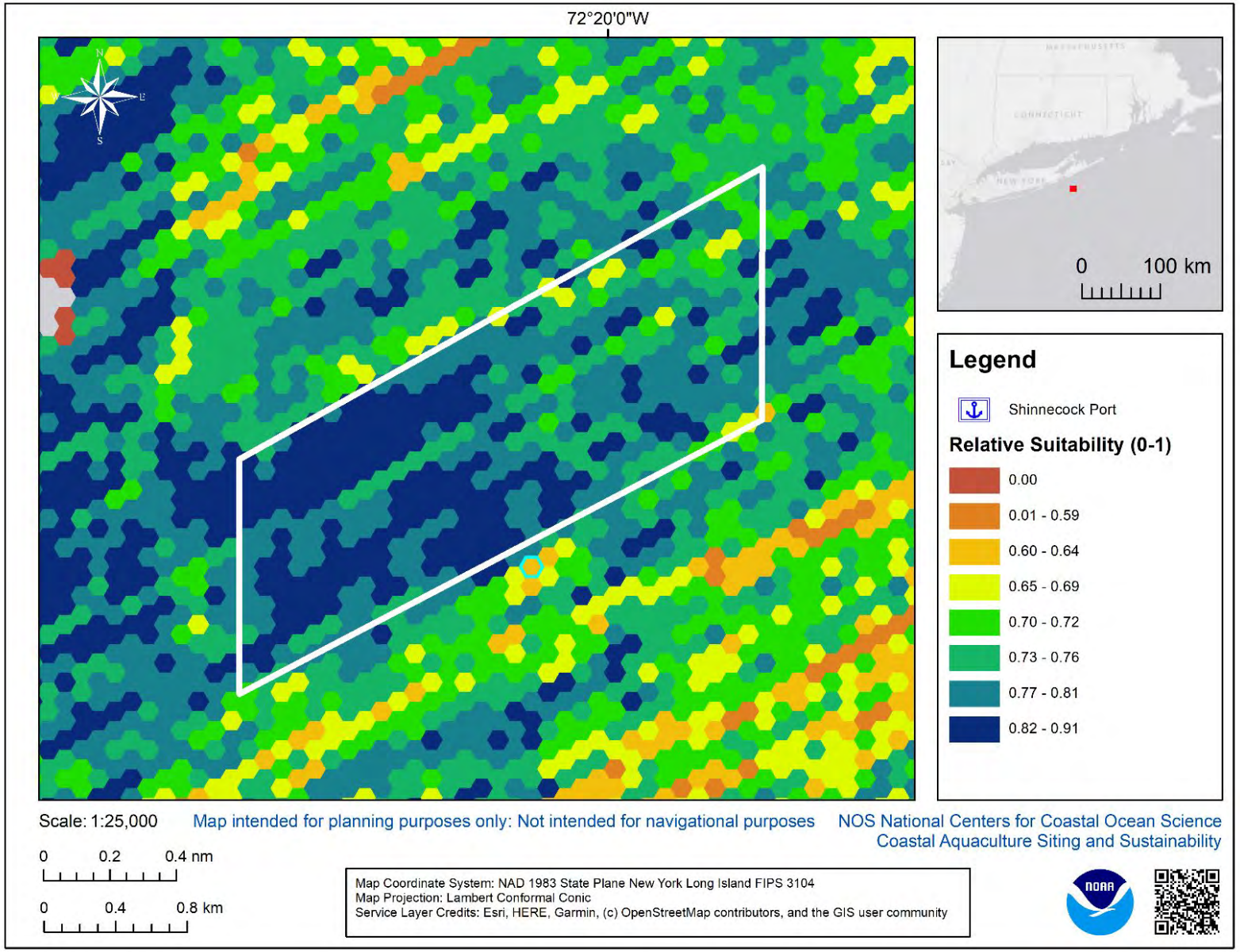
Alternative Sites Pleasure/Sailing Transits




72°30'0"W
72°20'0"W
40°50'0"N
40°40'0"N
N
W
E
S
Alternative Site Comparison
A
B
C
D
0
100 km
Legend
Shinnecock Port
Bathymetry (m)
High : -37.1375
Low : -42.025
Scale: 1:125,000
Map intended for planning purposes only: Not intended for navigational purposes
NOS National Centers for Coastal Ocean Science
Coastal Aquaculture Siting and Sustainability
0
1.5
3 nm
0
3
6 km
Map Coordinate System: NAD 1983 State Plane New York Long Island FIPS 3104
Map Projection: Lambert Conformal Conic
Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
NOAA

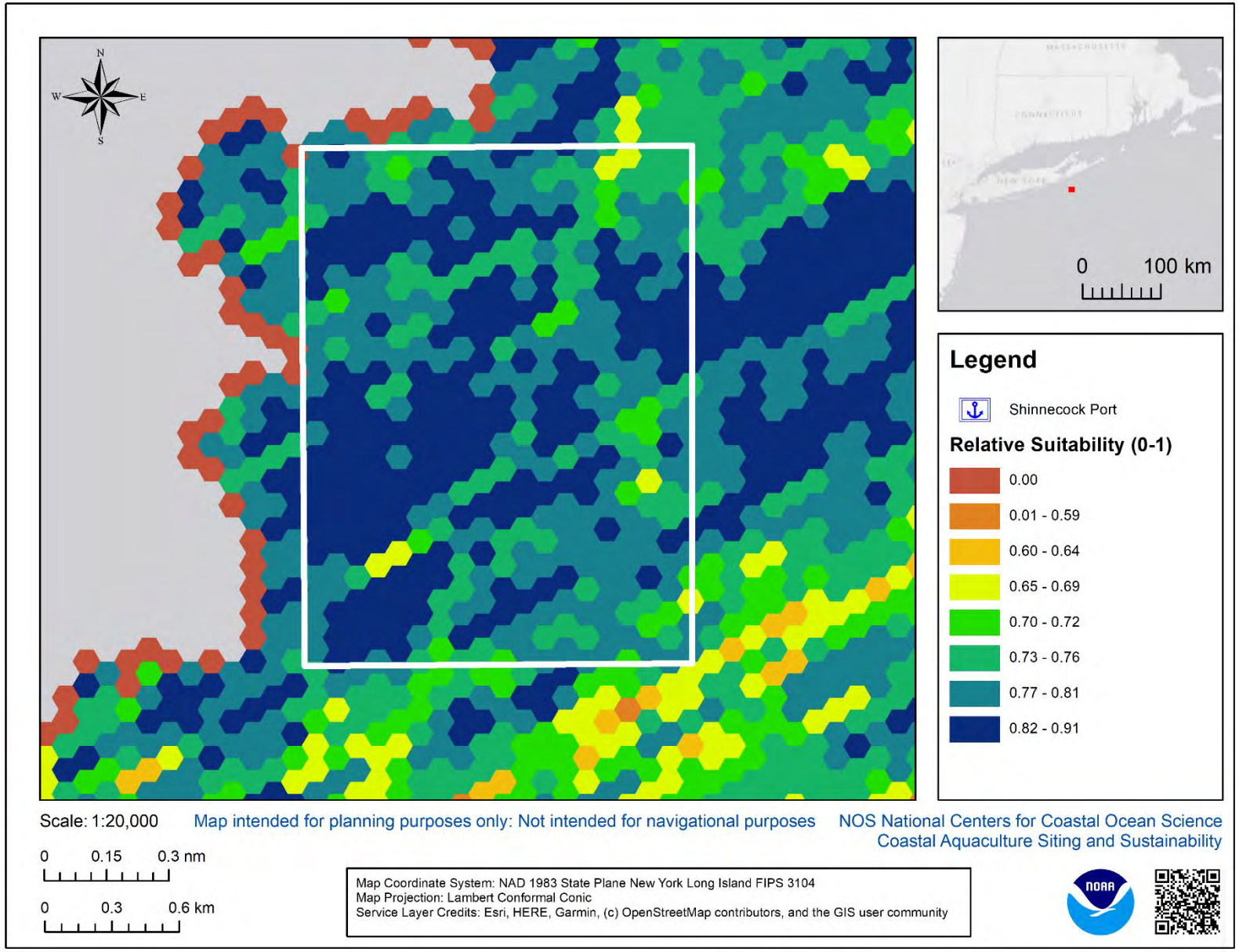
Alternative Site A

- Deepest site with fairly consistent slope
- Some pleasure craft and VMS fishing vessel transits were largest constraints



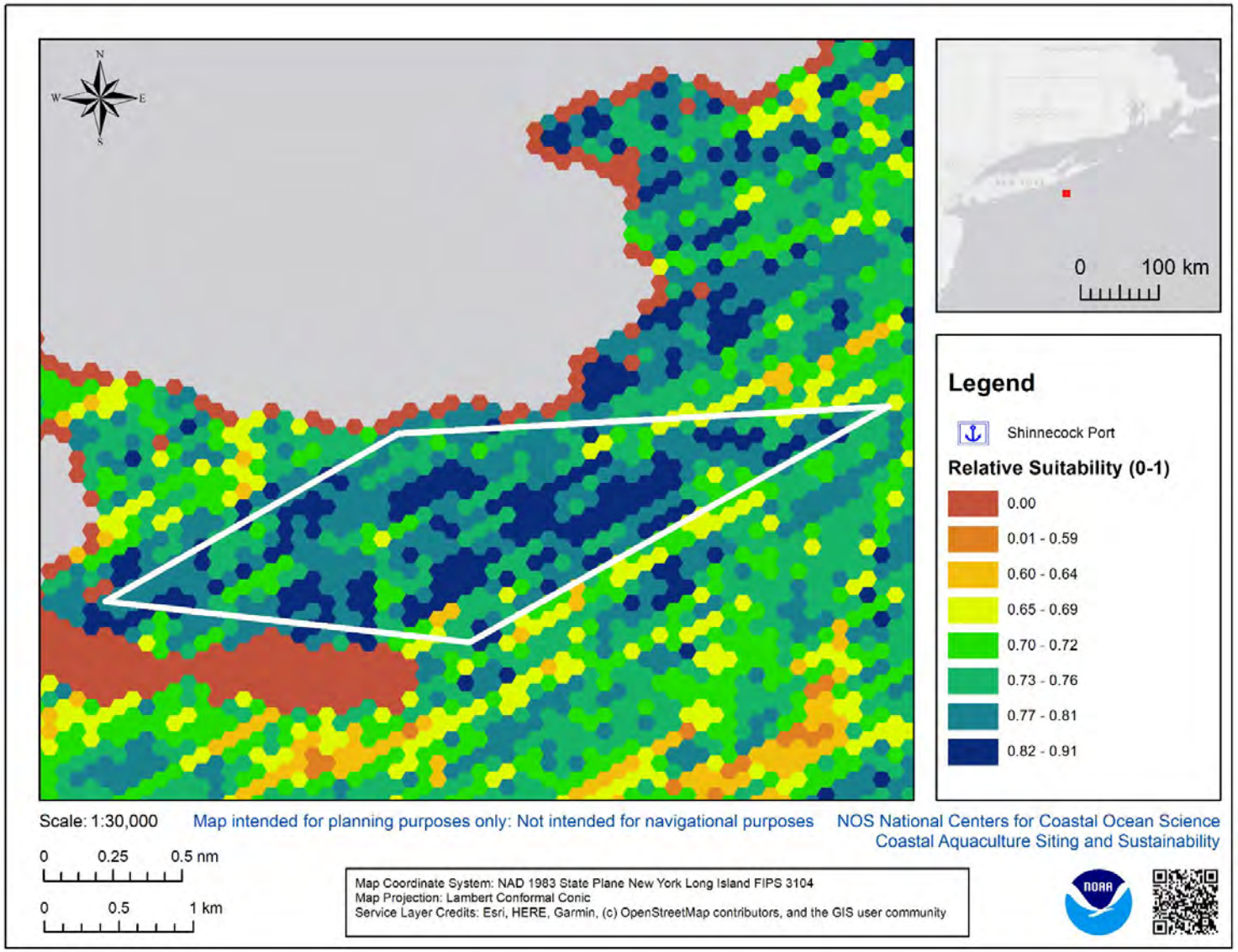
Alternative Site B

- Shallower areas to the North and West
- Elevated Slope
- Some pleasure craft and VMS fishing vessel transits were largest constraints



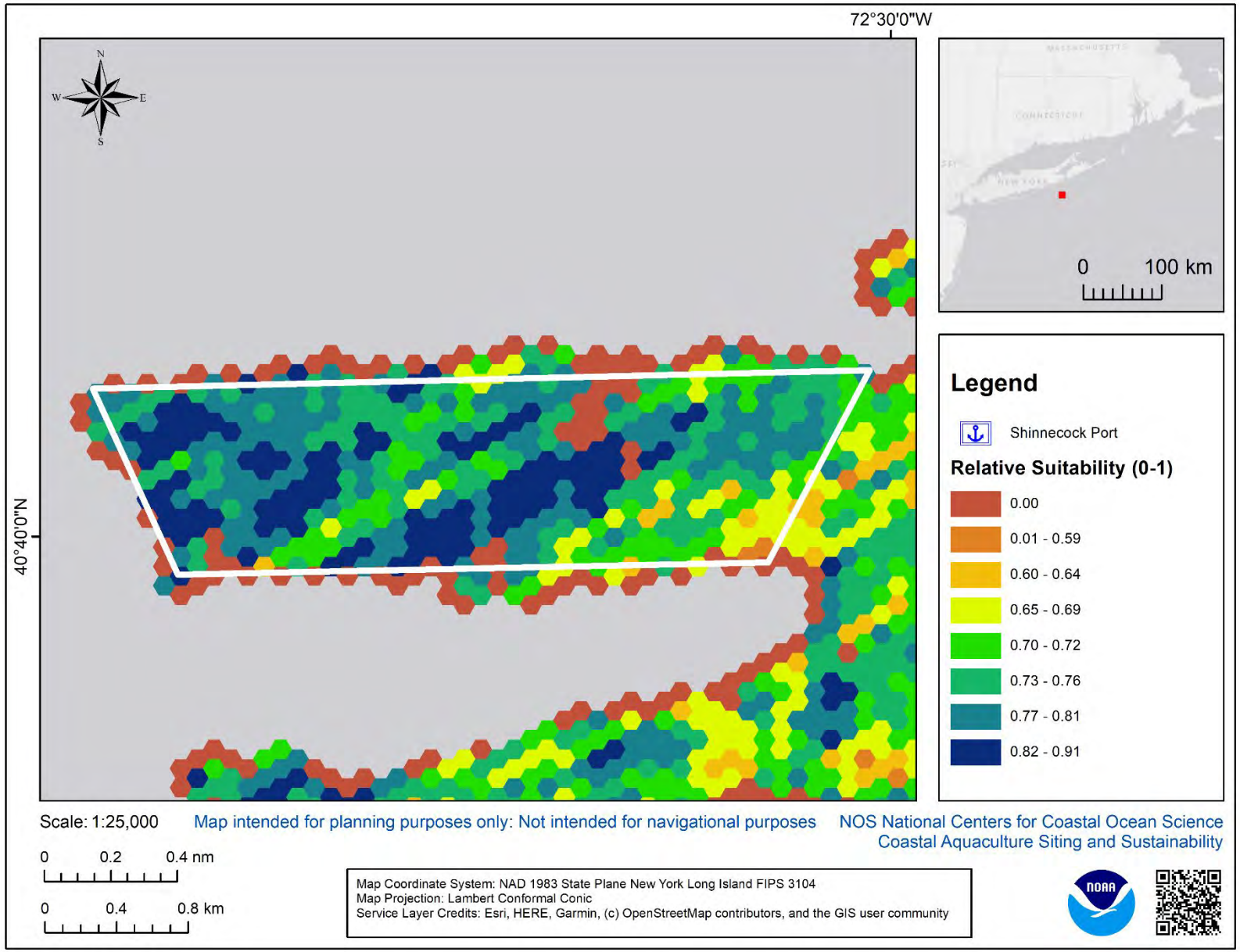
Alternative Site C

- Shallower areas to the North, South, and West
- Elevated Slope with depression in middle of site
- Some pleasure craft and VMS fishing vessel transits were largest constraints



Alternative Site D

- Shallow areas surrounding site
- Non-consistent Slope
- Higher VMS fishing transits in Eastern part of site



NCCOS | NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

1305 East West Hwy, Rm 8110
Silver Spring, Maryland 20910
240.533.0300 | coastalscience.noaa.gov
@noaacoastalsci

Siting Analysis for Manna Fish Farms, New York

Revised Report, July 2020

Lisa C. Wickliffe, Ph.D. [1], Jonathan A. Jossart, M.S.[1], Kenneth L. Riley, Ph.D. [2], and James A. Morris, Jr., Ph.D.[2]
[1]CSS, Inc. for NOAA NOS/NCCOS, Beaufort, NC
[2]NOAA NCCOS, Beaufort, NC

BACKGROUND

Planning and siting for marine aquaculture operations require thorough synthesis and spatial analyses of critical environmental and ocean space use conflicts (Kapetsky et al. 2013). Implementing spatial planning strategies into the process allows for compatibility to be assessed and works towards environmental and economically sustainable aquaculture operations. Aquaculture planning and siting analyses involve the use of geo-analytical tools (e.g., GIS – Geographic Information Systems) to examine and provide statistical analyses of spatial data to generate map-based products used to inform policy and permitting decisions. Importantly, gathering data and working with regional agencies improves the accuracy and inclusion of essential considerations during the planning process.

Manna Fish Farms (hereafter 'Manna') seeks to permit a commercial scale fish farm in the offshore, federal waters south of Suffolk County, New York. Manna has assembled a team of local and worldwide marine scientists, biologists, marine engineers, aquatic veterinarians, and aquaculture operation experts to implement this farming initiative (see http://mannafishfarms.com for more information). The project is complementary to Manna's other commercial aquaculture project in U.S. federal waters. The purpose of this report is to provide a relative suitability analysis that will aid in project development, including farm design, project feasibility assessments, and the pre-permitting and permitting processes. The NOAA NCCOS CASS alternative site suitability analysis identifies the most suitable siting areas for the proposed finfish farm, relative to surrounding ocean areas given the parameters considered. The target audience for this analysis includes all members of the regulatory community and Manna.

The **Coastal Aquaculture Siting and Sustainability (CASS)** program supports works to provide science-based decision support tools to local, state, and federal coastal managers supporting sustainable aquaculture development. The CASS program is located within the Marine Spatial Ecology Division of the National Centers for Coastal Ocean Science, National Ocean Service, NOAA.

To learn more about CASS and how we are growing sustainable marine aquaculture practices visit https://coastalscience.noaa.gov/research/marine-spatial-ecology/aquaculture/ or contact Dr. James Morris at James.Morris@noaa.gov.

This report provides a thorough review of the ocean neighborhood, a crucial first step for new developments as ocean-based aquaculture expands. Spatial data are used to represent critical potential environmental and ocean space use conflicts that potentially constrain, or conditionally constrain, the siting of aquaculture in U.S. federal waters. A Multi-Criteria Decision Analysis (MCDA), commonly used for marine aquaculture siting, was performed (Longdill et al. 2008; Radiarta et al. 2008, Gimpel et al. 2015, Bwadi 2019). This analysis evaluates numerous spatial data types for a location and provides a relative comparison of how suitable the areas in a location are for marine finfish aquaculture. Additionally, protected species, habitat descriptions, various fishing activities and management areas, and oceanographic and biophysical characteristics are described and identified in the aquaculture site characterization process.

Manna provided specific project requirements, such as required depth and distance from port, used to guide the site suitability analysis. This ensures the identified alternative site areas are suitable in regards to gear engineering specifications and cultivated species requirements. The analysis was iteratively developed with feedback provided by the U.S. Army Corps of Engineers (USACE), NOAA NMFS Greater Atlantic Regional Fisheries Office (GARFO) and the Manna team. The NMFS Regional Aquaculture Coordinator, Kevin Madley, provided critical assistance with interagency coordination of meeting with Manna and facilitated data exchange.

NOAA NCCOS has technically reviewed this report. Information within this report is intended for site characterization and does not equate to work needed concerning biological consultations, section 7 review, or other necessary consultations that may occur in the pre-permitting or permitting process. NOAA NCCOS makes no warranties to the accuracy or completeness of the data presented here, and NOAA will not be responsible for any adverse result based upon users' reliance on the application or the data presented. This report provides a "first look" at information available in a geographic area of interest. Users are advised to exercise due diligence and independently confirm the accuracy and correctness of the data provided. Approval does not signify that the contents necessarily reflect the views and policies of NOAA, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

METHODS

Project siting requirements provided by the applicant include: 1) spatial boundaries for region of interest; 2) preference for state or federal waters; 3) preferred project neighborhood or ocean region; 4) approximate proposed project size; 5) preferred port; 6) maximum distance from preferred port; 7) candidate species for cultivation; 8) acceptable depth range; 9) acceptable seawater temperature range and ideal temperature for species growth; 10) acceptable current velocity range; 11) maximum allowable significant wave height; and 12) preferred bottom substrate. This information was obtained via email communication and documented in Table 1.

Table 1. The NCCOS CASS Spatial Team requested information with response from farm operators (i.e., Manna Fish Farms, Inc.). The following represent the farm parameters provided by Manna.

CASS Request	Farm Response
Preferred project ocean region	Northeast United States
Spatial boundaries for region of interest	South of New York state (i.e., Suffolk County)
Preference for state or federal waters	Federal
Approximate proposed project size	1.5 mi² (388 ha)
Closest port with infrastructure	Shinnecock Bay Inlet Port
Maximum distance from preferred port	≤ 12 nautical miles from shore
Candidate specie(s) for cultivation	Steelhead Trout (*Oncorhynchus mykiss)*; Striped Bass (*Morone saxatilis*); Black Sea Bass (*Centropristis striata*)
Acceptable depth range	~38-50 m (cages at surface unless during storm event)
Acceptable seawater temperature range	Range: 10 to 25 °C (Striped Bass = 20 °C; Steelhead Trout = 16 °C: 15 to 18 °C = Black Sea Bass ideal for growth)
Acceptable current velocity range	≤ 0.5 m/s is optimal, ≤ 0.8 m/s is suitable
Maximum allowable significant wave height	≤ 3 m
Preferred substrate	Mud, sand, or mixed sediment

Area of Interest

The original Area of Interest (AOI) for analysis was developed by examining space use conflicts, input from the USACE, and farm requirements. After initial review and meetings with the USACE in 2018, two AOIs were identified for the site suitability analysis and for the formation of alternative areas for the Manna finfish aquaculture operation (Figure 1). The decision not to extend or include additional areas or ports hinged on space use conflicts surrounding the identified AOI, and logistical and economic rationale.

Conflicts within or abutting the AOI include dense submarine cables, heavy cargo, tug and tow traffic, regulated shipping lanes, active Special Use Air Space (SUAS) areas, Warning Areas, and Bureau of Ocean Energy Management (BOEM) active and draft Wind Energy Areas. A 12-nm maximum distance to port qualifier was applied further refining the area of analysis (Figure 2). The distance to port limit was based on proximity requirements for shore-based infrastructure (i.e., economic and logistical needs) where hatchery and nursery assets exist, employee transport to and from the farm, feed for cultured species is stored and transported to the farm site, stationing and repair of equipment occurs, and potentially where harvested product will be landed.

The depth requirement of ≥ 38 m and ≤ 50 m further reduced the area of analysis (Figure 2). Two thresholds determined the depth envelope (38-50 m). The minimum depth was determined by engineering experts who took the Stormsafe™ cage design and calculated the maximum wave height in 50- and 100-year storm events. This calculation allows determination of needed depth in order to sink the cage system if a large episodic storm event occurs. This equated to 38-m deep. The 50-m depth maximum was a result of mooring line length and economic constraints that would occur if the mooring lines were to go any deeper. The final area of analysis, referred to as the usable 'AOI' throughout the remainder of the report, is 180.89 km² (18,089 ha) (Figure 3).

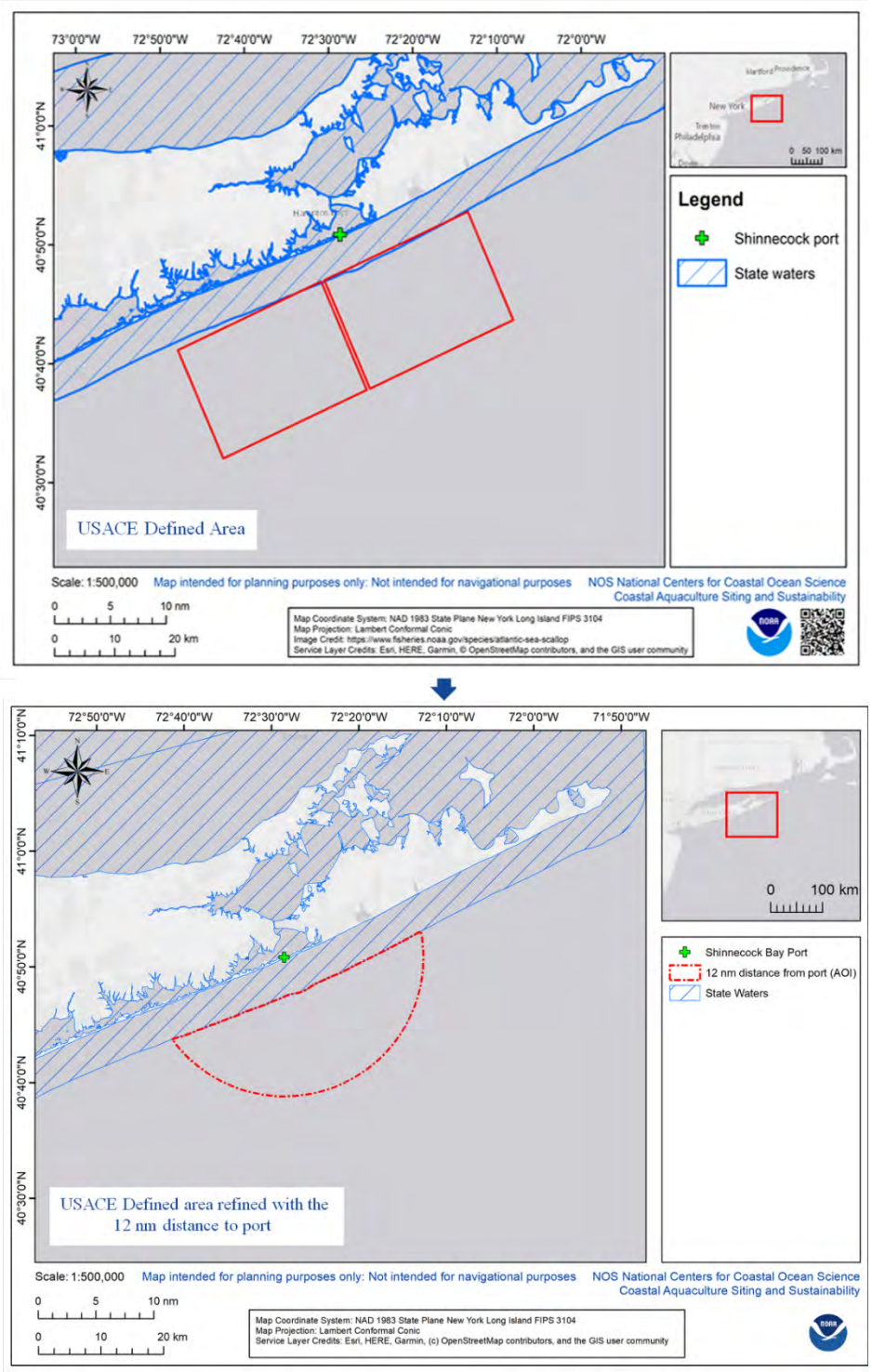


Figure 1. (Top Image) Initial areas (top - red boxes) defined by USACE (2018) for the aquaculture farm siting analysis south of Suffolk County, New York. Shinnecock Bay was identified as the area with the economic opportunity for the farm, because of land-based hatchery assets, technological assets, and farm assets already existing in this relatively small port area. (Bottom Image) The USACE defined area was then refined based on the distance to port requirement.

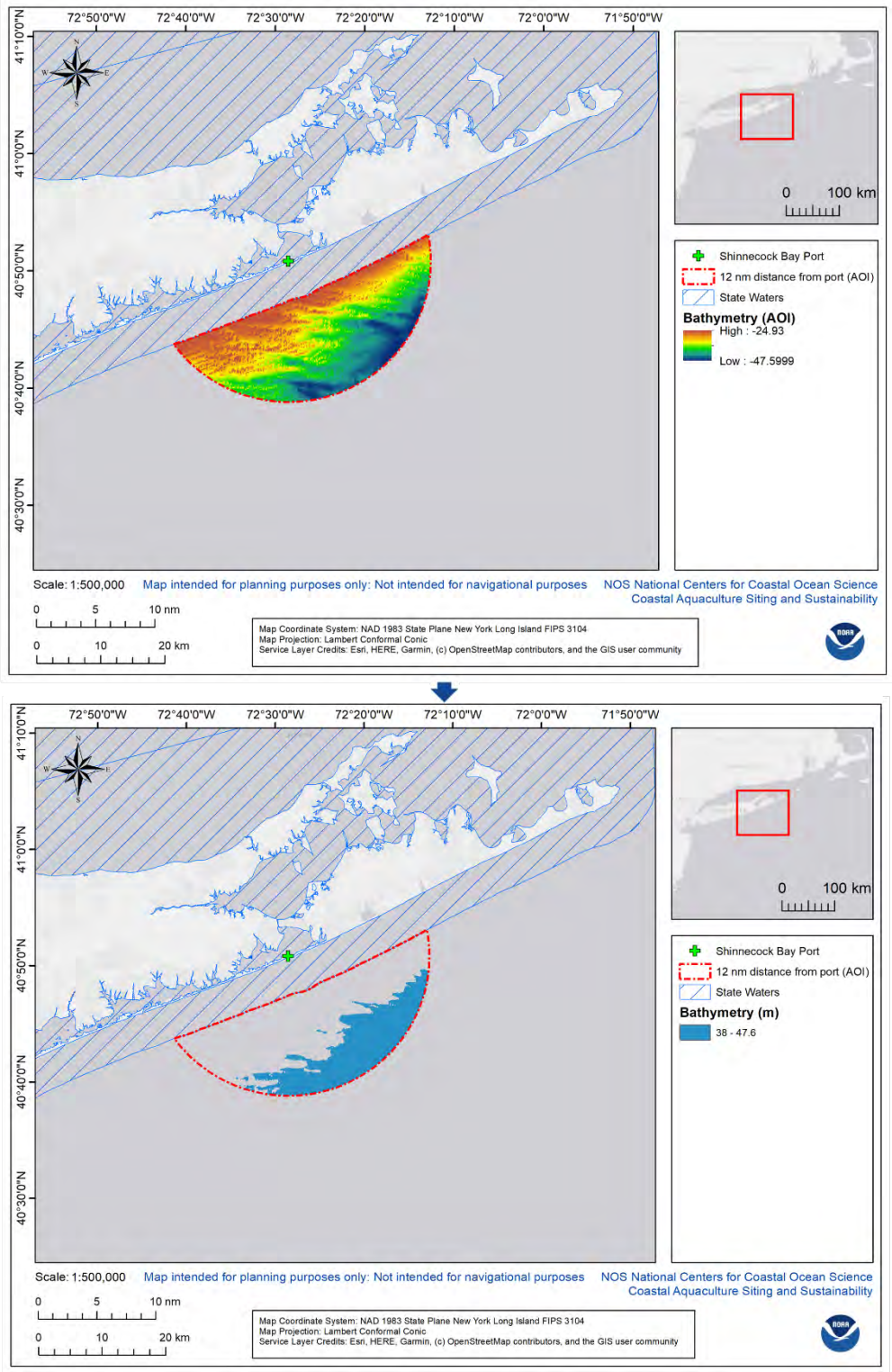


Figure 2. A 12-nm mile radius from the Shinnecock Bay Port was used to reshape the initial areas. Ten-meter resolution bathymetry was used to determine the 38 to 50 m depth range (solid blue portion of the bottom graphic).

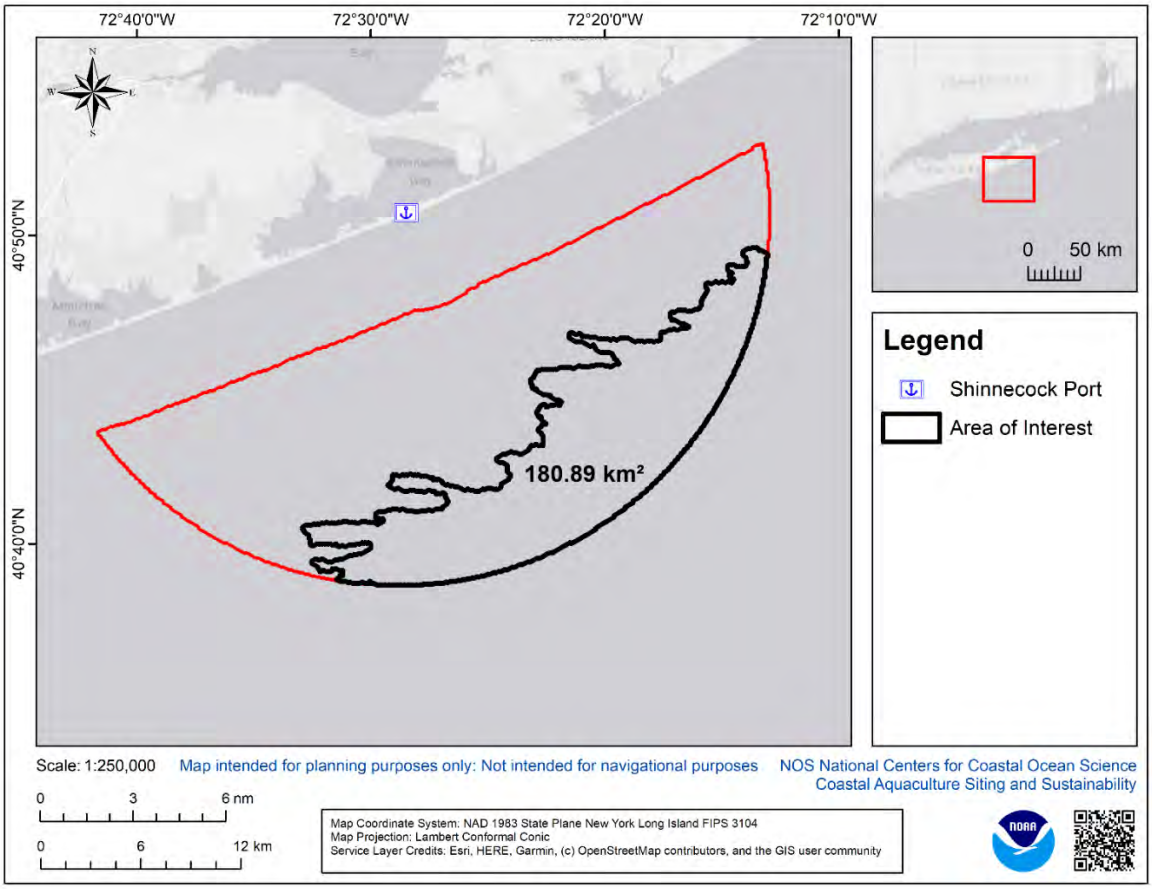


Figure 3. Final area of interest was 180.89 km² (i.e., refined AOI).

Data Inventory

The CASS team reviewed and updated all data holdings in the Northeast AquaData Catalog, a large database containing numerous spatial data sets used for siting marine aquaculture. A comprehensive spatial data inventory was developed for the Manna site suitability analysis, specifically for the waters south of Suffolk County, New York. This formulated geodatabase inventory included data layers relevant to administrative boundaries, national and homeland security (i.e., military), navigation and transportation, energy and industry infrastructure, commercial fishing, natural resources, recreation, culture, and oceanography. The vast data holdings were made possible by a broad suite of federal and state agencies (e.g., NOAA NMFS - specifically GARFO and NEFSC, U.S. Department of Defense, BOEM, U.S. Geological Survey, NOAA Office for Coastal Management, Northeast Regional Ocean Council, and New York State Department of Conservation) and academic institutions (e.g., Stoney Brook University, University of New Hampshire, Rutgers University, University of Massachusetts, Dartmouth, SMAST) contributed data resources. Data were reviewed for completeness and quality, and the most authoritative, up-to-date sources were used when possible. All data were projected in NAD 1983 State Plane New York Long Island FIPS 3104, WKID: 32118, Authority: EPSG. See Appendix A for a complete aquaculture siting data inventory generated for the siting analysis and the Northeast region, and subsequent characterization of identified areas (Table A-1).

Spatial Analysis

A relative suitability analysis examines multiple spatial data layers to identify locations in a predefined area with the highest suitability relative to other locations, in this case for marine aquaculture. A hexagonal gird with one-hectare grid cells chosen to allow for precision siting, and was created in the AOI (Figure 4). Data within the geodatabase were assessed, and if relevant, included in the suitability model or set aside for review in context to the alternative siting areas identified in the suitability analysis (Figure 5). Layers that were relevant, but have poor spatial or temporal coverage (i.e., data are too coarse for precision siting, sampling is skewed, or data are only available for part of a season, or year) are characterized for each alternative area after the suitability analysis was completed (e.g., MDAT/NEFSC density data).

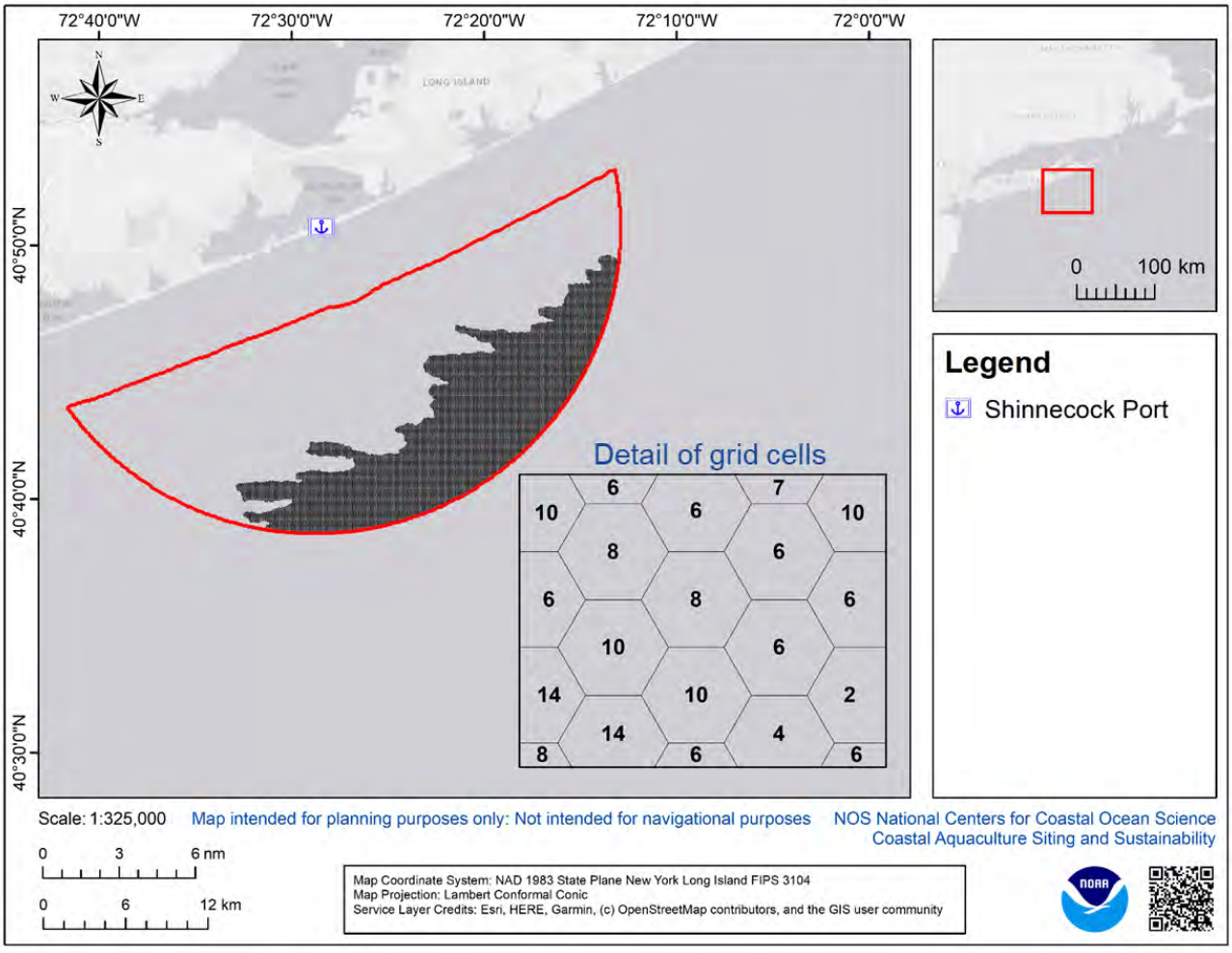


Figure 4. Gridded area within the depth parameters for the relative suitability analysis. The inset shows the detail of the one-hectare hexagonal grid, with example numbers from Automatic Information System (AIS) vessel transit data.

Overall, 15 individual spatial data sets were included in the suitability analysis, while 311 were acknowledged and documented for further review (Table 2 and Table A-1). Each data set included in the model was assigned a score schema ranging from 0 (low suitability) to 1 (high suitability) determined by its compatibility with an offshore aquaculture farm. All data sets were evaluated to determine if a feature was present or absent in each grid cell. For continuous data, such as bathymetry, sediment grain size, etc., mean values for each grid cell were calculated and scores were assigned based on the 25%, 50%, and 75% quartiles (Tables 3-7). Any grid cell that contained a data layer with a score of 0 was considered to be unsuitable for aquaculture regardless of the other scores, as this indicates a complete incompatibility of aquaculture in that cell. The scores for each data set were integrated by summing all individual values by grid cells across all data sets and dividing by the total number of data sets, providing a proportion from 0 to 1, with values closer to 0 representing 'low suitability' and values closer to 1 representing 'high suitability' relative to the other grid cells. Therefore, the final proportion calculation provides the relative suitability of that cell to the other grid cells.

A Local Indicator of Spatial Association (LISA) analysis (i.e., a type of cluster analysis) was then used to identify statistically significant clusters of the highly suitable grid cells (Anselin 1995). Esri™ ArcGIS Pro's "Cluster and Outlier Analysis" tool was used to perform the LISA analysis (ESRI 2020). The fixed distance spatial conceptualization with a 125 m search distance was used, along with row standardization, a false discovery rate correction, and 999 iterations. Visual assessment and review of the high-high clusters was performed, and alternative sites were identified within these clusters. A sensitivity analysis or review of major constraints from the suitability model, as well as other data sets, was performed for the alternative sites (Figure 5).

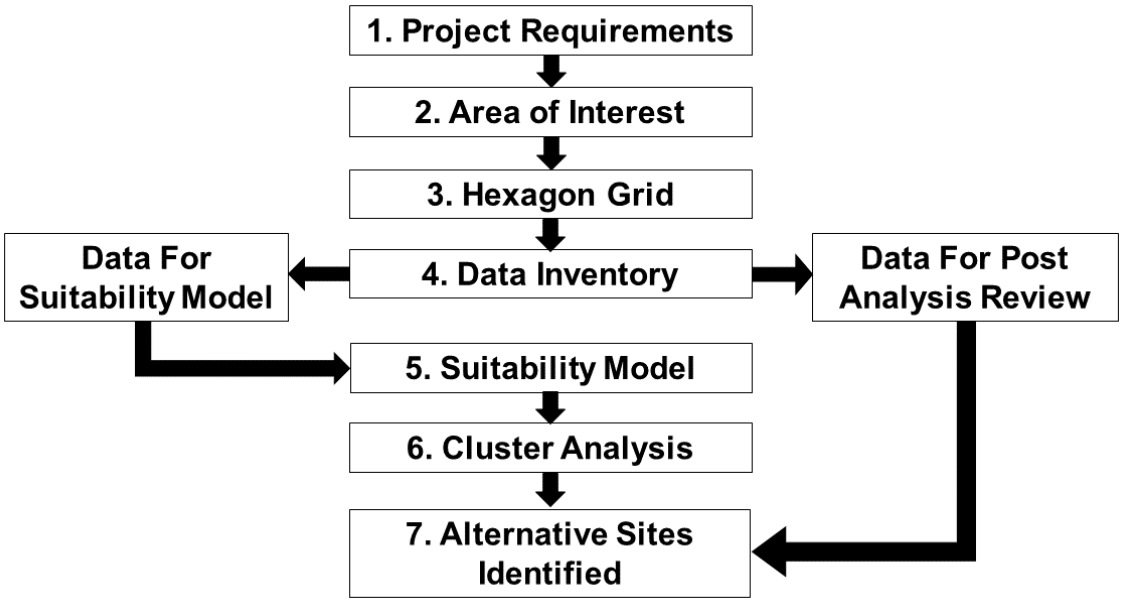


Figure 5. Overview of workflow for alternative site suitability analysis.

Table 2. Spatial data sets present within the area of interest and used for the suitability model.

Data sets used in suitability model
Distance to Port <10 nm
Bathymetry
Slope
Sediment grain size
AIS 2017 Vessel Traffic – Cargo
AIS 2017 Vessel Traffic – Tanker
AIS 2017 Vessel Traffic – Tug/Tow
AIS 2017 Vessel Traffic – Fishing
AIS 2017 Vessel Traffic – Pleasure Craft / Sailing
AIS 2017 Vessel Traffic – Passenger
AIS 2017 Vessel Traffic – Other
Vessel Monitoring System (VMS) 2009-2019 Vessel Traffic
Military Operating Area
Submarine Cable
Commercial Whale Watching

Table 3. Discrete spatial data layers included in the relative suitability analysis with scores ranging from 0 (low suitability) to 1 (high suitability).

Parameter / Data Layer	**Inside cell Score**	**Outside cell Score**	**Data Source***
<10 nm of Port	0.5	1	
Military Operating Area	0.5	1	USN
Submarine Cable	0	1	NOAA OCM
Commercial Whale Watching	0.5	1	NOAA OCM
* National Oceanic and Atmospheric Administration (NOAA), Office for Coastal Management (OCM), U.S. Navy (USN)			

Table 4. Continuous spatial data layers included in the relative suitability analysis with scores ranging from 0 (low suitability) to 1 (high suitability).

Parameter	**Value**	**Score**	**Source**
Mean Bathymetry (m)	< 38	0	NOAA
	≥ 38 and < 50	0.5	
	≥ 50	1	
Slope (°)	< 0.07	1	NOAA
	≥ 0.07 and < 0.13	0.7	
	≥ 0.13 and < 0.21	0.4	
	≥ 0.21	0.1	
Sediment Grain Size (mm)	≤ 2	1	The Nature Conservancy
	> 2	0.5	

Table 5. Commercial fishing effort from Vessel Monitoring System (VMS) categories and scoring schema ranging from 0 (low suitability) to 1 (high suitability).

Mean VMS vessel transits 2009 -2019	Score
0	1
<17.09	0.7
≥ 17.09 and < 20.18	0.5
≥ 20.18 and < 23.45	0.3
≥ 23.45	0.1

Table 6. AIS vessel counts by vessel type categories is the count of the vessel that passed through a grid cell over the course of 2017 with the corresponding scores ranging from 0 (low suitability) to 1 (high suitability).

Vessel Count Categories by Type				Score
Fishing	Passenger	Pleasure	Other	
0	0	0	0	1
1-4	1	1-4	1-2	0.8
5-6	≥ 2	5-6	3-4	0.6
7-10		7-8	-	0.4
> 10		> 8	> 4	0.2

Table 7. Larger vessels with limited maneuverability associated with established shipping lanes from the AIS 2017 data. With scores ranging from 0 (low suitability) to 1 (high suitability).

Vessel Count Categories by type			Score
Cargo	Tanker	Tug/Tow	
0	0	0	1
1	1	1	0.5
≥ 2	≥ 2	≥ 2	0.1

RESULTS

Preliminary Assessment of Ocean Neighborhood

National Security Considerations

Military operational areas and areas of national security interest were reviewed in the final gridded AOI (Figure 6). The Narragansett Operating Complex (including W-105, W-106, which are both Special Use Air Space) is adjacent to the coasts of Rhode Island and Long Island, New York, and is operated by the Fleet Area Control and Surveillance Facility, Virginia Capes (FACSFAC VACAPES) Naval Air Station Oceana (MC 2018). Military training activities within portions of these designated areas may be

conducted, and may extend from the surface to seafloor as exercises are performed throughout the water column (NSSC 2020).

Additional training operations come from the Naval Undersea Warfare Center (NUWC) based in Newport, Rhode Island.[1] The mission states the NUWC provides research, development, test and evaluation, engineering analysis and assessment, and fleet support for submarines, autonomous underwater systems, undersea weapon systems, and stewards existing and emerging technologies in support of undersea warfare (NSSC 2020). Activities occurring in the testing area (Figure 5, orange outline with grey hatching) change in space and time.

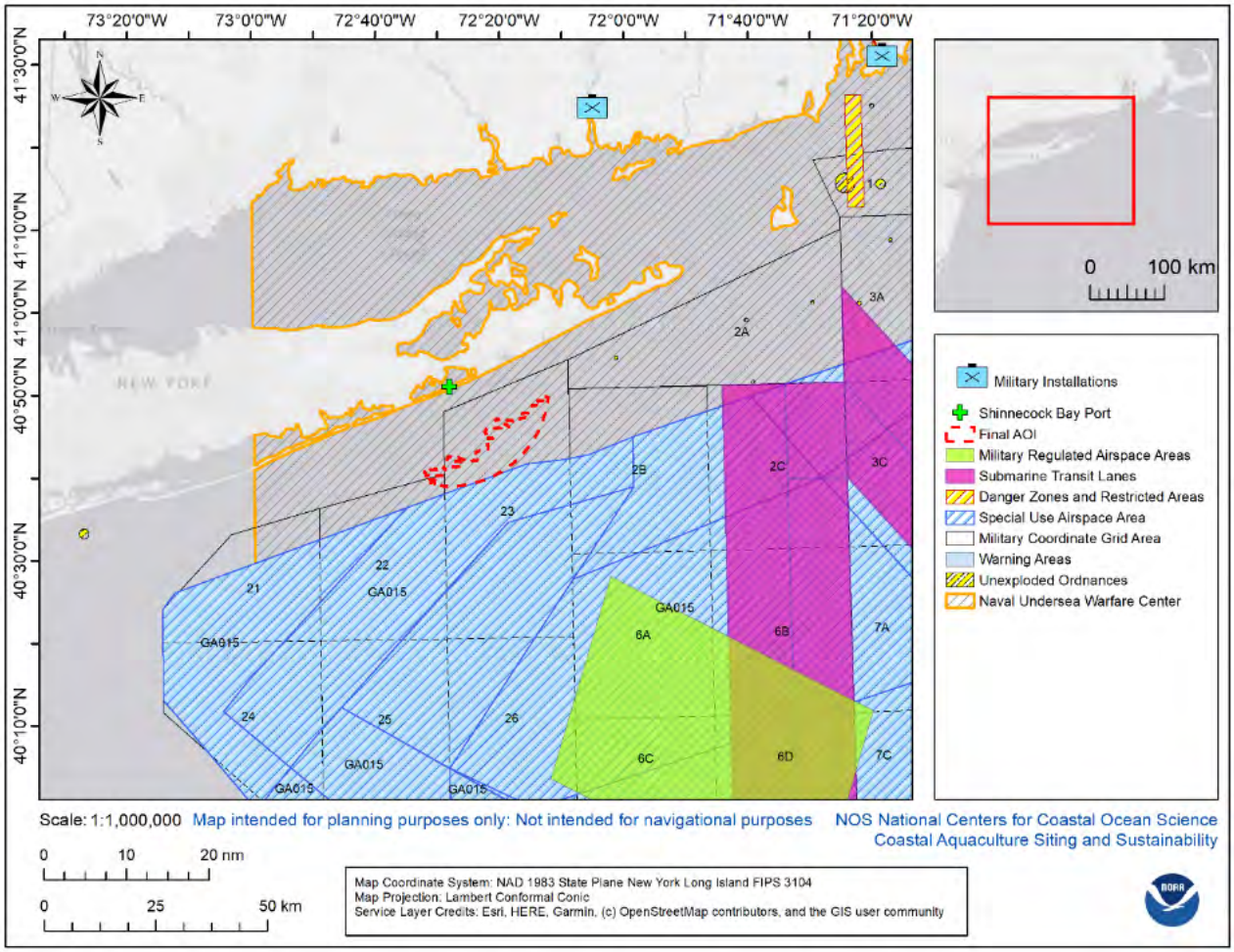


Figure 6. AOI intersects Narragansett OPAREA 23 and 22 as well as Naval Undersea Warfare Center testing and evaluation space, but it does not intersect with Special Use Airspace, Military Regulated Air Space, Submarine Transit Lanes, areas marked with unexploded ordnance, or Warning Areas.

[1] https://www.navsea.navy.mil/Home/Warfare-Centers/NUWC-Newport/Who-We-Are/

Navigational Considerations

Data were gathered to determine relative interference with navigation and navigational routes. Automated Identification System (AIS) data (OCM 2018) were analyzed to determine the relative vessel count (i.e., vessel traffic) of each vessel type (i.e., tanker, cargo, passenger, tug and tow, pleasure and sailing, and other vessels – e.g., first responders) within the AOI (Figure 7). AIS data from 2017, the most recent year available from the NOAA Office for Coastal Management, were used for the analysis. For the AOI, vessel density is relatively low for all vessel types. The highest vessel traffic within the AOI came from fishing and pleasure craft/sailing vessels (Figure 7). Local authorities and the U.S. Coast Guard are aware of regattas or other events when heavy recreational boating traffic occurs (in both time and space) in the region. To view each of the AIS maps individually, please refer to Appendix A, Figure A-1 (A – F). Other possible navigation conflicts were also evaluated including shipping fairways, separation zones, areas to be avoided, pilot boarding areas, active anchorage areas, regulated navigational space, navigable waterways, ferry routes, shipwrecks and obstructions, polluting wrecks, and artificial reefs (Figure 8).

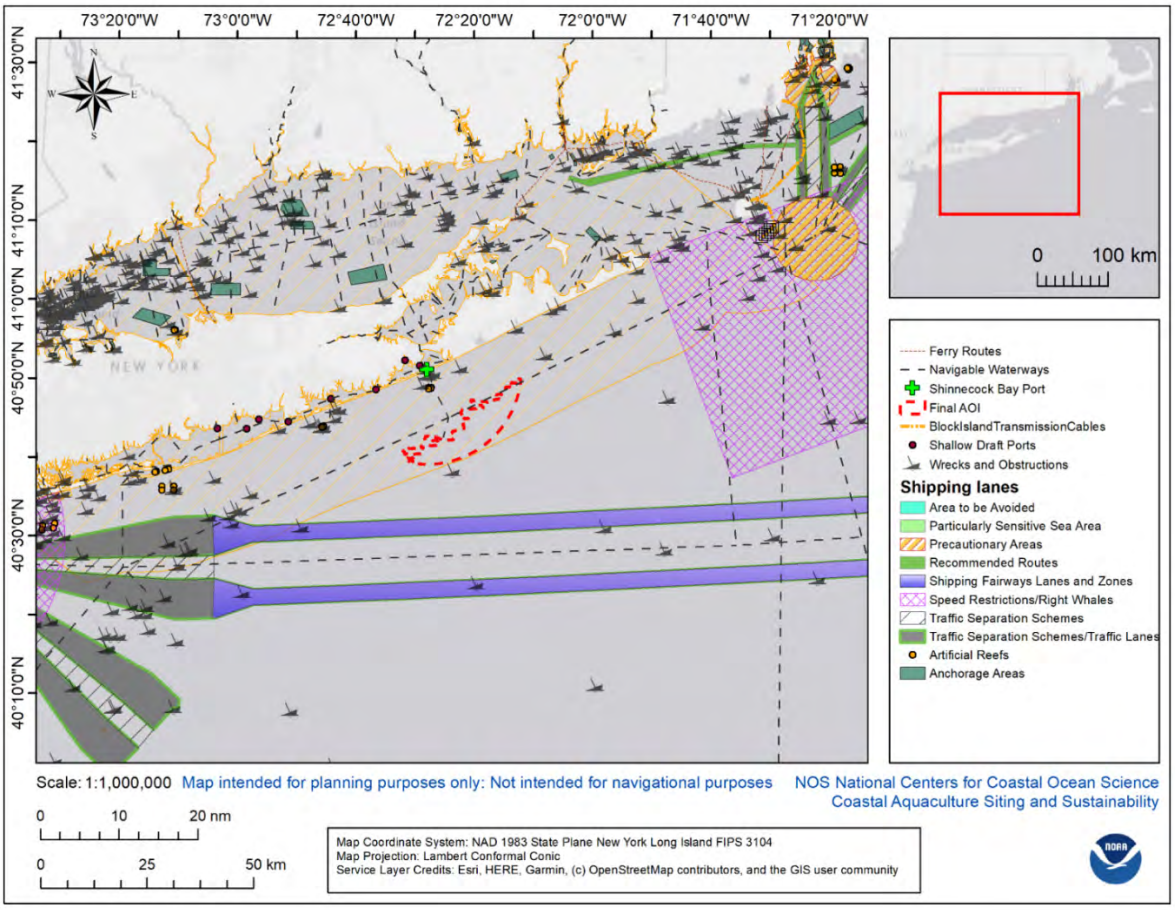


Figure 7. Navigation and transportation considerations within the ocean neighborhood of the AOI. Shipwrecks, shipping routes, areas to be avoided, speed restriction zones for the endangered North Atlantic Right Whales, artificial reefs, anchorage areas, precautionary areas, traffic separation schemes, shallow draft ports, navigable waterways, ferry routes, transmission cable (Block Island), Shinnecock Bay Port, safety zones, and particularly sensitive sea areas were considered for the AOI.

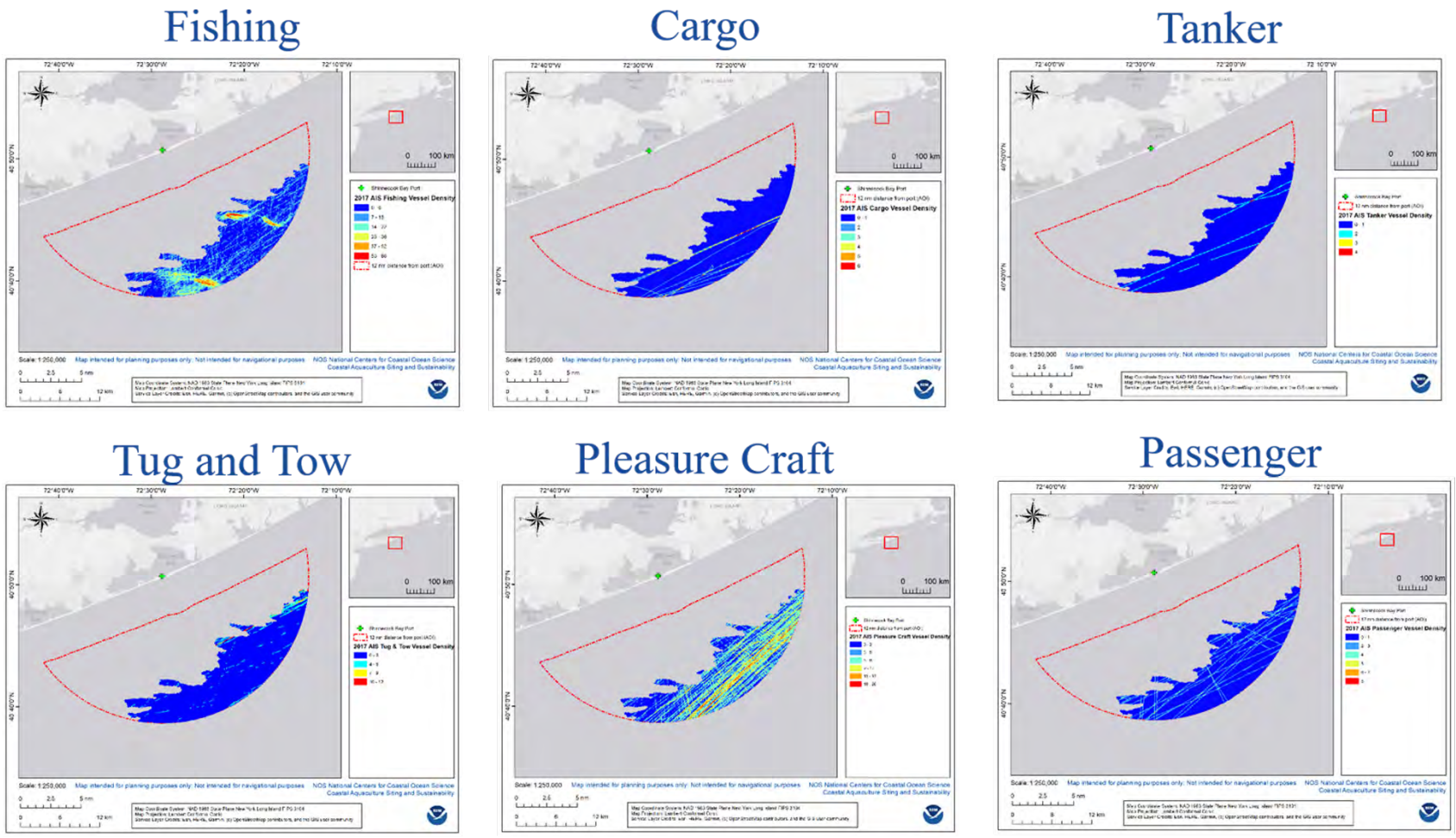


Figure 8. Automated Identification System (AIS) vessel transit density, shown as number of vessel transit/vessel type/grid cell/year for the AOI. All vessel density is considered relatively low to the many surrounding areas, but fishing vessels and pleasure craft/sailing has the highest number of transits through the AOI in 2017.

Industry and Infrastructure Considerations

Industrial activities in the Northeast U.S. considered herein included pipeline outfall structures, cable and pipeline areas, wind energy planning and lease areas, and submarine cables (Figure 9). Submarine cables, wind energy cables, and wind energy turbine lease areas are all dominant uses in the coastal waters off Suffolk County, New York. Specifically, a submarine cable runs through the northeast portion of the AOI and is part of BOEM OCS-A 0512 (Figure 9).

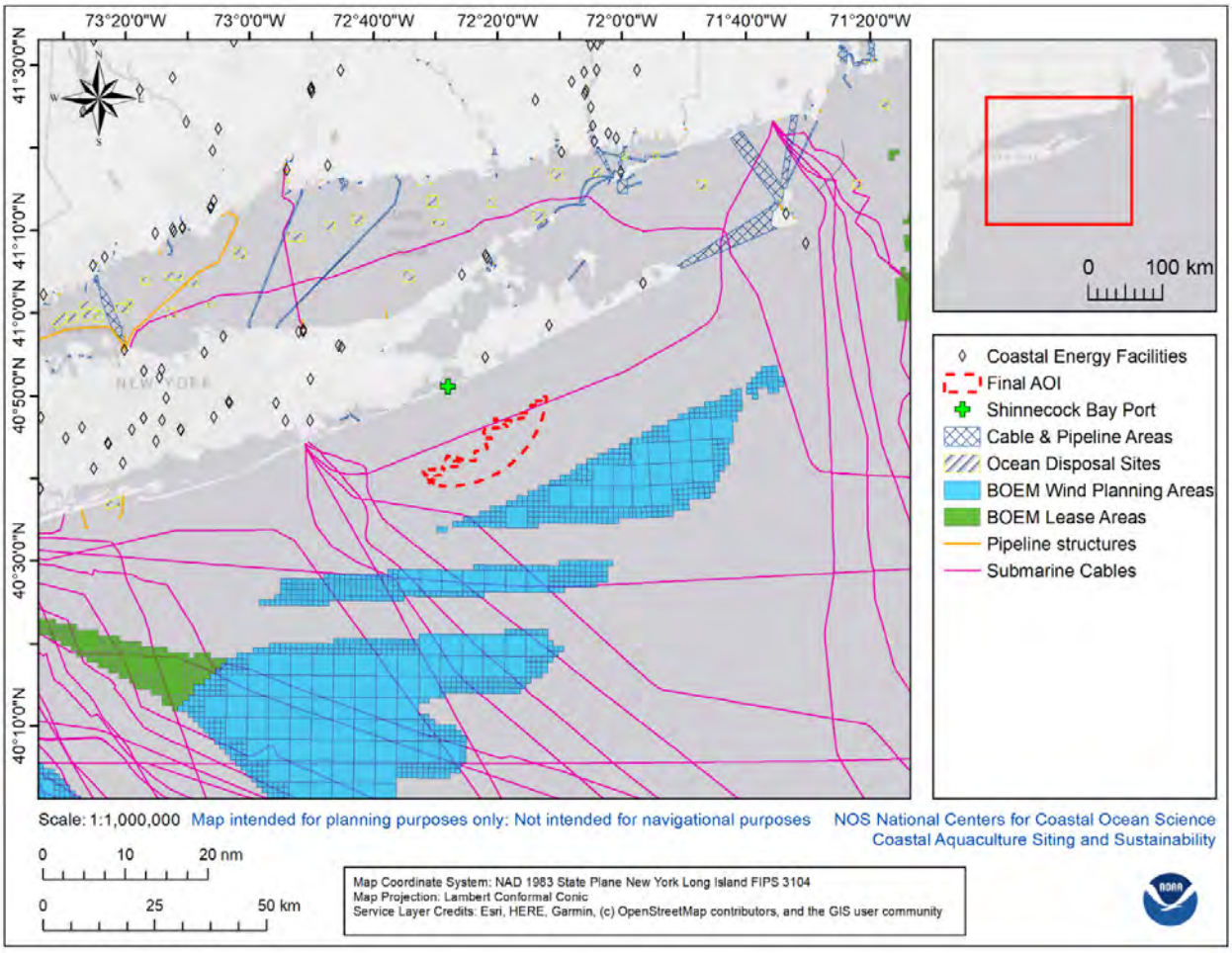


Figure 9. Energy and industry infrastructure in the ocean neighborhood of the AOI. BOEM wind planning and lease areas, pipelines (outfall structures), submarine cable, ocean disposal areas, cable and pipeline areas, and coastal energy facility locations were all considered if relevant to the AOI.

Social (Recreation) and Cultural Considerations

Social and cultural activities were examined, as empirical data exists for recreational ocean-based activities in the region. Recreational boater routes, recreational fishing areas, paddleboard events, boat launches, commercial whale watching areas, distance sailing races, secured lands, federally-recognized tribes, national historical places, scuba diving areas, water trails, and individual ocean uses (i.e., a survey conducted by SeaPlan, Surfrider Foundation, and Point 97 under the direction of the Northeast Regional Planning Body – see Longley-Wood 2015) were all considered. These layers were helpful to characterize culturally sensitive areas and areas the public uses regularly for ocean-based activities. The recreational

activity overlapping the planning area is a supplemental area, one type of commercial whale watching area (Figure 10). General use commercial whale watching areas reflect the full footprint of whale watching activity for 3 – 5 years (2010 – 2014) regardless of frequency or intensity. Dominant use commercial whale watching areas (all areas routinely used), according to seasonal patterns. Commercial whale watching transit routes include areas used for transit to and from general or dominant use areas; and supplemental areas depict areas used for activities closely related to whale watching and infrequent specialty trips. The commercial whale watching data layer was used in the suitability analysis, as it is an indicator where cetacean activity is likely occurring.

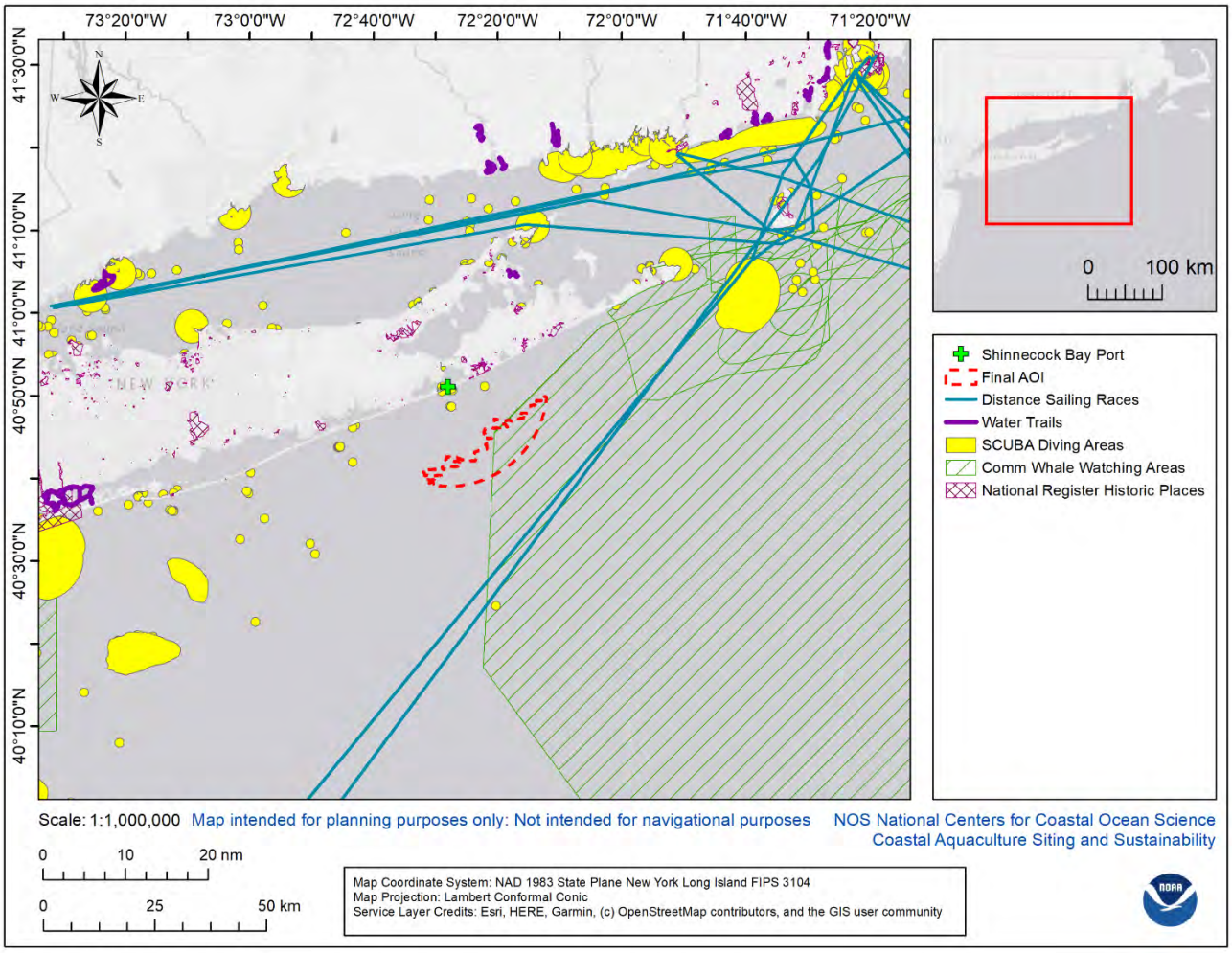


Figure 10. Recreational SCUBA diving areas, long-distance sailing races, national historic locations, and commercial whale watching areas around the Long Island coastal area.[2]

[2] Available from http://archive.neoceanplanning.org/wp-content/uploads/2015/10/Recreation-Study_Final-Report.pdf. Retrieved on March 2, 2020.

Commercial Fishing Considerations

The NMFS Office of Law Enforcement (OLE) tracks many important fisheries activities through the use of Vessel Monitoring System (VMS) data. However, other valued fisheries species data does not exist through VMS, so each species is also described for the final AOIs through literature and information from NMFS GARFO and the NEFSC. Please refer to Appendix A-2 to read the full species description and contacts for these, and other, fisheries species.[3] VMS data is subject to strict confidentiality restrictions, and are presented in summary format cognizant of the sensitivities using such data for planning purposes. Mean VMS patterns are displayed from 2009 - 2019 in the planning area (Figure 11). For this analysis we calculated a mean fishing vessel density over the 11-year time period for each grid cell. Within the AOI, there are areas that have prominent, consistent mean fishing vessel traffic over that time period (i.e., the northeast and southwest corners of the AOI). These data were categorized using a histogram approach and are included in the suitability analysis.

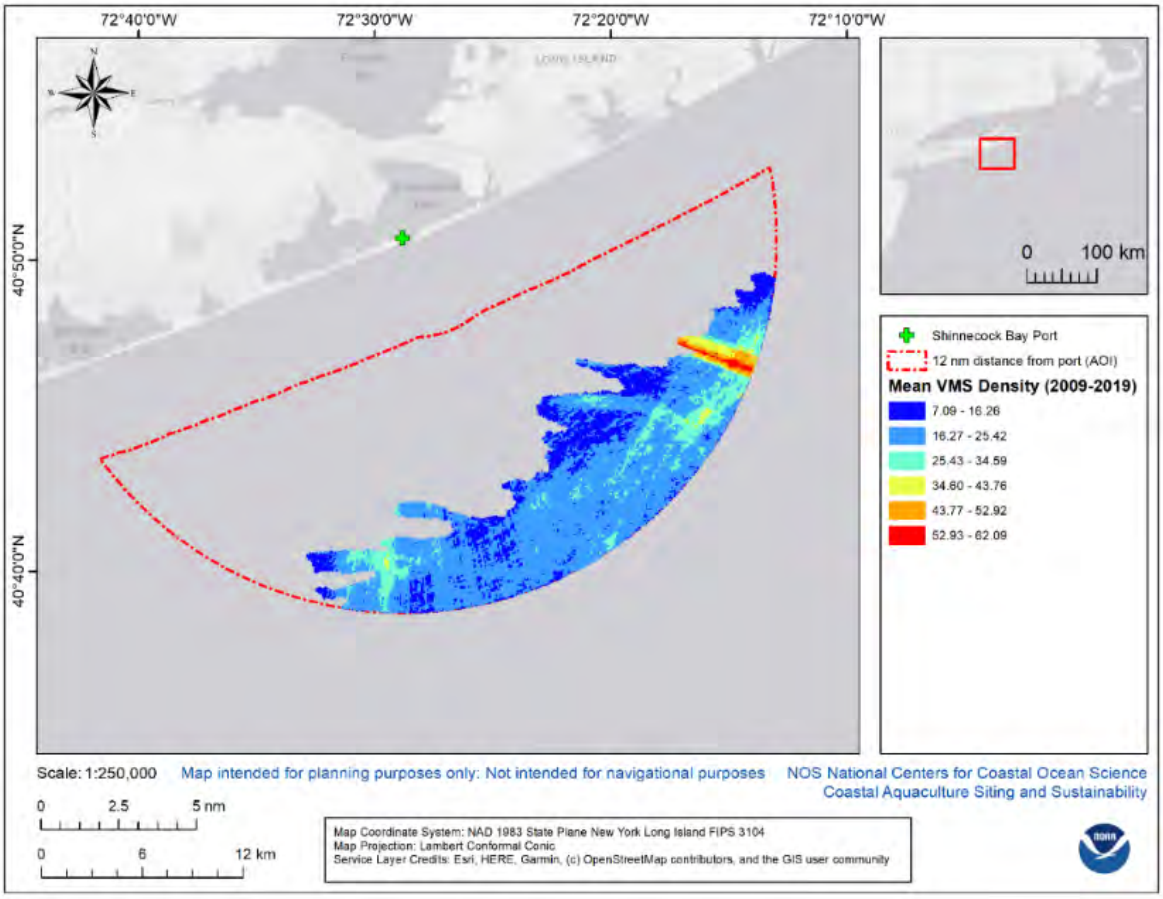


Figure 11. Mean VMS density per grid cell over an 11-year sampling period (2009 – 2019). The blue colors reflect lower mean VMS density, while the orange and red colors reflect higher fishing vessel density over the eleven-year time period.

[3] Also, visit https://www.fisheries.noaa.gov/new-england-mid-atlantic/resources-fishing/resources-fishing-greater-atlantic-region, https://www.nefmc.org/, and https://www.fisheries.noaa.gov/resources/maps?title=&field_management_area_value%5BNew%20England%5D=New%20England&field_management_area_value%5BMid-Atlantic%5D=Mid-Atlantic&field_species_vocab_target_id=&sort_by=created for more information on fisheries management in the region.

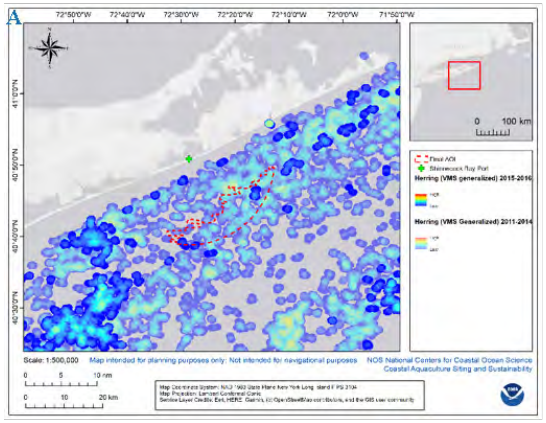
While not at as high of spatial resolution as the VMS transit density, the generalized VMS (NEOD 2020) and Vessel Trip Report (VTR) data and maps (St. Martin and Olsen 2017) are useful in providing characterization of activities in the ocean neighborhood for the proposed operation (Figure 12A – Figure 12E, Figure 13A – Figure 13E). These data followed a process of removing sensitive vessel locations using the "rule of three" mandated by OLE by utilizing a screening grid to identify grid cells containing three or more VMS records. VMS records within cells that contain fewer than three VMS records were not included in the analysis. A statistical method to normalize data was used on the subsequent density grids, and data values represent standard deviations (NEOD 2020). There is no distinction among vessel transit, fishing activity type, or other vessel activities, therefore the data displayed is when the vessel was traveling less than four knots, as this is the speed fishing is likely to occur. To view each of the maps in Figures 12 and 13 individually, please refer to Appendix A, Figure A-2 (A – E), and Figure A-3 (A – E). Sea scallop average abundance and biomass (meat weight in kg) (University of Massachusetts, Dartmouth, SMAST) can be viewed in supplemental Figure A-4. The Mid-Atlantic Ocean Data Portal also has future projections for many important fisheries species in the region relative to thermal shifts that also may be of use from a screening-level planning perspective (MARCO 2020).[4]

For site characterization purposes, generalized commercial fishing activity data (Figure 12A – Figure 12E) from 2011 – 2016, or some period therein, showed low overlap within the AOI in relative comparison to areas around the AOI. There was minimal overlap with the Herring and Monkfish fishery efforts (Figure 12A and 12B). The multi-species effort (including the Herring, Monkfish, and Mackerel fisheries) had low effort in the western portion of the AOI. Sea Scallop fishing activity is moderately high in the southwestern portion of the AOI as well (Figure 12C), and squid fishing is moderate on the western portion of the AOI. For more information on many of these fisheries, please refer to Table A-2 and Table A-3, which list the species distribution and fisheries management areas in and around the AOI, respectively. Heat maps derived from VTR data from 2011 to 2015 indicate bottom trawls (both vessels under and over 65 feet) occur most frequently on the western side of the AOI (Figure 13A and 13B). Sea Scallop dredging appears to occur throughout the AOI, with the highest effort in the outer central portion of the AOI (Figure 13C). Gillnet usage appears the highest in the western part of the AOI, with lighter effort in the center of the area (Figure 13D). Low effort for pots and trap gear in the AOI appeared in the data from 2011 to 2015 for the AOI (Figure 13E).

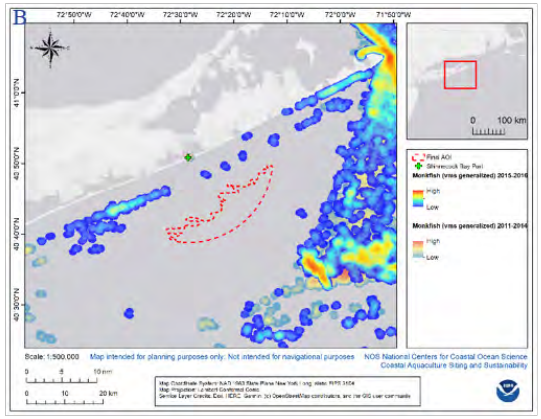
VMS data also have limitations. For example, VMS data only provide positional data, declarations, and does not necessarily translate to landings or accurate species information. VTR reports can supplement this information, and the NEFSC Social Science Branch has the VTR-Observer model and other tools using landings and revenue data over time and space, offering possibly a better characterization of fisheries effort. However, inclusion of the model within this analysis is outside the scope of this pre-permitting document and is anticipated to be incorporated as part of the NEPA analysis during permitting. In the interim, by visiting the NEFSC's Fishing Footprints[5] website for revenue and landings in the Northeast, users can visualize data overtime time and space and obtain a general sense of potential economic impacts to capture fisheries if displaced by new ocean-based operations.

[4] https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0196127
[5] https://fish.nefsc.noaa.gov/read/socialsci/fishing-footprints.php

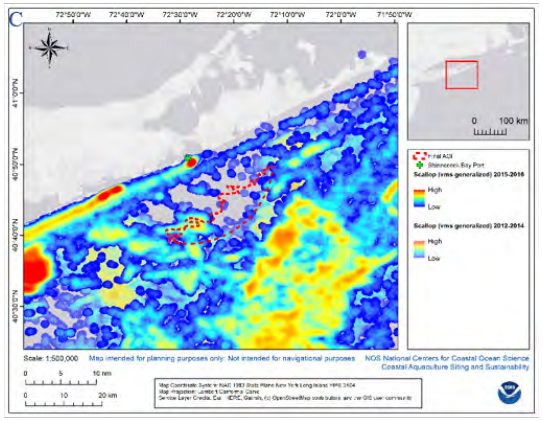
Herring (2011 to 2016)



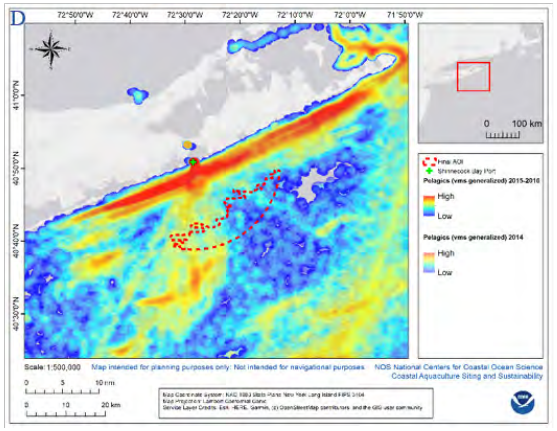
Monkfish (2011 to 2016)



Sea Scallops (2012 to 2016)



Pelagics (2014 to 2016)



SMB - Squid (2014 to 2016)

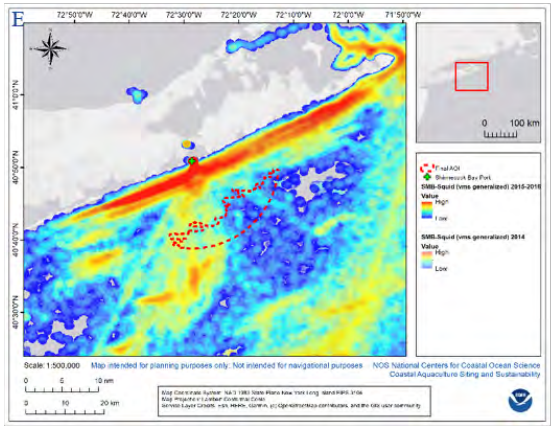
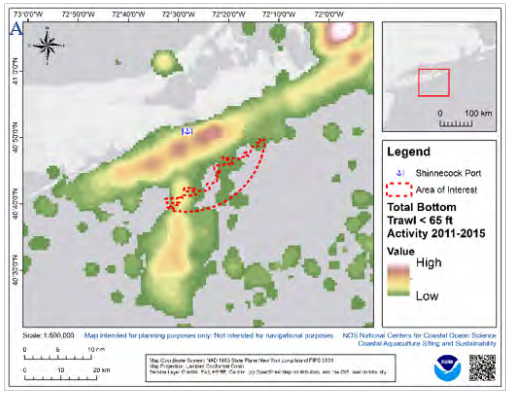


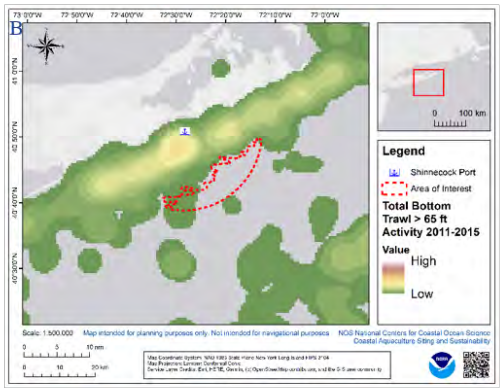
Figure 12A – E. Generalized Vessel Monitoring System (VMS) data (NEOD 2018) for Herring (2011 – 2016), Monkfish (2011-2016), Sea Scallops (2012- 2016), pelagic species (2014- 2016), and squid from the Squid-Mackerel-Butterfish complex. To view each of the maps individually, please refer to Appendix A, Figure A-2 (A – E), and Figure A-3 (A – E).[6]

[6] https://www.northeastoceandata.org/files/metadata/Themes/CommercialFishing/VMSCommercialFishingDensity.pdf

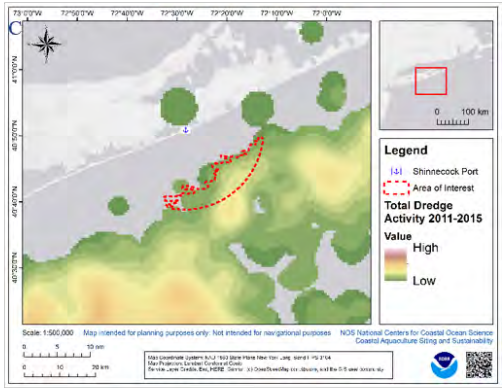
Bottom Trawl (<65 ft)
(2011 to 2015)



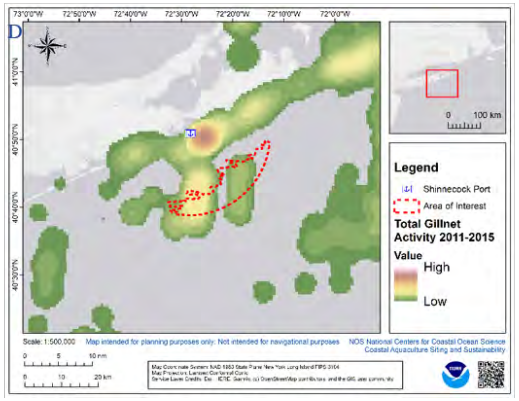
Bottom Trawl (>65 ft)
(2011 to 2015)



Sea Scallop Dredging
(2012 to 2015)



Gillnet (2011 to 2015)



Traps & Pots (2011 to 2015)

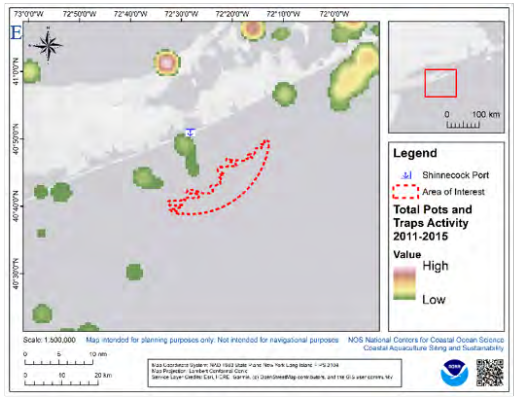


Figure 13A – E. Generalized data using Vessel Trip Reports (VTR) to show different fishing gear types and effort over time. These heat maps indicating effort (green is lower effort, while red is higher effort) were then overlaid (using the web service from Northeast Ocean Data) with the AOI to determine where the largest areas of usage for these gears occurred within the AOI. More information on eVTR reporting can be found from the New England and Mid-Atlantic Fisheries Councils VTR framework[7] or from Vessel Trip Reporting in the Greater Atlantic Region[8].

[7] https://s3.amazonaws.com/nefmc.org/eVTR_Fwk_document_Final_3_4_2020.pdf
[8] https://www.fisheries.noaa.gov/new-england-mid-atlantic/resources-fishing/vessel-trip-reporting-greater-atlantic-region

Protected Resource & Essential Fish Habitat (EFH) Considerations

Protected species considered in the AOI include cetaceans (e.g., Fin whales, North Atlantic Right Whales), seabirds (e.g., Gannet spp.), sea turtles (e.g., Green, Loggerhead, Leatherback, and Kemp's Ridley Sea Turtles), and seal species (e.g., Harbor Seal, Gray Seal).[9] Protected species considerations were not included in the weighted spatial analysis, but rather characterized to visualize potential overlaps that may occur in the region. The majority of known data sources are at a resolution too coarse for precision siting of aquaculture (e.g., one to two 10 x 10 km grid cell may cover the entire AOI), and therefore need regional expertise and further consultation beyond this technical siting report. Bird species characterization is beyond the scope of this report, although there are data available for many species.[10] As uncertainty exists in type and number of interactions with seabirds and finfish operations, an independent, farm-specific characterization is anticipated to be completed during the NEPA process, and expert review of potential interactions will occur at that time.

For cetacean characterization purposes, NOAA NEFSC and MDAT (Curtice et al. 2019) provides cetacean density estimates based on season in the Northeastern U.S. at from the NEFSC's AMAPPS Marine Mammal Model viewer[11] and Duke University-hosted OBIS-SEAMAP data[12], models[13], and technical reports[14]. These density estimates are at a relatively coarse spatial resolution for precision siting of aquaculture, but provide valuable insights into the distribution of protected species at the regional scale.[15] Statistical estimates from the data are also available including calculations of average density, 95% confidence interval, 5% confidence interval, coefficient of variation, and standard deviation (NEOD 2020). For screening and characterization purposes, MDAT Cetacean density data were overlaid with the AOI and were considered low average density relative to surrounding areas in the region (Figure 14). Looking at the MDAT Core Distribution Area for Baleen Whales, the purpose of which is to show a core abundance area representing the smallest area containing 50% of the predicted abundance of each included species, does not overlap with the AOI, but is in close proximity to one cell with the lowest score of '1' (highest score is 4) (MARCO 2020). North Atlantic Right Whales and Fin Whales Section 7 Consultation areas overlap with the AOI (Table 8). Other important whale species in the area are listed in Figure 14. In addition to cetacean species, the endangered Atlantic Sturgeon (*Acipenser oxyrinchus*) Section 7 consultation area also overlaps the AOI.

The NOAA Fisheries Atlantic Large Whale Take Reduction Team has also developed the Right Whale Risk Reduction Decision Support Tool.[16] Under an independent panel of non-NOAA scientists, panelists

[9] https://www.nefsc.noaa.gov/ecosys/ecosystem-ecology/pinnipeds.html
[10] https://portal.midatlanticocean.org/data-catalog/conservation/
[11] https://apps-nefsc.fisheries.noaa.gov/AMAPPSviewer/
[12] http://seamap.env.duke.edu/
[13] http://seamap.env.duke.edu/models/
[14] http://seamap.env.duke.edu/models/mdat/MDAT-Technical-Report.pdf
[15] We also considered information from the following sites: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-species-critical-habitat-information-maps-greater; & https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-mammal-protection/protecting-marine-life-new-england-mid-atlantic
[16] https://www.fisheries.noaa.gov/feature-story/decision-support-tool-helpful-those-finding-ways-reduce-whale-entanglement-fishing

concluded the decision support tool provides a transparent way for industry and resource agencies to compare relative changes in entanglement risk for North Atlantic Right Whales under various fishing scenarios (NOAA 2020). At present, it is beyond the scope of this technical report to add in additional modeling efforts, but see it as a valuable component to regional decision-making regarding two at-risk cetacean species. We anticipate that NEPA analysis and environmental documentation completed during permit review will include species-specific model assessment from the Risk Reduction Tool.

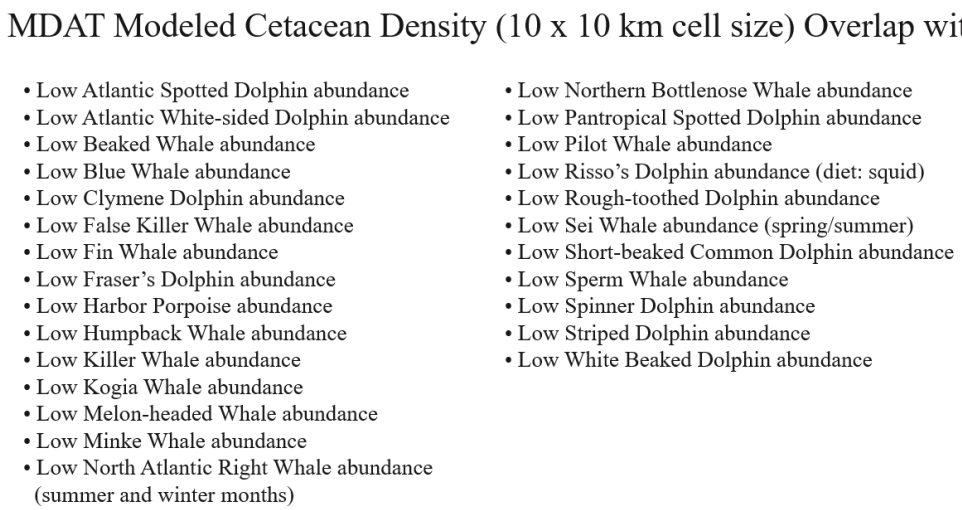


Figure 14. Mean Density estimates (10 km x 10 km grid cells) for cetaceans for the East coast are available (MDAT – Marine-life Data Analysis Team)[17], however at the precision-siting level, data are at a spatial resolution too coarse to be informative. Here we use at as a screening mechanism to determine relative density at the regional scale.

NEFSC sea turtle data, provided as SPUE (Sightings per Unit Effort) in 10 minute grid cells, were used to characterize which seasons had the highest relative presence (and overlap) of sea turtles in the AOI, with summer being the season with the highest SPUE for Loggerhead and Leatherback Sea Turtles (Figure 15) (MARCO 2020)[18]. All other seasons have relatively low presence for all four ESA-listed sea turtle species in the region. The SPUE of sea turtle observations and the annual density of Loggerhead Sea Turtles (Figure 16), which is moderately low, were used as a proxy for sea turtles during different seasons and annually, respectively. Section 7 consultation areas overlap the AOI for Green, Loggerhead, Leatherback, and Kemp's Ridley Sea Turtles (Table 8). The NEFSC SPUE data are at a resolution that is too coarse too make any precision-level siting decisions, and therefore were characterized, as with mammalian species, to describe generalized movements within and around the AOI. Consultation with protected resources biologists will be imperative in permitting and final siting, in conjunction with EFH assessment(s).

[17] http://seamap.env.duke.edu/models/mdat/MDAT-Technical-Report.pdf
[18] https://portal.midatlanticocean.org/static/data_manager/metadata/html/MigratoryPortfolio.html

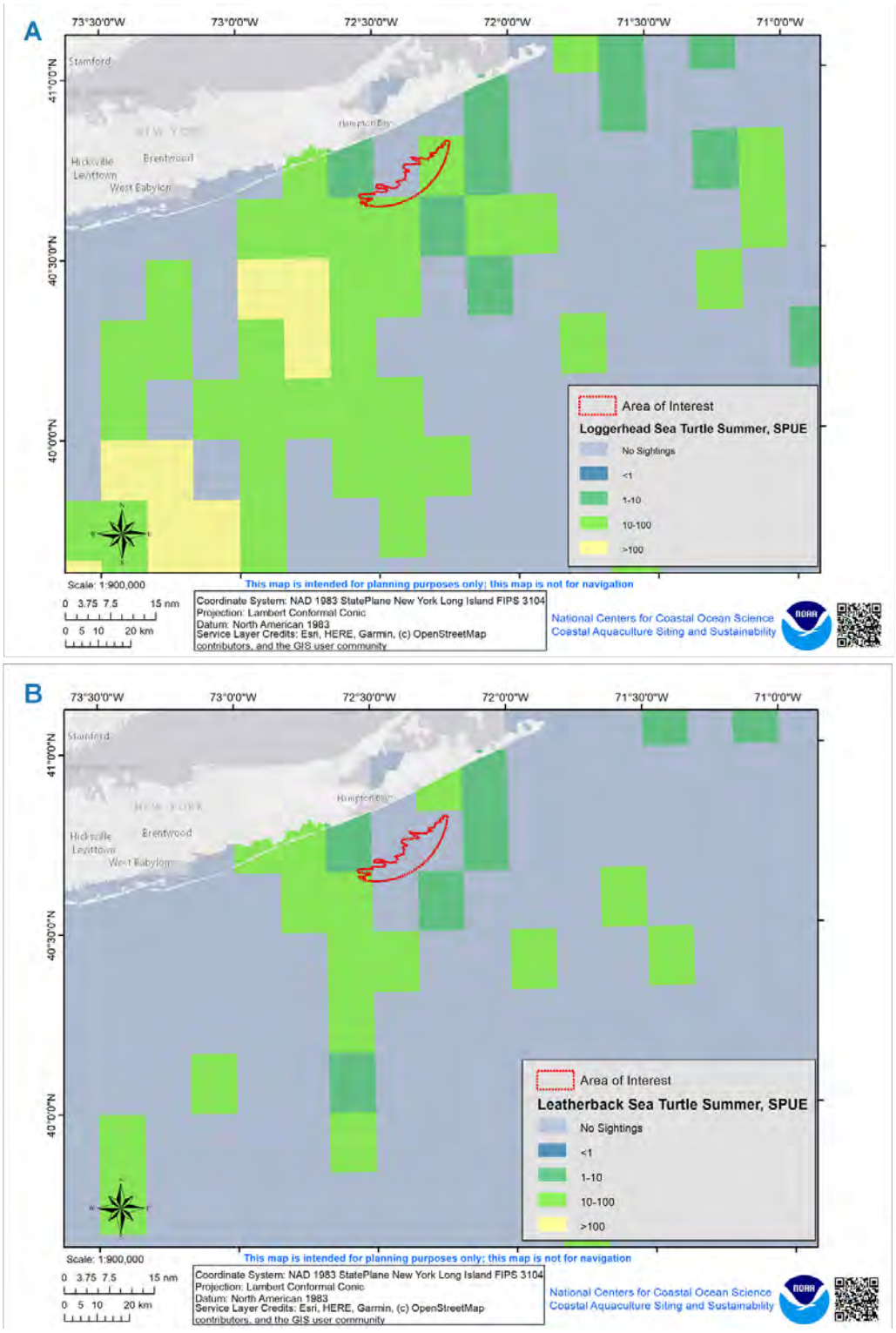


Figure 15. Sightings data were collated from NMFS-NEFSC Aerial Surveys, NMFS-NEFSC Shipboard Surveys, and the North Atlantic Right Whale Consortium Database to formulate the data layer used for sea turtles. The validity of sightings was screened and verified by U.S. Navy contractors before inclusion in the model. Sightings for each ten-minute grid cell were divided by the effort for each cell to calculate Sightings per Unit Effort (SPUE). SPUE was calculated for each target species, for each season, and for each ten minute square.

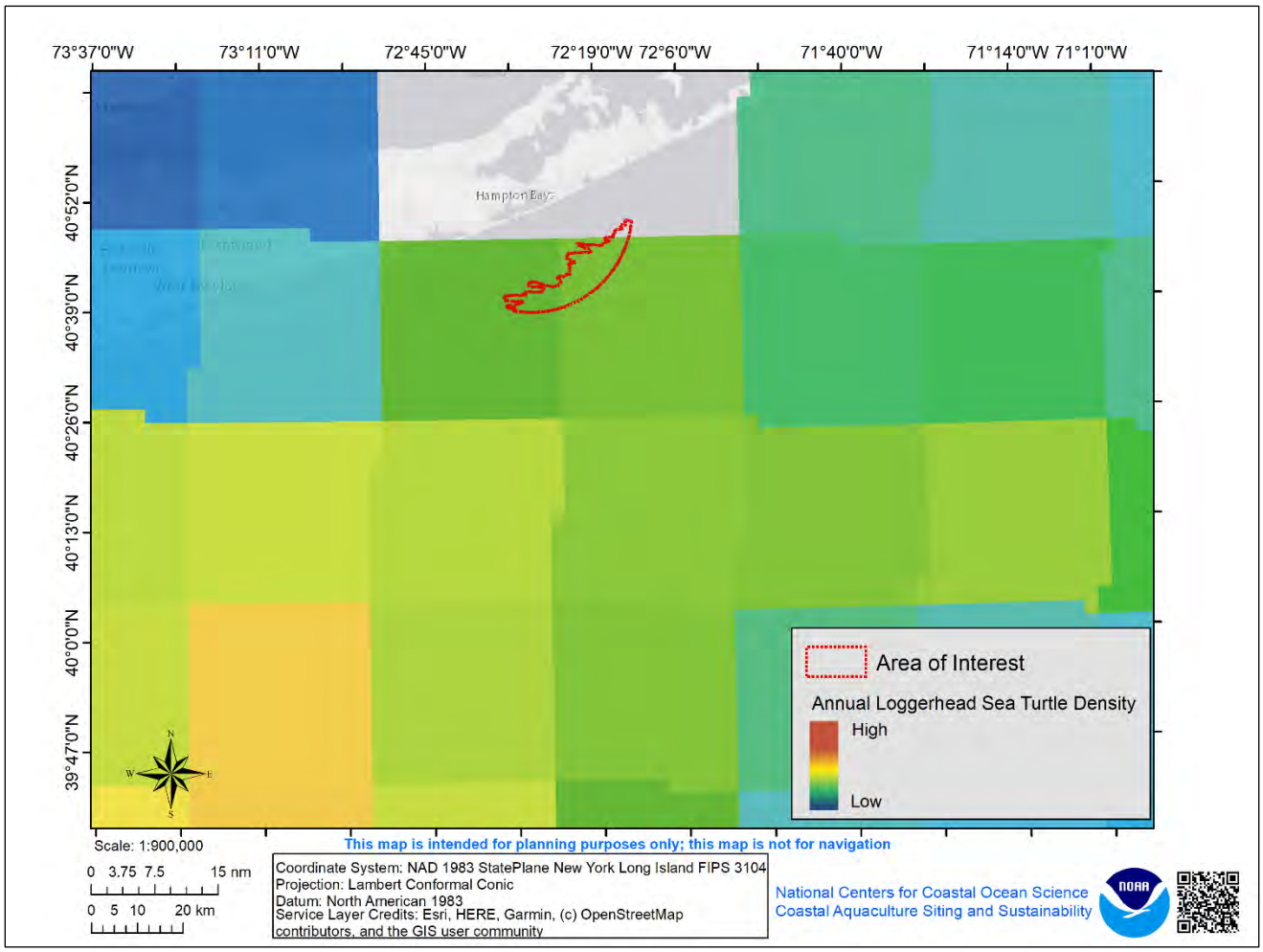


Figure 16. Data layers represent data from satellite tags deployed on large juvenile and adult Loggerheads (n = 271) in the Northwest Atlantic by 6 tagging programs between 2004 and 2016. Mixed effect models were used to map spatial variation in the relative density of tagged individuals over the time. The higher density areas shown in these data products are based on more than 10 years of satellite tagging data, and represent the relative distribution of tagged individuals that may be expected within a grid cell on average in a given month.[19]

[19] https://pdfs.semanticscholar.org/5f3b/42cecc9c486c3a325c2f20319963dd148c84.pdf

Table 8. Section 7 Consultation Areas intersecting on overlapping the original AOI.

Section 7 Areas	Manna AOI
Atlantic Large Whales	
North Atlantic Right Whale	Yes
Fin Whale	Yes
Sei Whale	No
Sperm Whale	No
Blue Whale	No
Sea Turtles	
Green Sea Turtle	Yes
Loggerhead Sea Turtle	Yes
Kemp's Ridley Sea Turtle	Yes
Leatherback Sea Turtle	Yes
ESA Fisheries Species	
Atlantic Sturgeon	Yes
Shortnose Sturgeon	No
Offshore Atlantic Salmon	No

Essential Fish Habitat (EFH)

EFH covers waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (16 U.S.C. 1802(10)). EFH within the AOI has been designated for 19 species (i.e., species with active Fishery Management Plans - FMPs) (Table 9) and 12 highly migratory species. These species and EFH were compiled from NOAA's Guide to Essential Fish Habitat Designations in the Northeastern United States (NOAA 2014). This guide summarizes EFH designated by species and life stage for that species (i.e., eggs, larvae, juveniles, and adults). Highly migratory species of fish and sharks include Albacore and Bluefin Tuna (juveniles), Skipjack (all life stages), Thresher Shark (all life stages), Dusky Shark (all life stages), Sandbar Shark (all life stages), White Shark (all life stages), Smoothhound (all life stages), and the Sand Tiger shark (all life stages).

Table 9. EFH species within the Area of Interest. Each species' common name is listed in the table. Next to the name, in parentheses, are the species life stage(s) (i.e., E = egg, L= larvae, J = juveniles, A = adult) present in the AOI. In some instances, data only indicated presence/absence of a species. In these instances, an asterisk appears next to the name.

EFH Species in the AOI		
Atlantic Sea Scallop*	Summer Flounder (L, J, A)	Ocean Pout (E, L, A)
Black Sea Bass (J)	Witch Flounder (L)	Quahog (J, A)
Butterfish (E, L, J)	Windowpane Flounder (E, L, J, A)	Red Hake (E, L, J)
Little Skate (J)	Winter Flounder (E, L, J, A)	Scup (J, A)
Longfin Inshore squid*	Yellowtail Flounder (E, L, J, A)	Silver Hake (E, L, J, A)
Mackerel (E, L, J)	Spiny Dogfish (J)	

* Life stage data is not fully developed

Examples of parameters considered as sensitive habitats in this study include submerged aquatic vegetation, hard bottom areas, deep-sea coral observations, protected areas, and designated areas such as restoration project areas, and designated fisheries management areas. Species associated with those habitat areas were also characterized (e.g., Longfin Squid habitat, Surf clams, and biomass and abundance of Sea Scallops) in and around the AOI (Table A-2).

Benthic and sensitive habitats will be further characterized during the NEPA analysis process and will provide the needed regional expertise for such information to be accurate. Consultation with the protected resources biologist will be imperative in permitting and final siting along with EFH assessment(s) (please see more at https://www.nefmc.org/management-plans/habitat). Notably, this report only assesses overlap with protected species. It is up to the action agency to determine if a project is going to need ESA consultation. If the action agency determines that there is "no effect" to listed species or critical habitat, a consultation may not be required. If there may be an effect, consultation is required and an effects determination is then submitted.

Oceanographic Considerations

Significant wave height (H_s), wind speed, and water temperature were collected from the Montauk Point buoy (Station 44017, 40.693, -72.049), which is approximately 10-nm east of the area of interest (Figure 17). Significant wave height (H_s) is the average of the highest one-third (33%) of waves (measured from trough to crest) that occur in a given period. H_s is used because the larger waves are usually more significant than the smaller waves, as the larger waves can cause navigational challenges for mariners (NWS 2020). Significant wave heights from Station 44017 in the years 2005, 2007, 2010, 2013, and 2017 all had H_s values above 6.5 m (Figure 18). Generally, the largest waves occurred from November through mid-April. Wind data from the same 17-year time period displayed stronger and more variable wind speeds during the months of September to May (Figure 19).

Water temperature (0.6 m depth) from Station 44017 over the 17-year time period displayed a consistent seasonal trend, with colder sub-optimal temperatures occurring from February through mid-May, while warmer sub-optimal temperatures may occur from July through August (Figure 20). Understanding depth and variability of the thermocline throughout the year is important to determine potential impacts to the cultivated species when the cage is sunken during storms. Modeled data may also be a helpful supplement, where multiple depth levels can be assessed, and estimates made for an average depth of thermocline during various seasons. The Finite Volume Coastal Ocean Model (FVCOM) model (Chen et al. 2011) is available for the northeast region and may be consulted further along in the permitting process.

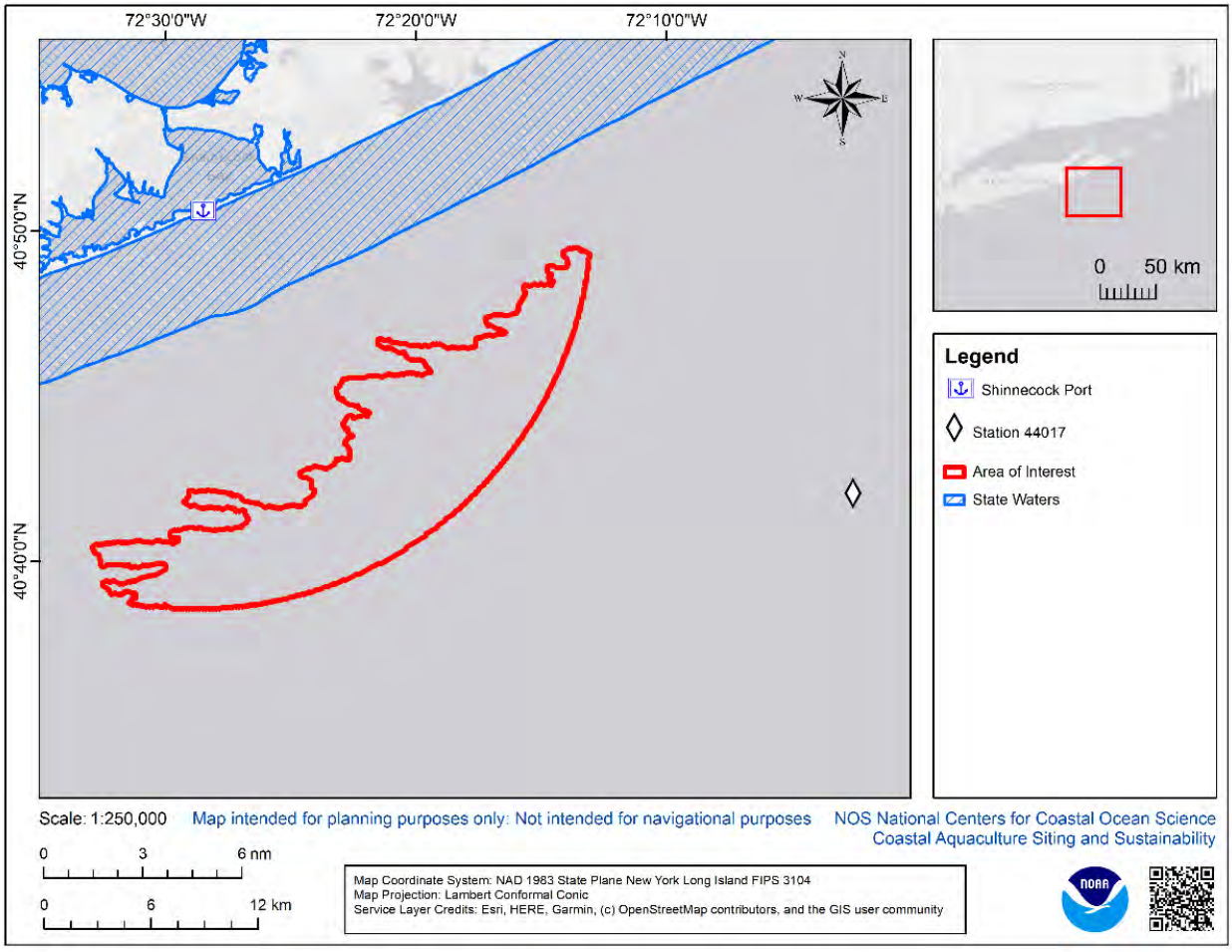


Figure 17. Meteorological and oceanographic data were collected from the Montauk Point buoy (Station 44017, 40.693, -72.049) (NDBC 2020).

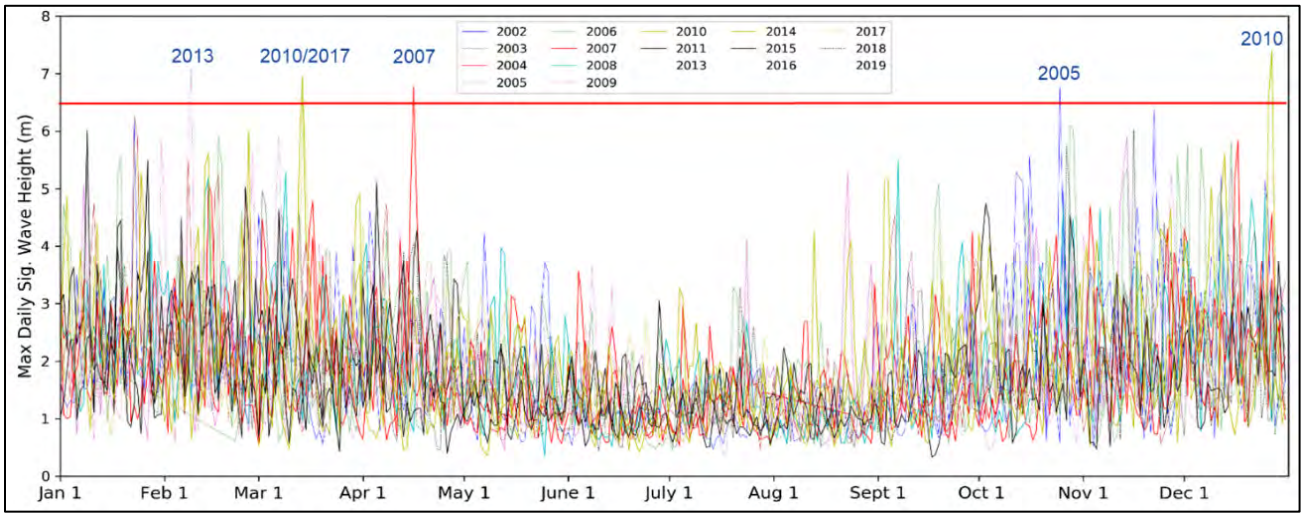


Figure 18. Significant wave height (H_s) data from 2002 to 2019 at oceanographic buoy station 44017 (NDBC 2020). The horizontal red line marks a H_s of 6.5 m. There are six instances during the assessed time period where this height was exceeded. There are no data for 2012.

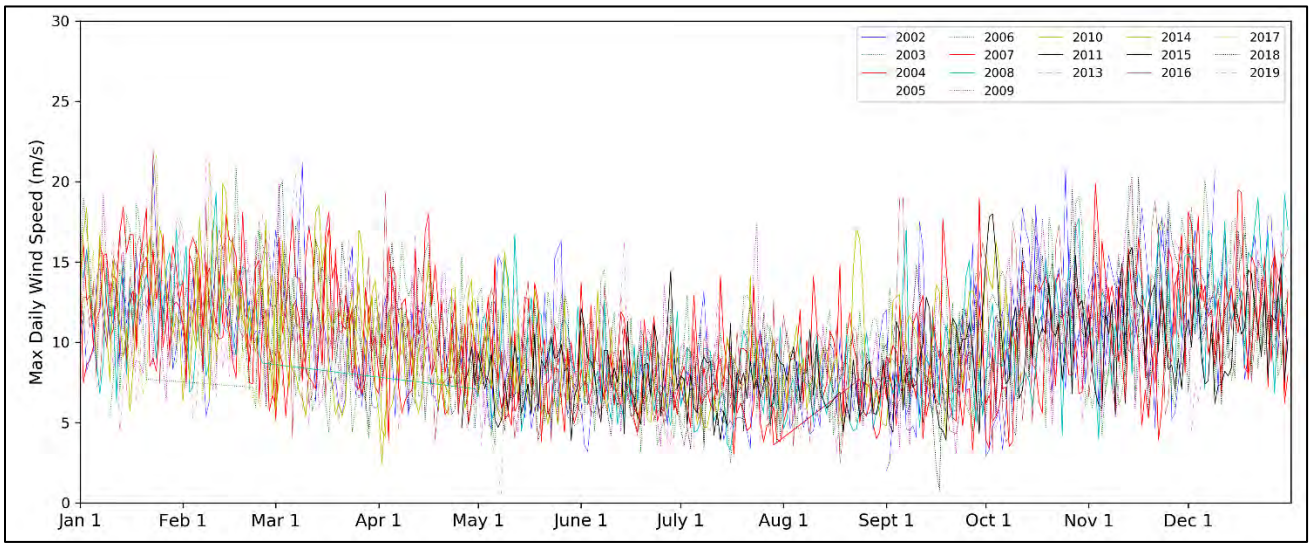


Figure 19. Maximum daily wind speeds from 2002 to 2019 at Montauk Point buoy (Station 44017, 40.693, -72.049). There are no data for 2012.

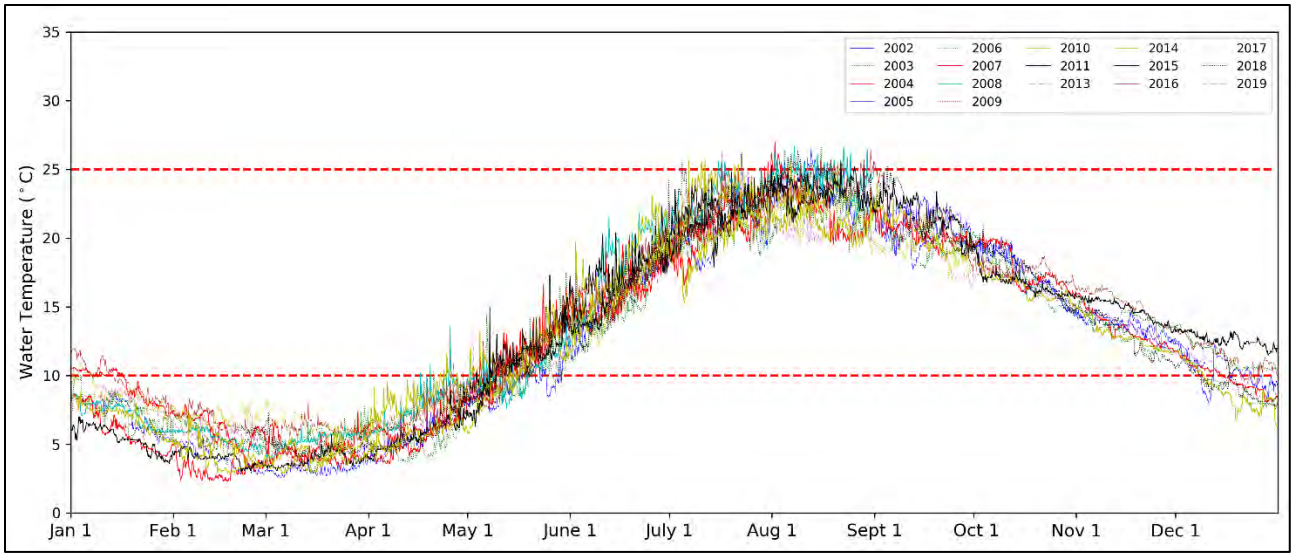


Figure 20. Hourly water temperature at 0.6 m depth from 2002 to 2019 at Montauk Point buoy (Station 44017, 40.693, -72.049). Area between red dotted lines are generally acceptable temperature ranges for grow out of Striped Bass or Steelhead Trout. All years follow the same seasonal trend. There are no data for 2012.

Moving from an AOI to Statistically Suitable Areas for Finfish Aquaculture

Initially, a large Area of Interest (AOI) was identified (~1056 km²) south of Shinnecock Port, Long Island, NY (Figure 1). Farm logistics required the location to be less than or equal to 12 nm from port and engineering requirements for the net pen required depths greater than 38 m (Figure 2). Once these parameters were considered, a smaller AOI of 180.89 km² was identified (Figure 3). The daily mean of

significant wave height was generally less than 3 m, with higher variations during the winter months (Figure 18). From May to December, sea surface conditions were in the acceptable temperature range (Figure 20). Surficial sediment data were obtained and used to determine compatibility with cage engineering needs (Figure 26B, Table 4). There were no interactions in the AOI with shipping fairways, wrecks and obstructions, unexploded ordnances, warning areas (e.g., Special Use Air Space), submarine transit lanes, ocean disposal sites, anchorage areas, pilot boarding areas, wind energy areas (planning or leased), or submerged aquatic vegetation (Table 10). There were however, interactions with two military areas, a commercial whale watching area, navigable waterway, and one submarine cable (Figure 21).

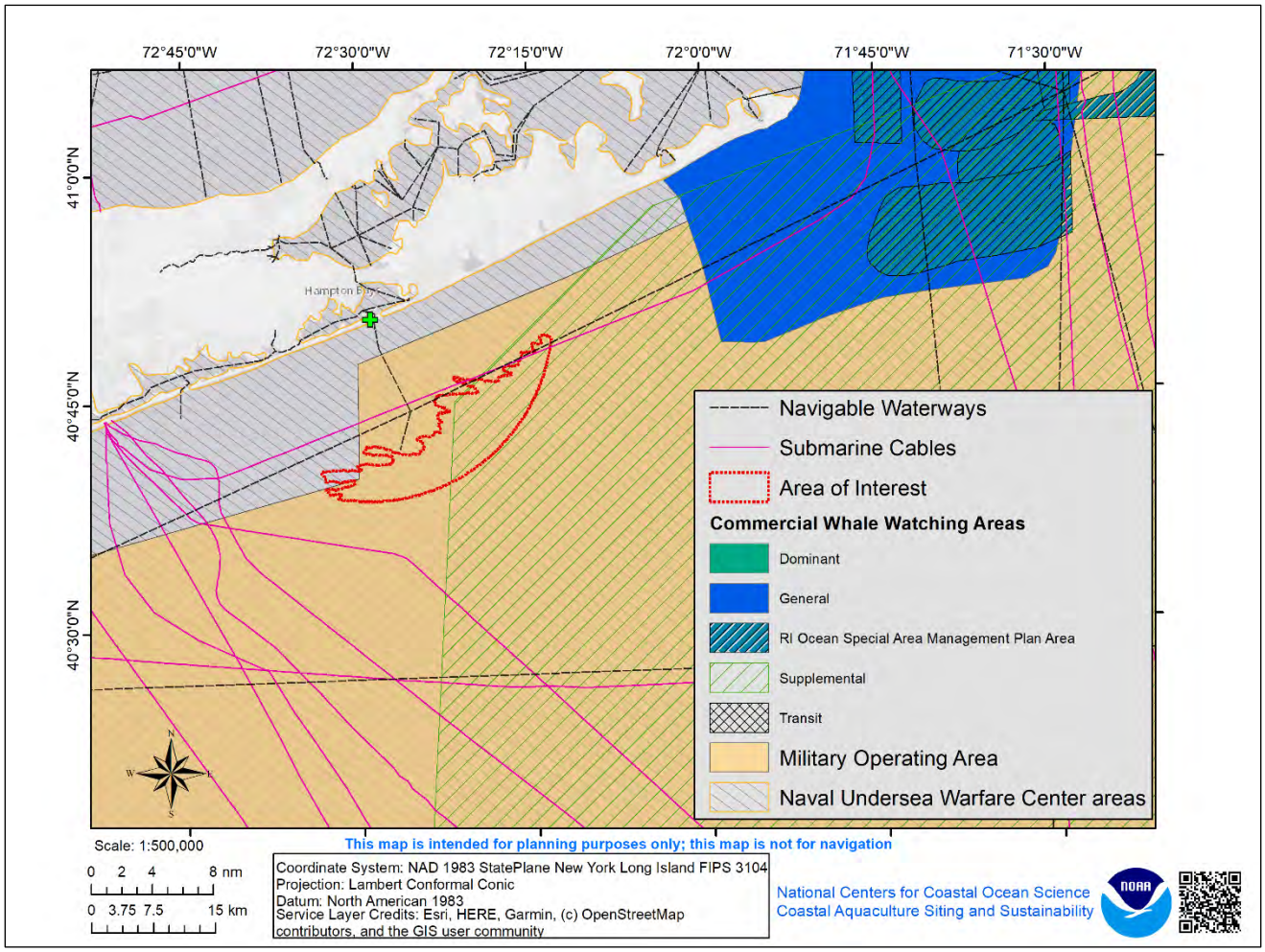


Figure 21. Overall discrete constraints for the AOI. Interactions included two military installations, the commercial whale watching area, and one submarine cable.

Final Site Suitability Model Output and Results

Figures 22 through 24 describe the site suitability process for the AOI. Once the factors needed in the suitability analysis were determined from the neighborhood assessment, all data layers were reviewed and scored appropriately for determining relative suitability in the AOI (Figure 22). The LISA analysis was then run to determine where the high-high clusters of suitable space occurred in the AOI (Figure

23). A polygon the size of the farm footprint was then applied to the high-high cluster areas to determine the number of alternative siting areas based on the factors considered. The polygon farm footprint was created by encompassing the areas with the highest relative suitability scores. Four alternative areas were identified during this process (Areas A, B, C and D), each encompassing a little more than 388 ha (one farm footprint) (Figure 24A). The four areas were then overlaid with the suitability analysis output to determine which constraints lowered the scores, and determine the types of conflict present (Figure 24B). The corner coordinates for each site (A – D) can be found in Table 11.

Table 10. Discrete spatial data sets NOT used for the suitability model.**

General Category	Data sets NOT used in suitability model*
Military	Special Use Air Space, Narragansett OPAREA 22 & 23, Military Regulated Air Space, submarine transit lane, unexploded ordnance, and Warning Areas
Transportation & Navigation	Shipwrecks, Areas to be avoided, speed restriction zones for the North Atlantic Right Whale, artificial reefs, anchorage areas, precautionary areas, traffic separation schemes, ferry routes
Fisheries Industry	Generalized Vessel Monitoring System (VMS) data (NEOD 2018) for Herring (2011 – 2016), Monkfish (2011-2016), Sea Scallops (2012- 2016), pelagic species (2014- 2016), and squid from the Squid-Mackerel-Butterfish complex; Generalized data using Vessel Trip Reports (VTR) to show different fishing gear types and effort over time; NEFSC's VTR-Observer Model; fisheries management areas
Energy & Infrastructure	BOEM wind planning and lease areas, pipelines (outfall structures), ocean disposal areas, cable and pipeline areas, and coastal energy facility locations
Natural Resources & EFH	Cetacean density (MDAT & NEFSC AMAPPS), seabird density, MDAT fish data
Recreation & Culture	Recreational SCUBA diving areas, long-distance sailing races, national historic locations

* These discrete data layers were not included in the suitability analysis for a multitude of reasons; e.g., they layer did not overlap or intersect the AOI, the layer did not have spatial or temporal coverage at a resolution appropriate for precision-siting, or because the nature of the interaction with aquaculture operations is not yet fully known – for instance certain fisheries management areas.

**Over 300 data layers were assessed in total and can be viewed in Table A-1.

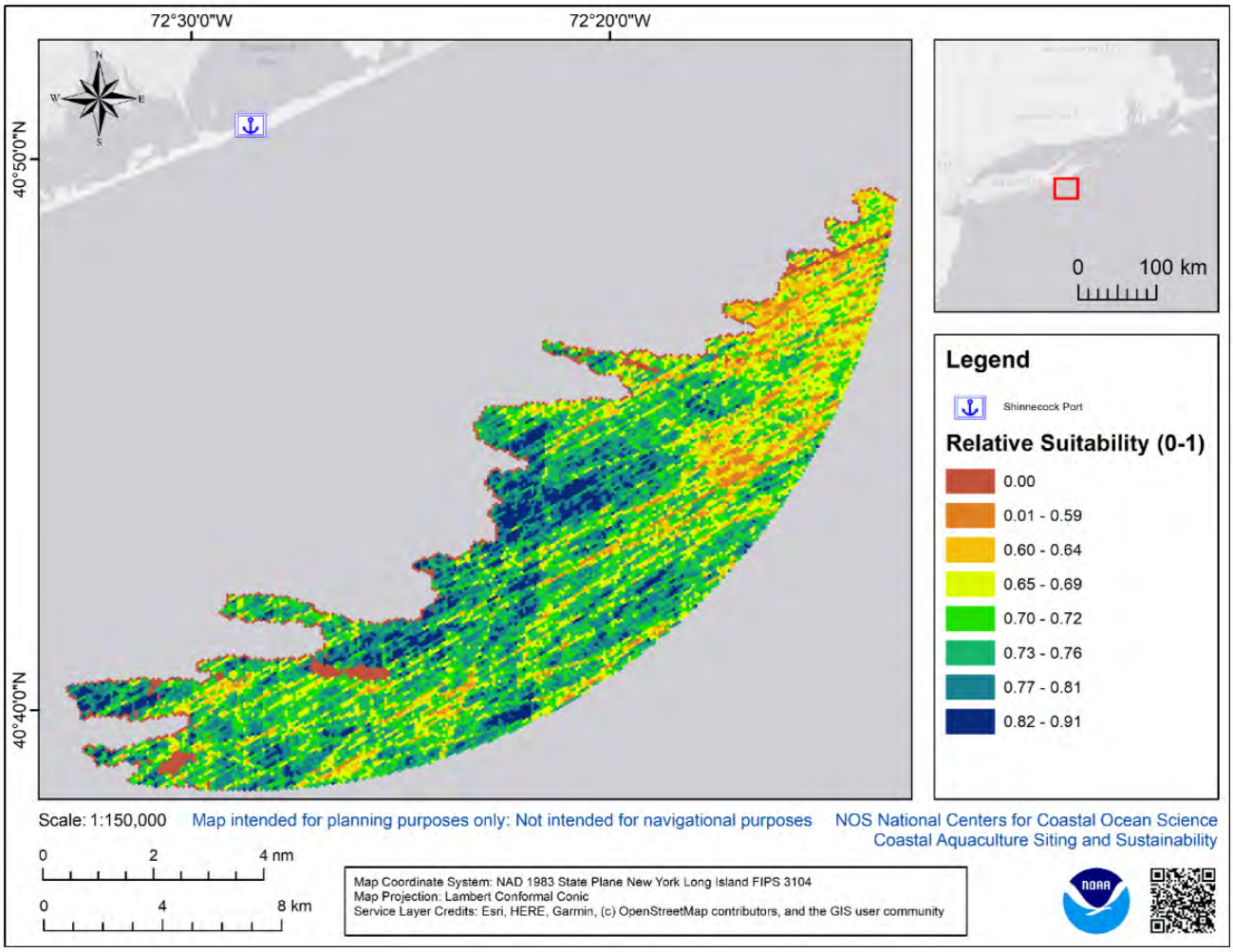


Figure 22. Final site suitability output for the AOI.

Table 11. Corner coordinates of alternative areas in decimal degrees.

Alternative Area	Longitude	Latitude
A	-72.32328033	40.74450684
A	-72.3236618	40.73181152
A	-72.35852051	40.71855545
A	-72.35823059	40.73033524
B	-72.35903931	40.71470642
B	-72.37952423	40.71489334
B	-72.37919617	40.73571777
B	-72.35852814	40.73552704
C	-72.42671967	40.69064713
C	-72.38775635	40.69173813
C	-72.42136383	40.67795563
C	-72.4502182	40.68082047
D	-72.55308533	40.67406082
D	-72.50177765	40.67433548
D	-72.50870514	40.66476059
D	-72.54767609	40.66463852

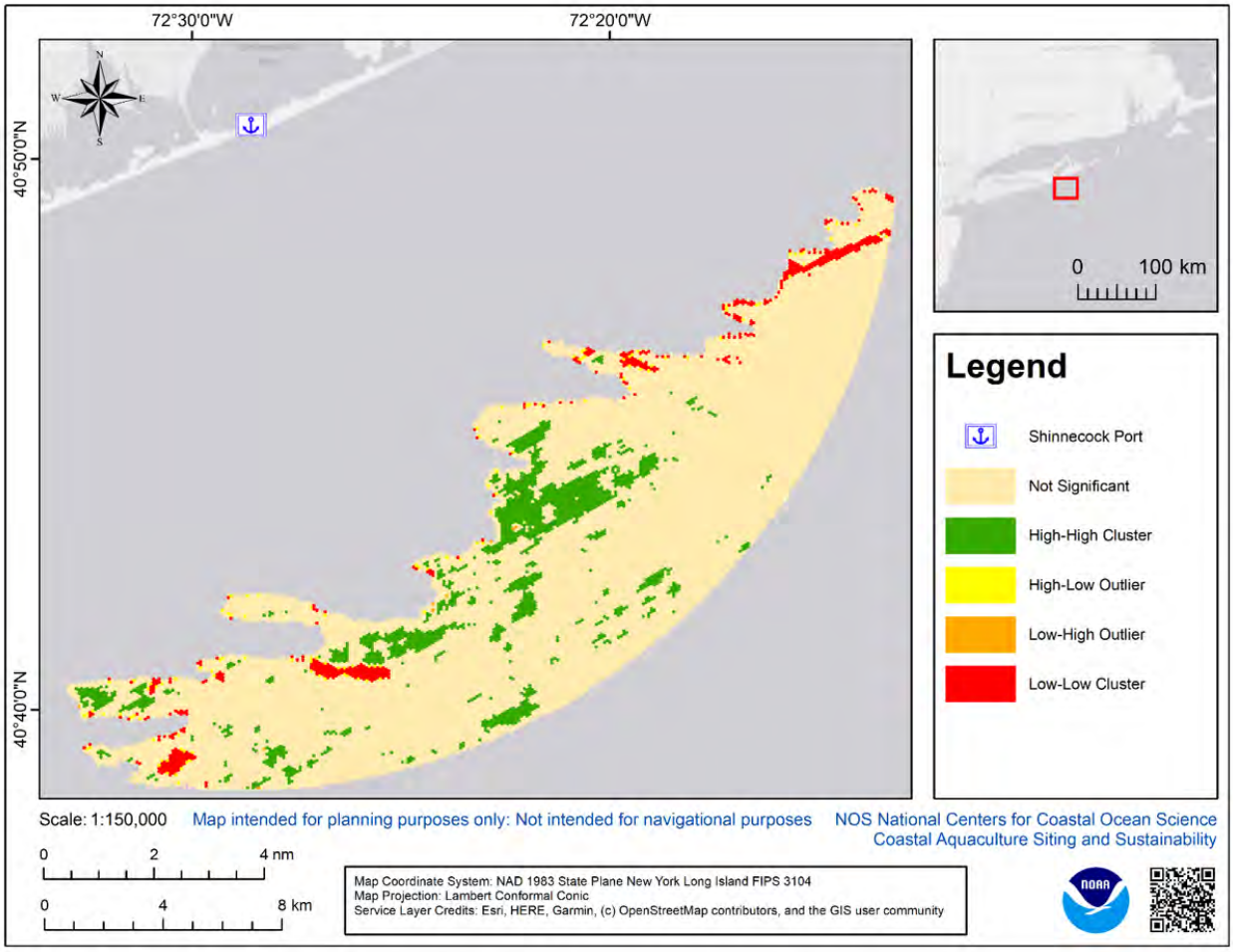


Figure 23. The LISA cluster analysis and statistically significant clusters of the suitability scores.

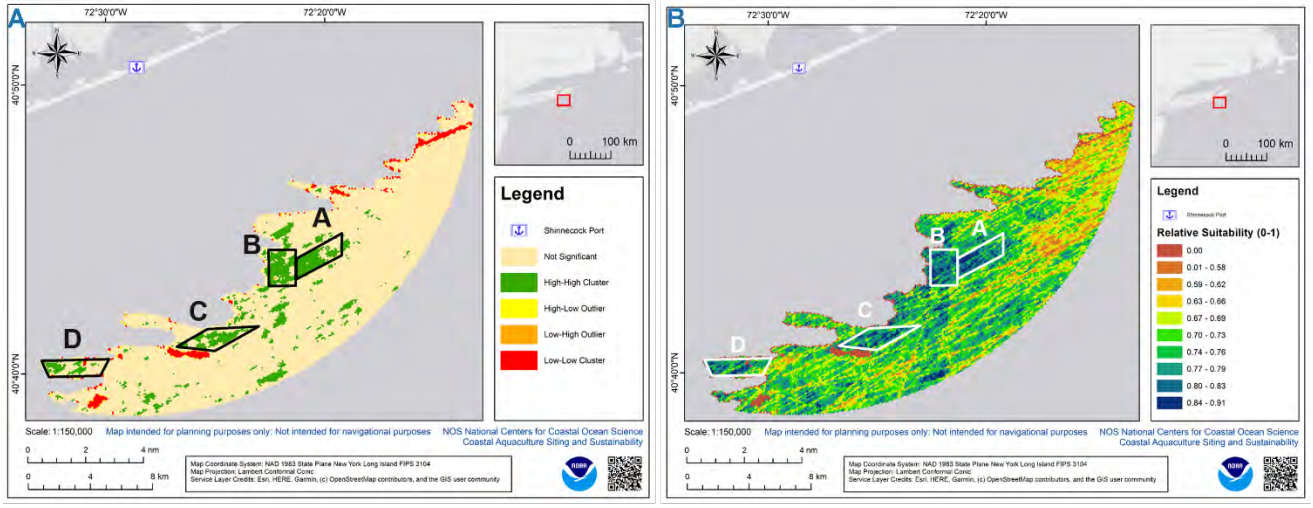


Figure 24A – B. The farm footprint overlaid with the LISA clusters to capture the high-high cluster areas (A), and those four areas overlaid over the suitability analysis results to determine which factors dropped the suitability scores (B).

Alternative Area Comparison

Benthic Characterization

Benthic factors (e.g., depth, slope, sediment type), often play a role in determining if a site is suitable for aquaculture gear, and certain types of aquaculture (e.g., finfish). Figure 25A and B and Figure 26A and B describe the benthic factors for the alternative areas A, B, C, and D. Area A has the most continuous depth area in the needed range, relative to areas B, C, and D (Figure 25A). Area D has the shallowest depths, with a portion of the area at 37 m. Areas A and B had the lowest slope factor, making them the flattest sites relative to C and D (Figure 25B). Areas C and D both have depressions and peaks. Area C has a large depression in the northern center portion of the area. The Esri Ecological Marine Units show that benthic habitats vary from area to area, with areas A and B being shallow depression areas, C being a moderate depression area, and D being a shallow depression area (Figure 26A). Finally, sediment type varies by area and within area as well (Figure 26B). Area B has the finest grain size sand. Area A also has fine grain sand, but coarser than B, and area C has coarser sand than both areas A and B. Area D is unique in that the right half of the area is fine sand, while the left half of the area appears to be made up of coarse sand or gravel (Figure 26B).

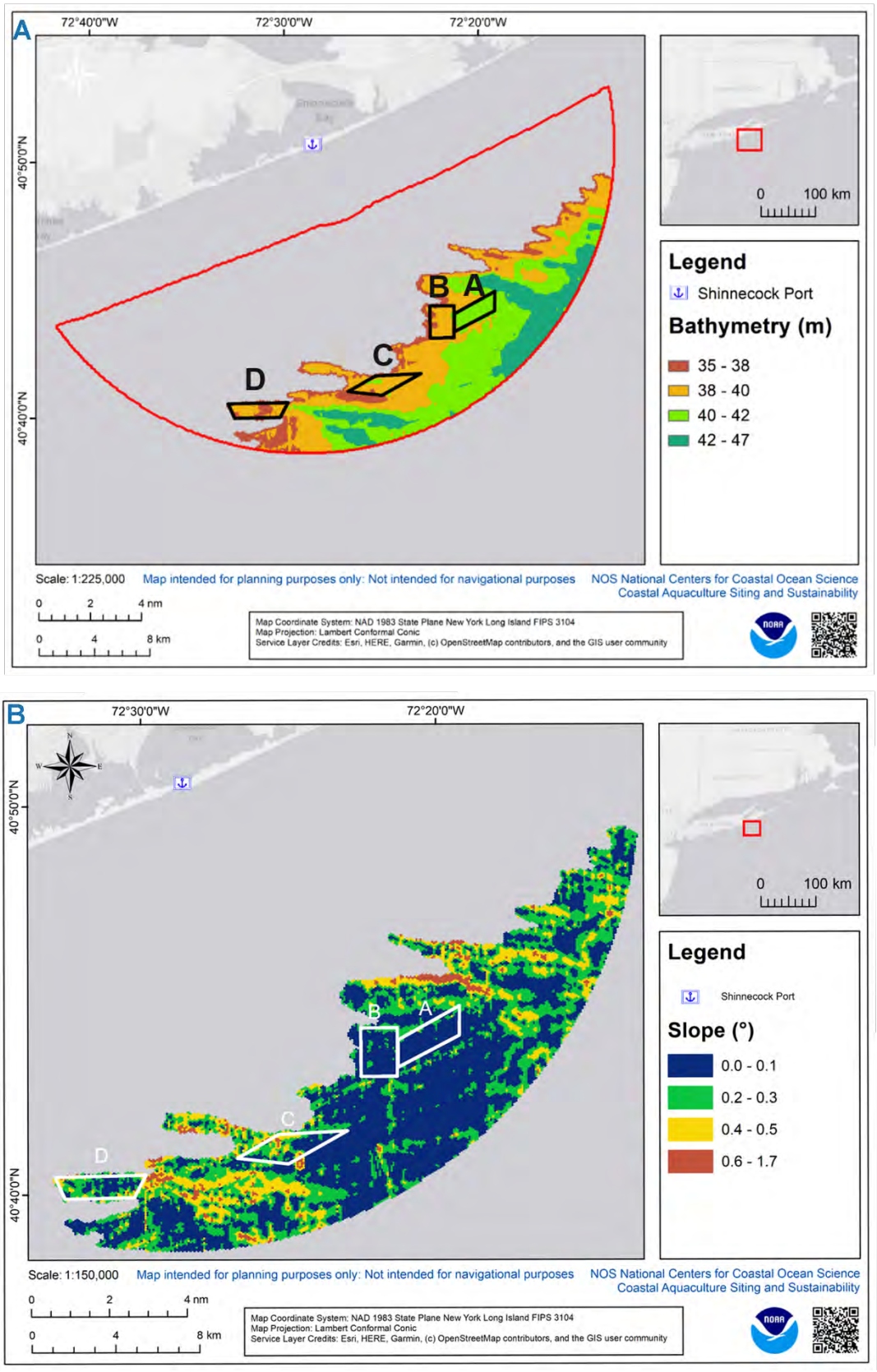


Figure 25A – B. Benthic characterization of sites A, B, C, and D. Benthic characterization includes defining the depth (A) and slope of the seafloor (B) for each area.

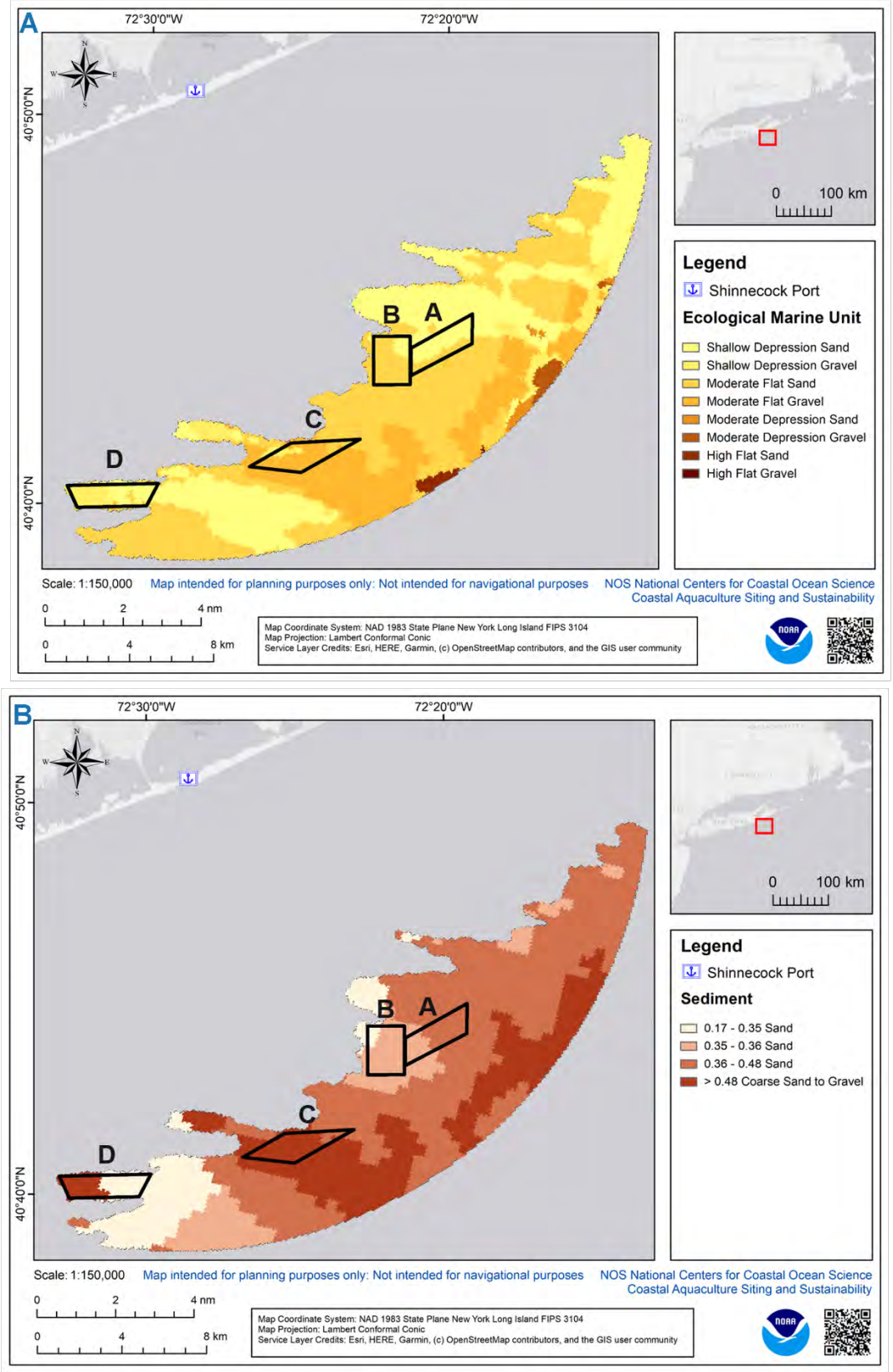


Figure 26A – B. Overall substrate type from the Esri Ecological Marine Units (A), and (B) sediment type based on the USGS usSEABED and USGS sediment texture database.

Fisheries Effort

Fisheries effort for areas A through D was examined in several ways. First, AIS and VMS data (Figure 27A - B) were used in the site suitability analysis as an approximation for long and short term fishing effort. Both the AIS vessel traffic data (2017) and the VMS data (2009 – 2019) indicate similar fishing effort patterns over short and long time-periods (Figure 25A - B). Areas with higher effort in the eastern portion of the area were avoided, but in the western half of area D seemed to have high activity. This was further demonstrated in area characterization, where in the generalized VMS and VTR data (Figures 12 and 13 A – E), bottom trawling and gillnet activity was higher on the right hand side of area D (fine sand), and squid fishing effort was high there as well.

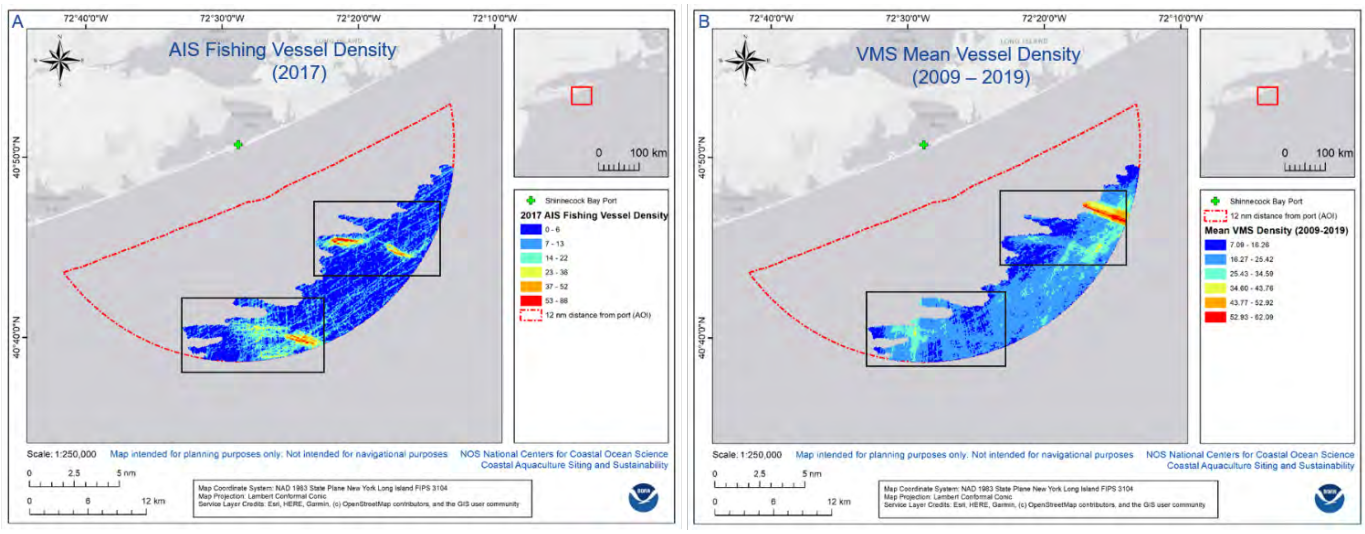


Figure 27A – B. AIS fishing vessel data (2017) and the mean VMS fishing vessel density (2009 – 2019) for the AOI. The two black rectangles in each map indicate areas of relatively higher fishing effort. Although patterns can be seen in the data, it is important to keep in mind the time-period for the data, and that they may not be directly comparable.

Fisheries Management Areas

There are many fisheries management areas – some general and some more specific - in the Northeast U.S., as there are FMPs in place based on empirical data trends in economically important fish populations in this region (see Table A-2 for more information). Generally, fisheries management areas aim to protect fisheries species over time, the habitats they occupy throughout their lives, and add seasonal or gear-restricted areas to protect endangered and managed species, continuing or rebuilding stocks for economic and food security. Each NMFS-designated fisheries management in the region was checked for overlap with the four final alternative aquaculture areas. Please refer to Appendix A, Table A-3, to review a list of interactions that occurred among the four areas. Areas A, B, and C had 33 interactions and 86 where there were no interactions, and area D had 27 interactions and 92 instances where there were no interactions with fisheries management areas. Importantly, each management area has different implications based on the type of management area (i.e., it may not be the number of management areas, but the management measures in each area) that require detailed characterization performed by regional NMFS office fisheries biologists and determination of how aquaculture operations may potentially impact those designated areas during permit review.

Factors Driving the Final Suitability Scores

Conducting a relative comparison of areas A through D offers insight into factors that ultimately impacted the site suitability scores for each area (Figures 28 - 31). Areas A, B, and C all had similar mean relative suitability scores, while Area D had a lower mean score (Table 12). Area A has the largest area of optimal depths and most consistent slope of all the sites, while being constrained by pleasure and sailing craft, fishing vessels, and other vessel transits, as well as VMS transits on the upper right side (Figure 28, Table 12). Area B adjacent to Area A is similar, the prominent difference is that Area B is shallower and has a slightly elevated slope. Area B is also surrounded by shallow areas to the North and West of the boundary, and has some pleasure and sailing craft, fishing vessel, and other vessel traffic. Area B had the lowest mean number of VMS transits for all the cells in the area, and does have the highest mean suitability score when compared to other areas (Figure 29). Area C is surrounded by shallower areas, has an elevated slope factor, and has a large depression in the middle of the site. Pleasure and sailing craft, fishing vessels, and VMS transits also lowered the score for this area (Figure 30). Area D has the lowest mean relative suitability, but could be a suitable alternative given its location outside of the Military Operating Area (Figure 31). Area D is surrounded by shallow areas and is the shallowest site, in addition to having an inconsistent slope. There is low pleasure sailing craft transits, but this area has a higher relative fishing effort when compared to other alternative areas (Figure 31).

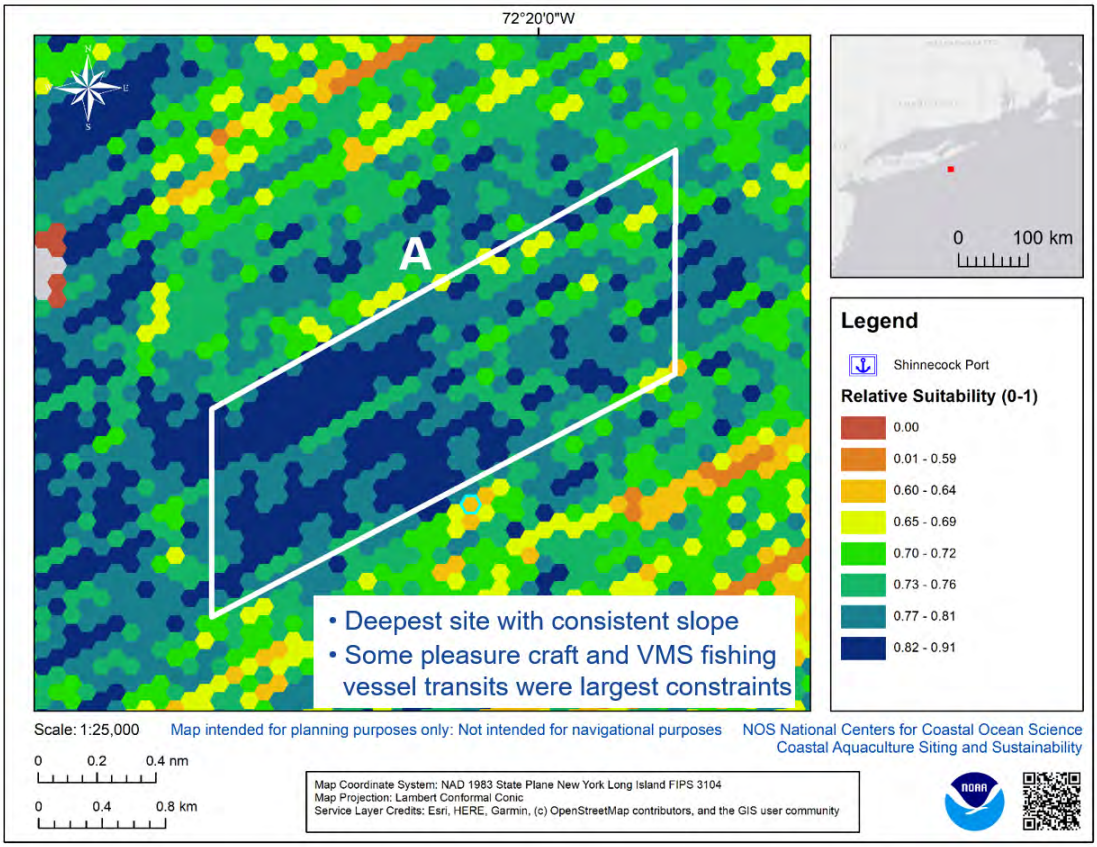


Figure 28. Relative suitability scores of area A, with the descriptions of major considerations for marine aquaculture.

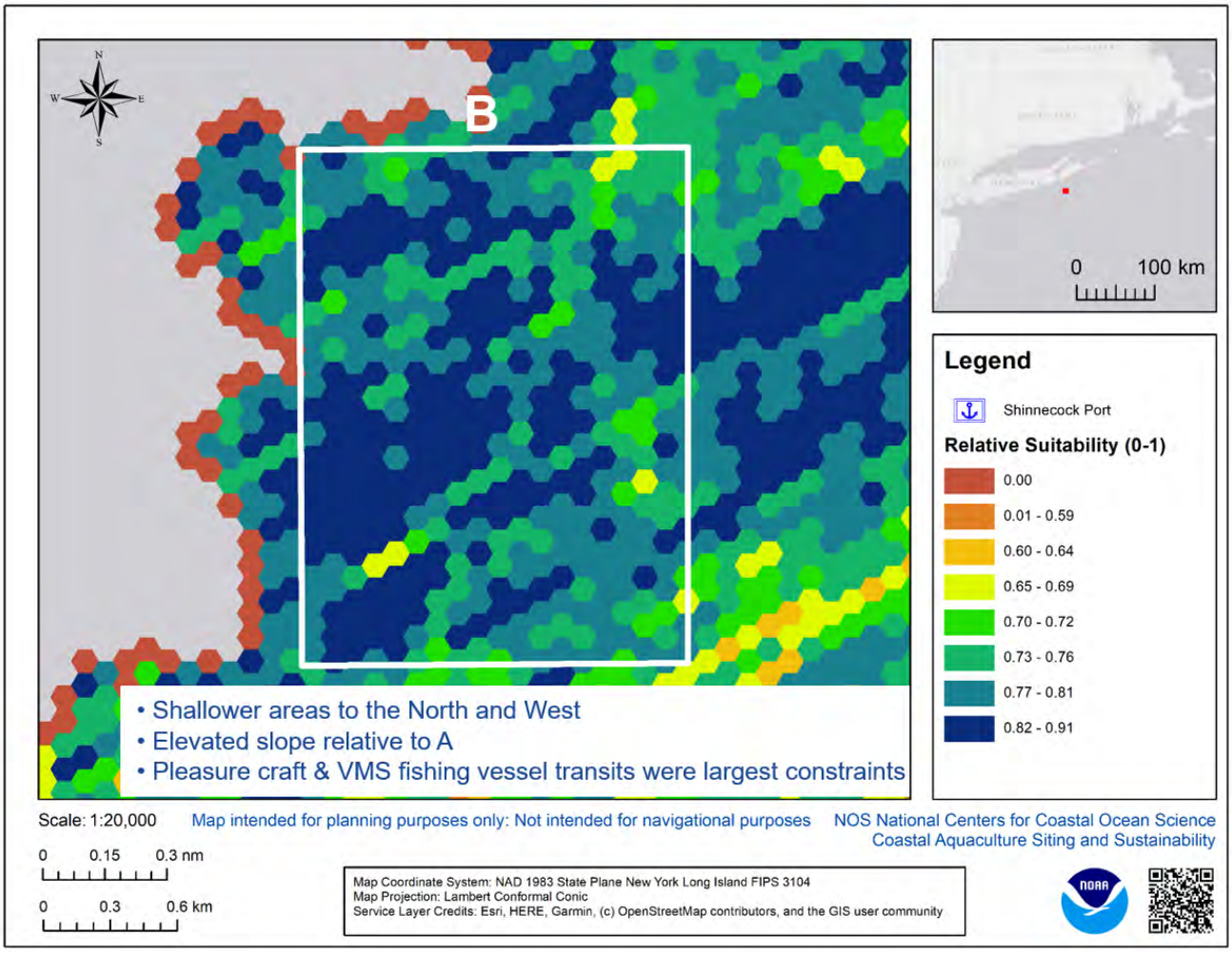


Figure 29. Relative suitability scores of area B, with the descriptions of major considerations for marine aquaculture.

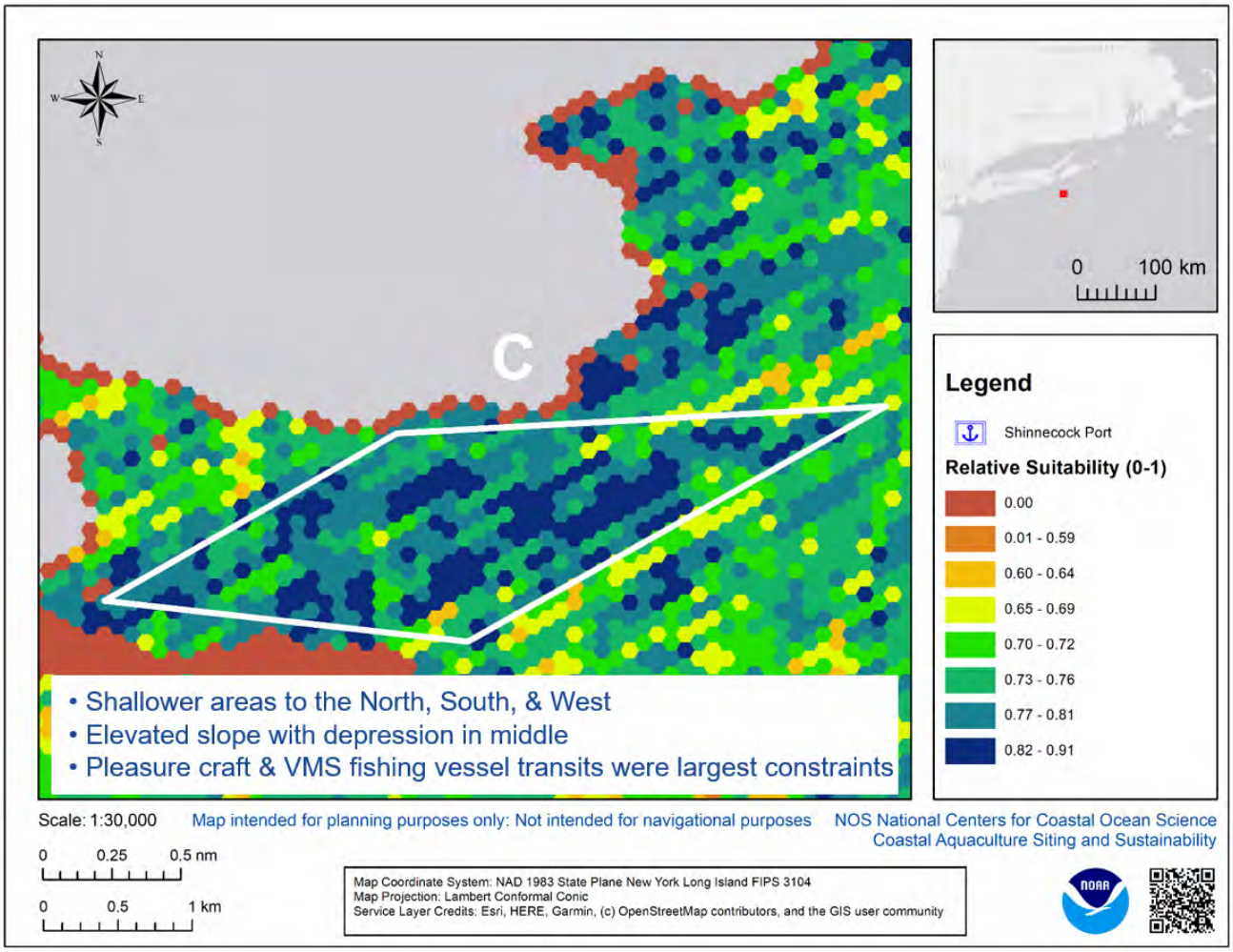


Figure 30. Relative suitability scores of area C, with the descriptions of major considerations for marine aquaculture.

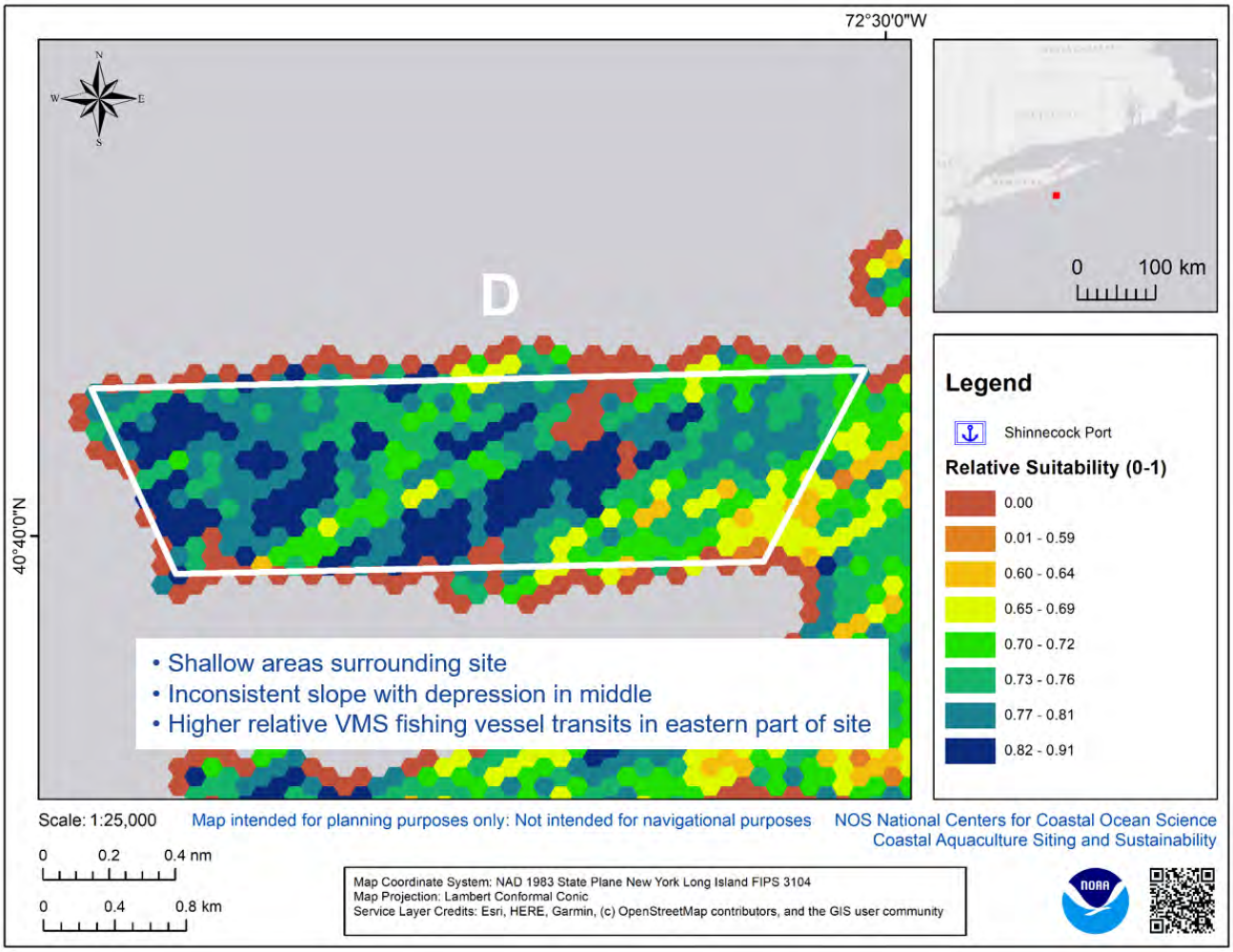


Figure 31. Relative suitability scores of area D, with the descriptions of major considerations for marine aquaculture.

Table 12. Alternative site comparison (Areas A, B, C, D) for major parameters characterized for each of the areas. Summary table of the four locations with descriptive metrics and parameters.

Parameter	Area A	Area B	Area C	Area D
Area (Acres) (one farm footprint)	396 ha	399 ha	402 ha	402 ha
Distance from Port (nm)	8.6	7.9	9.4	10.1
Mean Suitability Score (0-1)	0.78	0.79	0.78	0.70
Mean Bathymetry (m)	40.5	38.7	39	38.3
Bathymetry Range (m)	39 - 42	37- 40	37 - 41	37 - 39
Mean Slope (°)	0.08°	0.09°	0.18°	0.17°
Mean Sediment grain size (mm)	0.37	0.35	0.57	0.42
AIS 2017 Cargo Vessels (Total Transits in area 2017)	0	0	0	3
AIS 2017 Tanker Vessels (Total Transits in area 2017)	0	0	1	0
AIS 2017 Tug/Tow Vessels (Total Transits in area 2017)	3	7	2	8
AIS 2017 Pleasure/Sailing Vessels (Total Transits in area 2017)	48	50	54	18
AIS 2017 Passenger Vessels (Total Transits in area 2017)	5	6	3	8
AIS 2017 Other Vessels (Total Transits in area 2017)	34	29	27	23
AIS 2017 Fishing Vessels (Total Transits in area 2017)	43	58	91	80
VMS Traffic (2009-2019 Mean value of all cells in area)	16.63	15.73	17.03	20.84
Military Operating Area	Yes	Yes	Yes	No
Naval Undersea Warfare Area	Yes	Yes	Yes	Yes
Recreational Whale Watching	Yes	Yes	No	No
VTR Bottom Trawl Small 2011-2015 Effort	Low	Low	Low	Med
VTR Bottom Trawl Large 2011-2015 Effort	None	None	Low	Low
VTR Pots and Traps 2011-2015 Effort	None	None	None	None
VTR Longline 2011-2015 Effort	None	None	None	None
VTR Gillnet 2011-2015 Effort	Low	Low	Med	Low
VTR Sea Scallop Dredge 2011-2015 Effort	Med	Med	Low	None

Conclusion

Areas A and B would be preferred alternatives over the other two sites (C, D) based on the relative suitability analysis. Perhaps even a site created between Area A and B may be preferable. If deeper depths are important, Area A would be ideal, however Area B is slightly closer to port. Regardless of the alternative area chosen, further *in situ* data collection is appropriate to ensure finfish aquaculture can be performed sustainably, economically, and responsibly.

Data Availability: All spatial data sets used in this analysis are available upon request. The exception being the VMS data which are controlled unclassified information and not for public distribution.

References

Anselin, L. (1995). Local Indicators of Spatial Association—LISA. *Geog. Anal.* 27, 93-115.

Bwadi, B. E., Mustafa, F. B., Ali, M. L., Bhassu, S. (2019). Spatial analysis of water quality and its suitability in farming giant freshwater prawn (*Macrobrachium rosenbergii*) in Negeri Sembilan region, Peninsular Malaysia. *Singapore J. Trop. Geog.* 40, 71-91.

Chen, C., Beardsley, R. C., Cowles, G., Qi, J., Lai, Z., Gao, G., Stuebe, D. et al. (2011). An Unstructured Grid, Finite Volume Coastal Ocean Model (FV-COM) User Manual (3rd Ed.). SMAST/UMASSD-11-1101. 409 pp.

Curtice C., Cleary J., Shumchenia E., Halpin P.N. (2019). Marine-life Data and Analysis Team (MDAT) technical report on the methods and development of marine-life data to support regional ocean planning and management. Available at: http://seamap.env.duke.edu/models/mdat/MDAT-Technical-Report-v1_1.pdf

Esri (2020). ArcGIS Pro: Release 2.5.0. Redlands, CA: Environmental Systems Research Institute.

Gimpel, A., Stelzenmüller, V., Grote, B., Buck, B.H., Floeter, J., Núñez-Riboni, I., et al. (2015). A GIS modelling framework to evaluate marine spatial planning scenarios: Co-location of offshore wind farms and aquaculture in the German EEZ. *Mar. Policy 55*, 102-115.

Longdill, P. C., Healy, T. R., Black, K. P. (2008). An integrated GIS approach for sustainable aquaculture management area site selection. *Ocean Coastal Manage*, 51, 612-624.

Longley-Wood, K. (2015). Individual Ocean Uses Northeast United States. SeaPlan and Northeast Regional Ocean Council. 7 pp.

Kapetsky, J.M., Aguilar-Manjarrez, J. and Jenness, J. (2013). A global assessment of potential for offshore mariculture development from a spatial perspective. FAO Fisheries and Aquaculture Technical Paper No. 549. Rome, FAO. 181 pp.

Marine Cadastre (MC). (2018). NOAA Office for Coastal Management. MarineCadastre.gov. Charleston, SC.

Mid-Atlantic Ocean Data Portal (MARCO). (2020). Sea turtle survey data from the Migratory Portfolio (TNC). Original data source: M.G, J. Odell, M. Clark, Z. Ferdaña, and J.K. Greene. 2010. The Northwest Atlantic Marine Ecoregional Assessment: Identifying Conservation Areas in the Northwest Atlantic Marine Region. Phase Two. The Nature Conservancy, Eastern U.S. Division, Boston, MA. Accessed March 30, 2020. https://portal.midatlanticocean.org/data-catalog/conservation/#layer-info-sea-turtles60

National Data Buoy Center (NDBC). (2020). Standard meteorological data. Accessed March 23, 2020. https://www.ndbc.noaa.gov/station_page.php?station=44017

National Weather Service (NWS). (2020). Significant Wave Height. Accessed March 23, 2020. https://www.weather.gov/key/marine_sigwave.

Naval Sea Systems Command (NSSC). (2020). Warfare Divisions: NUWC Newport Division. Accessed March 17, 2020. https://navsea.dod.afpims.mil/Home/Warfare-Centers/NUWC-Newport/What-We-Do/.

National Oceanic and Atmospheric Administration (NOAA). (2014). Guide to Essential Fish Habitat Designations in the Northeastern United States. Accessed on May 1, 2020 at: http://www.greateratlantic.fisheries.noaa.gov/hcd/webintro.html

National Oceanic and Atmospheric Administration (NOAA). (2020). Decision Support Tool Helpful to Those Finding Ways to Reduce Whale Entanglement in Fishing Gear. Accessed July 5th, 2020 at: https://www.fisheries.noaa.gov/feature-story/decision-support-tool-helpful-those-finding-ways-reduce-whale-entanglement-fishing.

Northeast Ocean Data (NEOD). (2020). Maps and data for ocean planning in the Northeastern United States. Available at: https://www.northeastoceandata.org/. Accessed March 17, 2020.

Radiarta, I. N., Saitoh, S. I., Miyazono, A. (2008). GIS-based multi-criteria evaluation models for identifying suitable sites for Japanese scallop (*Mizuhopecten yessoensis*) aquaculture in Funka Bay, southwestern Hokkaido, Japan. *Aquacult.* 284, 127-135.

St. Martin, K. and J. Olson. (2017). Creating Space for Community in Marine Conservation and Management: Mapping 'Communities at Sea', in *Conservation in the Anthropocene Ocean*, Levin, P. and M. Poe eds. (Elsevier), pp. 123-141.

Appendix A: Further references for data and species in the Northeast United States

Table A-1: All data layers used for planning in the Northeast and Mid-Atlantic

Category	Dataset	Source	Source/link	Metadata link
Industry	Atlantic Link Cable	Northeast Regional Planning Body (RPB) Restoration Subcommittee	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/AtlanticLinkCable.pdf
Industry	Cobscook Bay OCGEN Power Project	NOAA OCM/BOEM	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	https://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/MarineHydrokineticProjects.pdf
Industry	Muskeget Channel Tidal Energy		http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	https://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/MarineHydrokineticProjects.pdf
Industry	Block Island Renewable Energy Zone	URI; http://seagrant.gso.uri.edu/oceansamp/	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/RenewableEnergyZone
Industry	Block Island Transmission cables	TetraTech	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/BlockIslandTransmissionCables.pdf
Industry	Block Island Turbines	Rhode Island Coastal Resources Management Council	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/BlockIslandWindFarmTurbineLocations.pdf
Industry	BOEM NY Draft WEA	BOEM	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	https://www.boem.gov/renewable-energy/state-activities/intergovernmental-renewable-energy-task-force-meeting-new-york-0
Industry	LNG pipelines	Massachusetts Office for Coastal Zone Management (CZM)	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	https://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/LNGPipelines.pdf
Industry	LNG sites	US Coast Guard Local Notice to Mariners	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/LNGsites
Industry	MA Wind Energy Areas	Massachusetts Office of Coastal Zone Management	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	https://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/moris_om_wind_energy_areas_poly

Industry	Prelim Permitted Marine Hydrokinetic Projects	BOEM	https://www.northeastoceandata.org/data-download/	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/MarineHydrokineticProjects.pdf
Industry	New England Electrical Transmission lines	NOAA Coastal Services Center	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	https://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/NewEnglandElectricalTransmissionLines.pdf
Industry	New England Electrical transmission substations	NOAA Coastal Services Center	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	https://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/NewEnglandElectricalTransmissionSubstations.pdf
Industry	ME Ocean Energy Demonstration Sites - state designated	Maine Coastal Program	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	https://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/OceanEnergyDemonstrationSites.pdf
Industry	Offshore Wind Energy Leases	BOEM	http://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure.zip	https://metadata.boem.gov/geospatial/BOEM_Wind_Planning_Areas.xml
Industry	Uni. Maine Aqua Ventus Project Proposed Turbine Locations	University of Maine	https://geo.nyu.edu/catalog/stanford-tm731mw2390	https://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/MaineAquaVentusProjectProposedTurbineLocations.pdf
Industry	Offshore Wind Technology Depths Zones	BOEM	https://www.arcgis.com/home/webmap/viewer.html?url=https://coast.noaa.gov/arcgis/rest/services/MarineCadastre/OceanEnergy/MapServer/3&extent=-100,40&level=4	https://coast.noaa.gov/arcgis/rest/services/MarineCadastre/OceanEnergy/MapServer/3
Industry	Proposed turbine locations (NY)	BOEM	https://www.boem.gov/renewable-energy/state-activities/intergovernmental-renewable-energy-task-force-meeting-new-york-0	https://www.boem.gov/renewable-energy/state-activities/intergovernmental-renewable-energy-task-force-meeting-new-york-0
Industry	Shellfish Management Areas (closed, approved, conditionally approved)	Connecticut Department of Agriculture Bureau of Aquaculture (CT DA/BA), Connecticut Department of Environmental Protection (CT DEP), Massachusetts Division of Marine Fisheries (MA DMF), Massachusetts Office of Geographic Information (MassGIS), Maine Department of	https://www.northeastoceandata.org/data-download/?data=Aquaculture	http://www.northeastoceandata.org/files/metadata/Themes/Aquaculture/ShellfishManagementAreas.pdf

		Marine Resources (MEDMR), Maine Office of Geographic Information Systems (MEGIS), New Hampshire Department of Environmental Services (NHDES), New York State Department of Environmental Conservation (NYSDEC) Bureau of Marine Resources, Rhode Island Department of Environmental Management (RIDEM), Rhode Island Geographic Information Database (RIGIS), US Food and Drug Administration National Shellfish Sanitation Program (NSSP), US Census		
Industry	Wind Planning Areas*	BOEM	https://www.boem.gov/BOEM-Renewable-Energy-Shapefiles.zip	https://metadata.boem.gov/geospatial/BOEM_Wind_Planning_Areas.xml
Industry	Renewable Energy Leases	BOEM	https://www.boem.gov/BOEM-Renewable-Energy-Shapefiles.zip	https://www.boem.gov/sites/default/files/renewable-energy-program/Mapping-and-Data/BOEM_Lease_Areas_12_15_2016_metadata.pdf
Industry	Aquaculture	Maine Department of Marine Resources Aquaculture Lease Records ▪ New Hampshire Department of Environmental Services Coastal Resources Program ▪ New Hampshire Department of Environmental Services Shellfish Program ▪ New Hampshire Fish and Game Department ▪ Massachusetts Division of Marine Fisheries ▪ Connecticut Department of Agriculture Bureau of Aquaculture and Laboratory Services ▪ Connecticut Department of	https://www.northeastoceandata.org/data-download/?data=Aquaculture	https://www.northeastoceandata.org/files/metadata/Themes/Aquaculture/Aquaculture.pdf

		Energy and Environmental Protection ▪ Connecticut SeaGrant ▪ Suffolk County (NY) Department of Economic Development and Planning ▪ Rhode Island Coastal Resources Management Council ▪ Rhode Island Department of Environmental Management Division of Fish and Wildlife, Marine Fisheries Section ▪ Northeastern Massachusetts Aquaculture Center (NEMAC) at Cat Cove Marine Laboratory, Salem State University		
Industry	cable and pipeline areas	NOAA	https://www.northeastoceandata.org/data-download/?data=Energy%20and%20Infrastructure	https://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/CableAndPipelineAreas
Industry	Ocean Disposal Sites (Active and inactive)	EPA	ftp://ftp.coast.noaa.gov/pub/MSP/OceanDisposalSites.zip	https://inport.nmfs.noaa.gov/inport/item/54193
Industry	Pipelines (active and inactive)	BSEE	https://www.data.bsee.gov/Mapping/Files/ppl_arcs.zip; https://www.boem.gov/PC-pipe.zip	https://metadata.boem.gov/geospatial/OCSpipelines-GOMR-NAD27.xml; https://metadata.boem.gov/geospatial/pc_pipe.xml
Industry or navigation	Principal Ports	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/PrincipalPorts.zip	https://inport.nmfs.noaa.gov/inport/item/56124
Industry	submarine cables* (active & inactive)	NOAA Coastal Services Center	https://www.northeastoceandata.org/data-download/?data=Energy%20and%20Infrastructure	https://www.northeastoceandata.org/files/metadata/Themes/EnergyAndInfrastructure/SubmarineCables
Industry	NASCA submarine cables	NOAA Coastal Services Center	https://www.northeastoceandata.org/data/data-download/?data=Energy+and%20Infrastructure	https://coast.noaa.gov/arcgis/rest/services/MarineCadastre/NASCASubmarineCables/MapServer/undefined
Industry	South Fork Wind Farm	BOEM	https://www.northeastoceandata.org/data-download/?data=Energy%20and%20Infrastructure	https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NY/SFWF_COP_2019-05-24.pdf

Industry	South Fork Wind Farm Proposed Project Envelope	BOEM	https://www.northeastoceandata.org/data-download/?data=Energy%20and%20Infrastructure	https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NY/SFWF_COP_2019-05-24.pdf
Industry	South Fork Wind Farm Proposed Cable route	BOEM	https://www.northeastoceandata.org/data-download/?data=Energy%20and%20Infrastructure	https://www.boem.gov/sites/default/files/renewable-energy-program/State-Activities/NY/SFWF_COP_2019-05-24.pdf
Industry	Vineyard Wind Farm Project Envelope	BOEM	https://www.northeastoceandata.org/data/data-download/?data=Energy+and%20Infrastructure	https://www.boem.gov/renewable-energy/state-activities/vineyard-wind-construction-and-operations-plan-cop-volume-i
Industry	Vineyard Wind Farm Proposed cable route	BOEM	https://www.northeastoceandata.org/data/data-download/?data=Energy+and%20Infrastructure	https://www.boem.gov/renewable-energy/state-activities/vineyard-wind-construction-and-operations-plan-cop-volume-i
Industry	Isle of Shoals Disposal Site North (Proposed)	USEPA	https://www.northeastoceandata.org/data-download/?data=Marine%20Transportation	https://www.epa.gov/sites/production/files/2019-09/documents/epar01ow20190521_iosn_odmds_draft_ea_with_appendices_final_8.29.19.pdf
Industry	wind energy areas	BOEM	https://www.boem.gov/BOEM-Renewable-Energy-Geodatabase.zip	https://metadata.boem.gov/geospatial/BOEM_Wind_Planning_Areas.xml
Industry	Substations	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/Substations.zip	https://inport.nmfs.noaa.gov/inport/item/54404
Industry	Oil and Gas Platforms (active/inactive)	BOEM	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/OilandGasPlatforms.zip	https://inport.nmfs.noaa.gov/inport/item/54390
Industry	Oil and Gas Wells	BOEM	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/OilandGasWells.zip	https://inport.nmfs.noaa.gov/inport/item/54392
Industry	Oil Spills	NOAA	https://incidentnews.noaa.gov/raw/index	https://www.ncei.noaa.gov/maps/gulf-data-atlas//Metadata/ISO/ORR_OilSpills_IncidentNews.html
Industry	wastewater treatment outfalls*	EPA	Talk to DANIEL MARTIN	https://edg.epa.gov/metadata/catalog/search/resource/details.page?uuid=%7B0A2C3F02-3D68-4556-8A87-B288C318E0EE%7D

Industry	BOEM Active Lease Blocks	BOEM	https://www.boem.gov/Oil-and-Gas-Energy-Program/Mapping-and-Data/Alaska/AKUpdate.aspx; gis.boem.gov/arcgis/rest/services/BOEM_BSEE/POC_Layers/MapServer/7; https://www.data.boem.gov/Mapping/Files/actlease.zip	https://metadata.boem.gov/geospatial/GOM_Active_OG_Leases.xml; https://metadata.boem.gov/geospatial/pac_lease.xml; https://metadata.boem.gov/geospatial/OCS_Alaska_Current_OilGas_Leases.xml
Industry	BOEM OCS Lease Blocks (5, 7 and 10 year blocks)	BOEM	https://www.northeastoceandata.org/data/data-download/?data=Administrative+Boundaries	https://metadata.boem.gov/geospatial/OCS_LeaseBlocks_Atlantic_NAD83.xml
Industry	Deepwater Ports	BOEM	ftp://ftp.coast.noaa.gov/pub/MSP/DeepwaterPorts.zip	https://inport.nmfs.noaa.gov/inport/item/54192
Industry	Beach Nourishment	ASBPA;WCU	biannually	https://gim2.aptim.com/ASBPANationwideRenourishment/; http://beachnourishment.wcu.edu/
Industry	Federal sand and gravel borrow areas	BOEM	https://www.boem.gov/Oil-and-Gas-Energy-Program/Mapping-and-Data/Federal-Sand-n-Gravel-Lease-Borrow-Areas_gdb.aspx	https://mmis.doi.gov/boemmmis/metadata/PlanningAndAdministration/LeaseAreas.xml
Industry	Sand Resource Blocks	BOEM	biannually	http://www.boem.gov/GOMR-Lease-Block-GIS/; download from MC.com
Military	Cape Cod TORPEX	US Navy Fleet Training and Testing (AFTT)	https://www.northeastoceandata.org/data/data-download/?data=National+Security	https://www.northeastoceandata.org/files/metadata/Themes/Security/NECapeCodTORPEX.pdf
Military	Military Range Complex	Navy EIMS	https://www.northeastoceandata.org/data-download/?data=National%20Security	https://www.northeastoceandata.org/files/metadata/Themes/Security/NEMilitaryRangeComplex.pdf
Military	Naval undersea warfare center	Navy EIMS	https://www.northeastoceandata.org/data-download/?data=National%20Security	https://www.northeastoceandata.org/files/metadata/Themes/Security/NENUWCDIVNPTTestingRangeBoundary.pdf
Military	Warning areas	Navy EIMS	https://www.northeastoceandata.org/data-download/?data=National%20Security	https://www.northeastoceandata.org/files/metadata/Themes/Security/NEWarningAreas.pdf
Military	Danger and Restricted Zones	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/DangerZonesAndRestrictedAreas.zip	https://inport.nmfs.noaa.gov/inport/item/48876
Military	Special Use Airspace	Navy EIMS	ftp://ftp.coast.noaa.gov/pub/MSP/MilitaryAreas.zip	https://inport.nmfs.noaa.gov/inport/item/48898
Military	Unexploded Ordnance points	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/UnexplodedOrdnance.zip	https://inport.nmfs.noaa.gov/inport/item/54407

Military	Unexploded Ordnance polygon	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/UnexplodedOrdnance.zip	https://inport.nmfs.noaa.gov/inport/item/54407
Military	Unexploded Ordnance FUDs	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/UnexplodedOrdnance_FUDS.zip	https://inport.nmfs.noaa.gov/inport/item/54409
Military	Submarine Transit Lanes	Navy EIMS	ftp://ftp.coast.noaa.gov/pub/MSP/MilitaryAreas.zip	https://inport.nmfs.noaa.gov/inport/item/48898
Military	Military Operating Areas	Navy EIMS	ftp://ftp.coast.noaa.gov/pub/MSP/MilitaryAreas.zip	https://inport.nmfs.noaa.gov/inport/item/48898
Military	Regulated Airspace	Navy EIMS	ftp://ftp.coast.noaa.gov/pub/MSP/MilitaryAreas.zip	https://inport.nmfs.noaa.gov/inport/item/48898
natural resources	North Atlantic Right Whale Critical Habitat Area (foraging area Unit 1 & 2)	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/North_Atlantic_Right_Whale_Critical_Habitat/North_Atlantic_Right_Whale_Critical_Habitat_METADATA.pdf
natural resources	Long Island Sound Ecological Assessment	TNC	https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/marine/data/Pages/default.aspx	embedded in gdb layers
natural resources	Offshore Video Survey and Oceanographic Analysis: Georges Bank to the Chesapeake (SMAST)	Uni.of Mass, Dartmouth SMAST	https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/marine/data/Pages/default.aspx	embedded in gdb layers
natural resources	EFH Fish Species Biomass, core biomass area, species richness (fall) (summary product)	MDAT	http://seamap.env.duke.edu/models/mdat/	http://seamap.env.duke.edu/models/mdat/Fish/MDAT_NEFSC_Fish_Summary_Products_Metadata.pdf
natural resources	Forage Fish: species richness, core biomass area, biomass (fall - species richness, spring, all three)	MDAT	http://seamap.env.duke.edu/models/mdat/	http://seamap.env.duke.edu/models/mdat/Fish/MDAT_NEFSC_Fish_Summary_Products_Metadata.pdf
natural resources	HMS: Biomass, Core Biomass Area, Species richness (fall)	MDAT	http://seamap.env.duke.edu/models/mdat/	http://seamap.env.duke.edu/models/mdat/Fish/MDAT_NEFSC_Fish_Summary_Products_Metadata.pdf
natural resources	MAFMC FMPs (Core Biomass Area, Abundance, Species Richness) fall	MDAT	http://seamap.env.duke.edu/models/mdat/	http://seamap.env.duke.edu/models/mdat/Fish/MDAT_NEFSC_Fish_Summary_Products_Metadata.pdf

natural resources	All cetacean abundance, core abundance area, species richness	MDAT	http://portal.midatlanticocean.org/data-catalog/conservation/#layer-info-efh-species-biomass-fall3231	http://seamap.env.duke.edu/models/mdat/Mammal/MDAT_Mammal_Summary_Products_Metadata.pdf
natural resources	Marine Mammal Abundance, Marine mammal 5 percentile, Marine mammal 95 percentile, marine mammal coefficient of variation, marine mammal standard error)	NEFMC, MDAT	http://portal.midatlanticocean.org/data-catalog/conservation/#layer-info-efh-species-biomass-fall3232	http://seamap.env.duke.edu/models/mdat/Mammal/MDAT_Mammal_Summary_Products_Metadata.pdf
natural resources	Baleen Whale mid-Atlantic scale (Core Biomass Area, Abundance, Species Richness)	MDAT	http://portal.midatlanticocean.org/data-catalog/conservation/#layer-info-efh-species-biomass-fall3231	http://seamap.env.duke.edu/models/mdat/Mammal/MDAT_Mammal_Summary_Products_Metadata.pdf
natural resources	Sperm and Beaked Whale (Core Biomass Area, Abundance, Species Richness)	MDAT	http://portal.midatlanticocean.org/data-catalog/conservation/#layer-info-efh-species-biomass-fall3232	http://seamap.env.duke.edu/models/mdat/Mammal/MDAT_Mammal_Summary_Products_Metadata.pdf
natural resources	Species of Concern: (Core Biomass Area, Abundance, Species Richness)	MDAT	http://portal.midatlanticocean.org/data-catalog/conservation/#layer-info-efh-species-biomass-fall3232	http://seamap.env.duke.edu/models/mdat/Mammal/MDAT_Mammal_Summary_Products_Metadata.pdf
natural resources	Stellwagen Bank NMS	NOAA NMS	https://sanctuaries.noaa.gov/library/imast_gis.html; https://www.northeastoceandata.org/data/data-download/?data=Administrative+Boundaries	http://www.northeastoceandata.org/files/metadata/Themes/Recreation/NationalMarineSanctuary
natural resources	NE Canyons and Seamounts Marine National Monument	NOAA NMFS GARFO	https://www.northeastoceandata.org/data/data-download/?data=Administrative+Boundaries; http://www.greateratlantic.fisheries.noaa.gov/gis	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Northeast_Canyons_and_Seamounts_Marine_National_Monument/Northeast_Canyons_and_Seamounts_Marine_National_Monument_METADATA.pdf
natural resources	Right Whale Seasonal Management Area	NOAA NMFS GARFO	https://www.fisheries.noaa.gov/tags/southeast-and-new-england-mid-atlantic-north-atlantic-right-whale-management-areas-map	https://www.northeastoceandata.org/files/metadata/Themes/MarineTransportation/right_whale_SMA_all_ln.htm
natural resources	Lobster Management Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Lobster_Management_Areas/Lobster_Management_Areas_METADATA.pdf
natural resources	Dedicated Habitat Research Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Dedicated_Habitat_Research_Area/Dedicate

				d_Habitat_Research_Area_METADATA.pdf
natural resources	Frank R. Lautenberg Deep-sea coral protection area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Frank_R_Lautenberg_Deep_Sea_Coral_Protection_Area/Frank_R_Lautenberg_Deep_Sea_Coral_Protection_Area_METADATA.pdf
natural resources	GOM Cod Spawning Protection Closure Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/GOM_Cod_Protection_Closure_Areas/GOM_Cod_Protection_Closure_Areas_METADATA.pdf
natural resources	Groundfish closure areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Groundfish_Closure_Areas/Groundfish_Closure_Areas_METADATA.pdf
natural resources	GOM & GB Spawning Groundfish closures	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/GB_Spawning_Groundfish_Closures/GB_Spawning_Groundfish_Closures_METADATA.pdf; https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/GOM_Spawning_Groundfish_Closures/GOM_Spawning_Groundfish_Closures_METADATA.pdf
natural resources	Habitat Management Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Habitat_Management_Areas/Habitat_Management_Areas_METADATA.pdf
natural resources	Herring Management Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Herring_Management_Areas/Herring_Management_Areas_METADATA.pdf
natural resources	Sea scallop rotational Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Se

				a_Scallop_Rotational_Areas/Sea_Scallop_Rotational_Areas_METADATA.pdf
natural resources	Surfclam environmental degradation closures	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Environmental_Degradation_Closures/Environmental_Degradation_Closures_METADATA.pdf
natural resources	Section 7 consultation areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Section_7_Consultation_Areas/S7_Consultation_Areas_Metadata_20180301.pdf
natural resources	280 fathom contour	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/280_Fathom_Contour/280_Fathom_Contour_METADATA.pdf
natural resources	ALWTRP Regulated and Exempted Waters (Atlantic Large Whale Take Reduction Plan Regulated Waters; Atlantic Large Whale Take Reduction Plan Exempted Waters)	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/ALWTRP_Regulated_and_Exempted_Waters/ALWTRP_Regulated_and_Exempted_Waters_METADATA.pdf
natural resources	Atlantic Coast Weakfish Flynet Fishing Prohibition Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Atlantic_Coast_Weakfish_Flynet_Fishing_Prohibition_Area/Atlantic_Coast_Weakfish_Flynet_Fishing_Prohibition_Area_METADATA.pdf
natural resources	Atlantic Halibut trawl gear accountability measures (AM) Area; Atlantic Halibut Gillnet Gear AM area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Atlantic_Halibut_Accountability_Measure_Areas/Atlantic_Halibut_Accountability_Measure_Areas_METADATA.pdf
natural resources	Atlantic Red Drum fishery harvest or possession prohibition area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Atlantic_Red_Drum_Fishery_Harvest_or_Possession_Prohibition_Area/Atlantic_Red_Drum_Fishery_Harvest_or_Possession_Prohibition_Area_METADATA.pdf

natural resources	Atlantic Salmon Critical Habitat (Gulf of ME DPS)	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	No metadata available
natural resources	Atlantic Striped Bass possession area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Atlantic_Striped_Bass_Possession_Area/Atlantic_Striped_Bass_Possession_Area_METADATA.pdf
natural resources	Atlantic Sturgeon Critical Habitat River lengths (all DPSs)	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Atlantic_Sturgeon_Critical_Habitat_River_Lengths/Atlantic_Sturgeon_Critical_Habitat_River_Lengths_METADATA.pdf
natural resources	Atlantic Wolffish Accountability Measure Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Atlantic_Wolffish_Accountability_Measure_Areas/Atlantic_Wolffish_Accountability_Measure_Areas_METADATA.pdf
natural resources	Block Island Sound Lighthouses	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Block_Island_Sound_Lighthouses/Block_Island_Sound_Lighthouses_METADATA.pdf
natural resources	CA I Hook Gear Haddock SAP area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/CA_I_Hook_Gear_Haddock_SAP_Area/CA_I_Hook_Gear_Haddock_SAP_Area_METADATA.pdf
natural resources	Cape Cod Bay Restricted Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Cape_Cod_Bay_Restricted_Area/Cape_Cod_Bay_Restricted_Area_METADATA.pdf
natural resources	Cape Cod South Closure Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Cape_Cod_South_Closure_Area/Cape_Cod_South_Closure_Area_METADATA.pdf
natural resources	Cape Cod Spiny Dogfish Exemption Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Cape_Cod_Spiny_Dogfish_Exemption_Area

				s/Cape_Cod_Spiny_Dogfish_Exemption_Areas_METADATA.pdf
natural resources	Cashes Ledge Closure Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Cashes_Ledge_Closure_Area/Cashes_Ledge_Closure_Area_METADATA.pdf
natural resources	Chain Mat-modifed Scallop Dredge Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Chain_Mat-Modified_Scallop_Dredge_Area/Chain_Mat-Modified_Scallop_Dredge_Area_METADATA.pdf
natural resources	Closure Area II Yellowtail Flounder/Haddock SAP Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Closed_Area_II_Yellowtail_Flounder-Haddock_SAP_Area/Closed_Area_II_Yellowtail_Flounder-Haddock_SAP_Area_METADATA.pdf
natural resources	Cultivator Shoal Whiting Fishery Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Cultivator_Shoal_Whiting_Fishery_Exemption_Area/Cultivator_Shoal_Whiting_Fishery_Exemption_Area_METADATA.pdf
natural resources	Differential DAS Counting Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Differential_DAS_Counting_Areas/Differential_DAS_Counting_Areas_METADATA.pdf
natural resources	Delaware Special Management Zone Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Delaware_Special_Management_Zone_Areas/Delaware_Special_Management_Zone_Areas_METADATA.pdf
natural resources	Eastern US/Canada Haddock SAP Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Eastern_US-Canada_Haddock_SAP_Area/Eastern_US

				- Canada_Haddock_SAP_Area_METADATA.pdf
natural resources	Environmental Degradation Closures	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Environmental_Degradation_Closures/Environmental_Degradation_Closures_METADATA.pdf
natural resources	Exempted Waters for Maine State American Lobster Permits (ME Pocket Waters)	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Exempted_Waters_for_Maine_State_American_Lobster_Permits/Exempted_Waters_for_Maine_State_American_Lobster_Permits_METADATA.pdf
natural resources	Fippennies Ledge Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Fippennies_Ledge_Area/Fippennies_Ledge_Area_METADATA.pdf
natural resources	GOM Grate Raised Footrope Trawl Whiting Fishery Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/GOM_Grate_Raised_Footrope_Trawl_Whiting_Fishery_Exemption_Area/GOM_Grate_Raised_Footrope_Trawl_Whiting_Fishery_Exemption_Area_METADATA.pdf
natural resources	GOM Scallop Dredge Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/GOM_Scallop_Dredge_Exemption_Area/GOM_Scallop_Dredge_Exemption_Area_METADATA.pdf
natural resources	GOM-GB Dogfish and Monkfish Gillnet Fishery Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/GOM-GB_Dogfish_and_Monkfish_Gillnet_Fishery_Exemption_Area/GOM-GB_Dogfish_and_Monkfish_Gillnet_Fishery_Exemption_Area_METADATA.pdf
natural resources	GOM-GB Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/G

				OM-GB_Exemption_Area/GOM-GB_Exemption_Area_METADATA.pdf
natural resources	GOM-GB Inshore Restricted Roller Gear Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/GOM-GB_Inshore_Restricted_Roller_Gear_Areas/GOM-GB_Inshore_Restricted_Roller_Gear_Areas_METADATA.pdf
natural resources	GOM-GB Regulated Mesh Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/GOM-GB_Regulated_Mesh_Areas/GOM-GB_Regulated_Mesh_Areas_METADATA.pdf
natural resources	Great South Channel Restricted Gillnet Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Great_South_Channel_Restricted_Gillnet_Areas/Great_South_Channel_Restricted_Gillnet_Areas_METADATA.pdf
natural resources	Great South Channel Restricted Trap-Pot Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Great_South_Channel_Restricted_Trap-Pot_Area/Great_South_Channel_Restricted_Trap-Pot_Area_METADATA.pdf
natural resources	Great South Channel Scallop Dredge Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Great_South_Channel_Scallop_Dredge_Exemption_Area/Great_South_Channel_Scallop_Dredge_Exemption_Area_METADATA.pdf
natural resources	Herring Haddock Accountability Measure Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Herring_Haddock_Accountability_Measure_Areas/Herring_Haddock_Accountability_Measure_Areas_METADATA.pdf
natural resources	HRTRP Mid-Atlantic Regulated and Exempted waters	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/HPTRP_Mid-

				Atlantic_Regulated_and_Exempted_Waters/HPTRP_Mid-Atlantic_Regulated_and_Exempted_Waters_METADATA.pdf
natural resources	Illex Fishery Mesh Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Illex_Fishery_Mesh_Exemption_Area/Illex_Fishery_Mesh_Exemption_Area_METADATA.pdf
natural resources	Jan-Feb River Herring Monitoring-Avoidance Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/January-February_River_Herring_Monitoring-Avoidance_Areas/January-February_River_Herring_Monitoring-Avoidance_Areas_METADATA.pdf
natural resources	Jeffery's Ledge Restricted Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Jeffreys_Ledge_Restricted_Area/Jeffreys_Ledge_Restricted_Area_METADATA.pdf
natural resources	Jordon Basin Restricted Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Jordan_Basin_Restricted_Area/Jordan_Basin_Restricted_Area_METADATA.pdf
natural resources	July-August River Herring Monitoring-Avoidance Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/July-August_River_Herring_Monitoring-Avoidance_Areas/July-August_River_Herring_Monitoring-Avoidance_Areas_METADATA.pdf
natural resources	Large Mesh Gillnet Restricted Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Large_Mesh_Gillnet_Restricted_Area/Large_Mesh_Gillnet_Restricted_Area_METADATA.pdf
natural resources	Lobster Gear Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Lo

				bster_Gear_Areas/Lobster_Gear_Areas_METADATA.pdf
natural resources	Lobster Restricted Gear Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Lobster_Restricted_Gear_Areas/Lobster_Restricted_Gear_Areas_METADATA.pdf
natural resources	Mid-Atlantic Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/MA_Exemption_Area/MA_Exemption_Area_METADATA.pdf
natural resources	Mid-Atlantic Regulated Mesh Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/MA_Regulated_Mesh_Area/MA_Regulated_Mesh_Area_METADATA.pdf
natural resources	Maine Mahogany Quahog	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Maine_Mahogany_Quahog_Zone/Maine_Mahogany_Quahog_Zone_METADATA.pdf
natural resources	Management Units Summer Flounder-Scup-Black Sea Bass	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Management_Units_SF-Scup-BSB/Management_Units_SF-Scup-BSB_METADATA.pdf
natural resources	March-April River Herring Monitoring-Avoidance Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/March-April_River_Herring_Monitoring-Avoidance_Areas/March-April_River_Herring_Monitoring-Avoidance_Areas_METADATA.pdf
natural resources	Massachusetts Bay Management Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Massachusetts_Bay_Management_Area/Massachusetts_Bay_Management_Area_METADATA.pdf
natural resources	Massachusetts Restricted Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/M

				assachusetts_Restricted_Area/Massachusetts_Restricted_Area_METADATA.pdf
natural resources	May-June River Herring Monitoring-Avoidance Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/May-June_River_Herring_Monitoring-Avoidance_Areas/May-June_River_Herring_Monitoring-Avoidance_Areas_METADATA.pdf
natural resources	Mid-Atlantic Forage Species Management Unit	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Mid-Atlantic_Forage_Species_Management_Unit/Mid-Atlantic_Forage_Species_Management_Unit_METADATA.pdf
natural resources	Mid-Coast Management Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Mid-Coast_Management_Area/Mid-Coast_Management_Area_METADATA.pdf
natural resources	Mid-South Atlantic Gillnet Waters	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Mid-South_Atlantic_Gillnet_Waters/Mid-South_Atlantic_Gillnet_Waters_METADATA.pdf
natural resources	Modified Haddock Stock Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Modified_Haddock_Stock_Areas/Modified_Haddock_Stock_Areas_METADATA.pdf
natural resources	Monkfish Canyon Closed Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Monkfish_Canyon_Closed_Areas/Monkfish_Canyon_Closed_Areas_METADATA.pdf
natural resources	Monkfish Fishery Management Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Monkfish_Fishery_Management_Areas/Mo

				nkfish_Fishery_Management_Areas_METADATA.pdf
natural resources	MSB (Atlantic Mackerel, Squid, Butterfish) Bottom Trawling Restricted Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/MSB_Bottom_Trawling_Restricted_Areas/MSB_Bottom_Trawling_Restricted_Areas_METADATA.pdf
natural resources	Mudhole North Management Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Mudhole_North_Management_Area/Mudhole_North_Management_Area_METADATA.pdf
natural resources	Mudhole South Management Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Mudhole_South_Management_Area/Mudhole_South_Management_Area_METADATA.pdf
natural resources	Nantucket Lightship Closed Area Exemption Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Nantucket_Lightship_Closed_Area_Exemption_Areas/Nantucket_Lightship_Closed_Area_Exemption_Areas_METADATA.pdf
natural resources	Nantucket Shoals Dogfish Fishery Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Nantucket_Shoals_Dogfish_Fishery_Exemption_Area/Nantucket_Shoals_Dogfish_Fishery_Exemption_Area_METADATA.pdf
natural resources	Nantucket Shoals Mussel and Sea Urchin Dredge Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Nantucket_Shoals_Mussel_and_Sea_Urchin_Dredge_Exemption_Area/Nantucket_Shoals_Mussel_and_Sea_Urchin_Dredge_Exemption_Area_METADATA.pdf
natural resources	NE Multispecies Broad Stock Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/NE_Multispecies_Broad_Stock_Areas/NE_Multispecies_Broad_Stock_Areas_METADATA.pdf

natural resources	New Jersey Special Management Zone Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/New_Jersey_Special_Management_Zone_Areas/New_Jersey_Special_Management_Zone_Areas_METADATA.pdf
natural resources	NGOM Scallop Management Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/NGOM_Scallop_Management_Area/NGOM_Scallop_Management_Area_METADATA.pdf
natural resources	Northeast Canyons and Seamounts Marine National Monument	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Northeast_Canyons_and_Seamounts_Marine_National_Monument/Northeast_Canyons_and_Seamounts_Marine_National_Monument_METADATA.pdf
natural resources	Northeast Closure Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Northeast_Closure_Area/Northeast_Closure_Area_METADATA.pdf
natural resources	Northern Inshore State Trap-Pot Waters Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Northern_Inshore_State_Trap-Pot_Waters_Area/Northern_Inshore_State_Trap-Pot_Waters_Area_METADATA.pdf
natural resources	Northern Nearshore Trap-Pot Waters Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Northern_Nearshore_Trap-Pot_Waters_Area/Northern_Nearshore_Trap-Pot_Waters_Area_METADATA.pdf
natural resources	November-December River Herring Monitoring-Avoidance Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/November-December_River_Herring_Monitoring-Avoidance_Areas/November-December_River_Herring_Monitoring-Avoidance_Areas_METADATA.pdf

natural resources	Offshore Fishery Program Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Offshore_Fishery_Program_Area/Offshore_Fishery_Program_Area_METADATA.pdf
natural resources	Offshore Management Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Offshore_Management_Area/Offshore_Management_Area_METADATA.pdf
natural resources	Offshore Trap-Pot Waters Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Offshore_Trap-Pot_Waters_Area/Offshore_Trap-Pot_Waters_Area_METADATA.pdf
natural resources	Other Northeast Gillnet Waters Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Other_Northeast_Gillnet_Waters_Area/Other_Northeast_Gillnet_Waters_Area_METADATA.pdf
natural resources	Other Southeast Gillnet Waters	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Other_Southeast_Gillnet_Waters/Other_Southeast_Gillnet_Waters_METADATA.pdf
natural resources	Pocket Waters	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Pocket_Waters/Pocket_Waters_METADATA.pdf
natural resources	Pound Net Regulated Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Pound_Net_Regulated_Areas/Pound_Net_Regulated_Areas_METADATA.pdf
natural resources	Raised Footrope Trawl Whiting Fishery Exemption Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Raised_Footrope_Trawl_Whiting_Fishery_Exemption_Areas/Raised_Footrope_Trawl_Whiting_Fishery_Exemption_Areas_METADATA.pdf

natural resources	Red Crab Management Unit	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Red_Crab_Management_Unit/Red_Crab_Management_Unit_METADATA.pdf
natural resources	Red Crab Trap-Pot Fishery	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Red_Crab_Trap-Pot_Fishery/Red_Crab_Trap-Pot_Fishery_METADATA.pdf
natural resources	Red Hake Stock Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Red_Hake_Stock_Areas/Red_Hake_Stock_Areas_METADATA.pdf
natural resources	Redfish Exemption Area and Cod Closure	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Redfish_Exemption_Area_and_Cod_Closure/Redfish_Exemption_Area_and_Cod_Closure_METADATA.pdf
natural resources	Restricted Gear Areas Mults	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Restricted_Gear_Areas/Restricted_Gear_Areas_METADATA.pdf
natural resources	River Herring and Shad Catch Cap Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/River_Herring_and_Shad_Catch_Cap_Areas/River_Herring_and_Shad_Catch_Cap_Areas_METADATA.pdf
natural resources	River Herring and Shad Catch Cap Closure Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/River_Herring_and_Shad_Catch_Cap_Closure_Areas/River_Herring_and_Shad_Catch_Cap_Closure_Areas_METADATA.pdf
natural resources	Scallop Days-at-Sea (DAS) Change to Declare Out of Fishery (DOF) Transit with Product On Board Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Scallop_DAS_Change_to_DOF_Transit_w_Product_On_Board_Area/Scallop_DAS_Change_to_DOF_Transit_w_Product_On_Board_Area_METADATA.pdf

natural resources	Scup Gear Restricted Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Scup_Gear_Restricted_Areas/Scup_Gear_Restricted_Areas_METADATA.pdf
natural resources	Scup Transfer-at-Sea	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Scup_Transfer-at-Sea/Scup_Transfer-at-Sea_METADATA.pdf
natural resources	Sea Scallop Accountability Measure Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Sea_Scallop_Accountability_Measure_Areas/Sea_Scallop_Accountability_Measure_Areas_METADATA.pdf
natural resources	Sector Small-Mesh Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Sector_Small-Mesh_Exemption_Area/Sector_Small-Mesh_Exemption_Area_METADATA.pdf
natural resources	Sector Stock Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Sector_Stock_Areas/Sector_Stock_Areas_METADATA.pdf
natural resources	September-October River Herring Monitoring-Avoidance Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/September-October_River_Herring_Monitoring-Avoidance_Areas/September-October_River_Herring_Monitoring-Avoidance_Areas_METADATA.pdf
natural resources	Silver Hake Stock Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Silver_Hake_Stock_Areas/Silver_Hake_Stock_Areas_METADATA.pdf
natural resources	Six Mile Line	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Six_Mile_Line/Six_Mile_Line_METADATA.pdf

natural resources	Skate Management Unit	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Skate_Management_Unit/Skate_Management_Unit_METADATA.pdf
natural resources	Small Mesh Areas 1 and 2	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Small_Mesh_Areas_1_and_2/Small_Mesh_Areas_1_and_2_METADATA.pdf
natural resources	SNE Dogfish Gillnet Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/SNE_Monkfish_and_Skate_Gillnet_Exemption_Area/SNE_Monkfish_and_Skate_Gillnet_Exemption_Area_METADATA.pdf
natural resources	SNE Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/SNE_Exemption_Area/SNE_Exemption_Area_METADATA.pdf
natural resources	SNE Little Tunny Gillnet Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/SNE_Little_Tunny_Gillnet_Exemption_Area/SNE_Little_Tunny_Gillnet_Exemption_Area_METADATA.pdf
natural resources	SNE Monkfish and Skate Gillnet Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/SNE_Monkfish_and_Skate_Gillnet_Exemption_Area/SNE_Monkfish_and_Skate_Gillnet_Exemption_Area_METADATA.pdf
natural resources	SNE Monkfish and Skate Trawl Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/SNE_Monkfish_and_Skate_Trawl_Exemption_Area/SNE_Monkfish_and_Skate_Trawl_Exemption_Area_METADATA.pdf
natural resources	SNE Regulated Mesh Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/SNE_Regulated_Mesh_Area/SNE_Regulated_Mesh_Area_METADATA.pdf
natural resources	SNE Scallop Dredge Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/S

				NE_Scallop_Dredge_Exemption_Area/SNE_Scallop_Dredge_Exemption_Area_METADATA.pdf
natural resources	SNE Skate Bait Trawl Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/SNE_Skate_Bait_Trawl_Exemption_Area/SNE_Skate_Bait_Trawl_Exemption_Area_METADATA.pdf
natural resources	SNE-MA Winter Flounder Trawl Gear Accountability Measure Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/SNE-MA_Winter_Flounder_Trawl_Gear_Accountability_Measure_Areas/SNE-MA_Winter_Flounder_Trawl_Gear_Accountability_Measure_Areas_METADATA.pdf
natural resources	Southeast US Monitoring Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Southeast_US_Monitoring_Area/Southeast_US_Monitoring_Area_METADATA.pdf
natural resources	Southeast US Restricted Area N; Southeast US Restricted Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Southeast_US_Restricted_Area/Southeast_US_Restricted_Area_METADATA.pdf
natural resources	Southern Mid-Atlantic Management Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Southern_Mid-Atlantic_Management_Area/Southern_Mid-Atlantic_Management_Area_METADATA.pdf
natural resources	Southern Nearshore Trap-Pot Waters Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Southern_Nearshore_Trap-Pot_Waters_Area/Southern_Nearshore_Trap-Pot_Waters_Area_METADATA.pdf
natural resources	Southern New England Management Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/So

				uthern_New_England_Management_Area/Southern_New_England_Management_Area_METADATA.pdf
natural resources	Stellwagen Bank Management Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Stellwagen_Bank_Management_Area/Stellwagen_Bank_Management_Area_METADATA.pdf
natural resources	Stellwagen Bank-Jeffreys Ledge Restricted Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Stellwagen_Bank-Jeffreys_Ledge_Restricted_Area/Stellwagen_Bank-Jeffreys_Ledge_Restricted_Area_METADATA.pdf
natural resources	Stellwagen Shipwreck Sites	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Stellwagen_Shipwreck_Sites/Stellwagen_Shipwreck_Sites_METADATA.pdf
natural resources	Stock Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Stock_Areas/Stock_Areas_METADATA.pdf
natural resources	Summer Flounder Fishery-Sea Turtle Protection Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Summer_Flounder_Fishery-Sea_Turtle_Protection_Area/Summer_Flounder_Fishery-Sea_Turtle_Protection_Area_METADATA.pdf
natural resources	Summer Flounder Small-Mesh Exemption Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Summer_Flounder_Small-Mesh_Exemption_Area/Summer_Flounder_Small-Mesh_Exemption_Area_METADATA.pdf

natural resources	Tilefish Gear Restricted Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Tilefish_Gear_Restricted_Areas/Tilefish_Gear_Restricted_Areas_METADATA.pdf
natural resources	Tilefish Management Unit	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Tilefish_Management_Unit/Tilefish_Management_Unit_METADATA.pdf
natural resources	Trimester TAC Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Trimester_TAC_Areas/Trimester_TAC_Areas_METADATA.pdf
natural resources	Turtle Deflector Dredge Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Turtle_Deflector_Dredge_Area/Turtle_Deflector_Dredge_Area_METADATA.pdf
natural resources	US-Canada Management Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/US-Canada_Management_Areas/US-Canada_Management_Areas_METADATA.pdf
natural resources	VMS Demarcation Line	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/VMS_Demarcation_Line/VMS_Demarcation_Line_METADATA.pdf
natural resources	Waters Exempt from Minimum Traps per Trawl Requirement	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Waters_Exempt_from_Minimum_Traps_per_Trawl_Requirement/Waters_Exempt_from_Minimum_Traps_per_Trawl_Requirement_METADATA.pdf
natural resources	Waters Off New Jersey management Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/Waters_Off_New_Jersey_Management_Area/Waters_Off_New_Jersey_Management_Area_METADATA.pdf
natural resources	West of Cutler Set-Aside Area	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/shapefiles/W

				est_of_Cutler_Set-Aside_Area/West_of_Cutler_Set-Aside_Area_METADATA.pdf
natural resources	Windowpane Flounder and Ocean Pout Accountability Measure Areas	NOAA NMFS GARFO	https://archive.fisheries.noaa.gov/garfo/educational_resources/gis/data/	404 error
natural resources	Marine mammal habitat	NOAA MDAT	http://seamap.env.duke.edu/models/mdat/	Curtice C., Cleary J., Shumchenia E., Halpin P.N. 2019. Marine-life Data and Analysis Team (MDAT) technical report on the methods and development of marine-life data to support regional ocean planning and management. Roberts et al. (2016, 2017, 2018) and Curtice et al. (2019)
natural resources	Benthic habitats	TNC	http://portal.midatlanticocean.org/static/data_manager/data-download/Zip_Files/Marine_Life/Benthic_Habitats.zip	http://portal.midatlanticocean.org/static/data_manager/metadata/html/benthic_habitats.html
natural resources	Log density of tagged sea turtles	NOAA NEFSC	https://inport.nmfs.noaa.gov/inport/item/27337/rubric/data-set-completion	https://inport.nmfs.noaa.gov/inport/item/51655; https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/marine/namera/Pages/default.aspx
natural resources	sea scallop biomass, meat weight (kg) - draft	NEFSC and Virginia Institute of Marine Science (VIMS), School of Marine Science and Technology (SMAST) at University of Massachusetts Dartmouth	https://www.northeastoceandata.org/data-download/?data=Fish	https://www.northeastoceandata.org/files/metadata/Themes/Fish/ScallopBiomass.pdf
natural resources	sea scallop average abundance	School of Marine Science and Technology (SMAST) at University of Massachusetts Dartmouth	https://www.northeastoceandata.org/data-download/?data=Fish	https://easterndivision.s3.amazonaws.com/Marine/MooreGrant/AveragePresenceAbundanceSMAST.pdf
natural resources	Individual fish species (MARCO and MDAT) - Dogfish, Monkfish, Bluefish, butterfish	Northeast Fisheries Science Center (NEFSC/NMFS/NOAA), Massachusetts Division of Marine Fisheries (MDMF), North East Area Monitoring and Assessment	https://www.northeastoceandata.org/data-download/?data=Fish	http://seamap.env.duke.edu/models/mdat/Fish/MDAT_Fish_Biomass_Metadata.pdf

		Program (NEAMAP), and Maine & New Hampshire state trawls (ME/NH).		
natural resources	NEFMC Small Mesh multispecies FMP (Total Biomass and Species Richness) Spring/Fall	NEFMC (summary product)	https://www.northeastoceandata.org/data-download/?data=Fish	http://seamap.env.duke.edu/models/mdat/Fish/MDAT_NEFSC_Fish_Summary_Products_Metadata.pdf
natural resources	Species vulnerable to climate change (core species biomass area, biomass, species richness)	NEFMC (summary product)	https://www.northeastoceandata.org/data-download/?data=Fish	http://seamap.env.duke.edu/models/mdat/Fish/MDAT_NEFSC_Fish_Summary_Products_Metadata.pdf
natural resources	Diadromous species: Species Richness (Spring)	NEFMC (summary product)	https://www.northeastoceandata.org/data-download/?data=Fish	http://seamap.env.duke.edu/models/mdat/Fish/MDAT_NEFSC_Fish_Summary_Products_Metadata.pdf
natural resources	NEFMC Skates: Biomass, Core Biomass Area, Species Richness) - Spring	NEFMC (summary product)	https://www.northeastoceandata.org/data-download/?data=Fish	http://seamap.env.duke.edu/models/mdat/Fish/MDAT_NEFSC_Fish_Summary_Products_Metadata.pdf
natural resources	Birds (individual species; important bird polygons; movement information, modeled distribution), (Avian 90% Abundance Confidence Interval Range, Avian Abundance, Avian Abundance Coefficient of Variation (MARCO))	NEFMC/MDAT	https://data.nodc.noaa.gov/cgi-bin/iso?id=gov.noaa.nodc:0176682#	https://data.nodc.noaa.gov/cgi-bin/iso?id=gov.noaa.nodc:0176682;view=iso
natural resources	NEFMC Multispecies (Biomass, core biomass area, species richness)	NEFMC/MDAT	http://seamap.env.duke.edu/models/mdat/	http://seamap.env.duke.edu/models/mdat/Fish/MDAT_NEFSC_Fish_Summary_Products_Metadata.pdf
natural resources	NEFSC Trawl Extent	NOAA NEFSC	https://www.northeastoceandata.org/data-download/?data=Fish	https://easterndivision.s3.amazonaws.com/Marine/MooreGrant/AveragePresenceAbundanceSMAST.pdf
natural resources	NEFSC Trawl Strata	NOAA NEFSC	https://www.northeastoceandata.org/data-download/?data=Fish	https://easterndivision.s3.amazonaws.com/Marine/MooreGrant/AveragePresenceAbundanceSMAST.pdf
natural resources	shellfish habitat	TNC	https://www.northeastoceandata.org/data-download/?data=Habitat	https://www.northeastoceandata.org/files/metadata/Themes/Habitat/ShellfishHabitat.pdf

natural resources	hardbottom points	NOAA NCCOS	CASS NE AMA gdb	NMFS 2014 and NOAA BioGeo (2018)
natural resources	hardbottom predicted area	NOAA NCCOS	CASS NE AMA gdb	NMFS 2014 and NOAA BioGeo (2018)
Natural Resources	Artificial Reefs	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ArtificialReefs.zip	https://inport.nmfs.noaa.gov/inport/item/54191
Natural Resources	Audubon IBAs	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/CoastalAudobonIBAs.zip	https://inport.nmfs.noaa.gov/inport/item/54363
Natural Resources	Cetacean BIAs	NOAA NMFS	http://cetsound.noaa.gov/Assets/cetsound/data/CetMap_BIA_WGS84.zip	https://inport.nmfs.noaa.gov/inport/item/23643
Natural Resources	Coastal Barrier Island Resource System	FWS	https://www.fws.gov/ecological-services/habitat-conservation/cbra/Maps/a/CBRS_Polygons.zip	http://www.fws.gov/ecological-services/habitat-conservation/cbra/maps/CBRS-Metadata.xml
Natural Resources	Coastal Critical Habitat Designation	NOAA	https://inport.nmfs.noaa.gov/inport/item/54209	ftp://ftp.coast.noaa.gov/pub/MSP/CoastalCriticalHabitatDesignations.zip
Natural Resources	coastal wetlands inventory	NWI	https://www.northeastoceandata.org/data-download/?data=Habitat	https://www.northeastoceandata.org/files/metadata/Themes/Restoration/CoastalWetlands.pdf
Natural Resources	zooplankton	TNC	https://www.northeastoceandata.org/data-download/?data=Habitat	http://easterndivision.s3.amazonaws.com/Marine/MooreGrant/CalanusfinmarchicusAbundance.pdf
Natural Resources	Deep Sea Coral and Sponge Observations	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/DeepSeaCoralObservations.zip	https://inport.nmfs.noaa.gov/inport/item/54377
Natural Resources	primary production	NEFMC (from NOAA Ocean Color) by season	https://www.northeastoceandata.org/data-download/?data=Habitathttps://www.northeastoceandata.org/data-download/?data=HabitatTNV	https://www.northeastoceandata.org/files/metadata/Themes/Habitat/NEFSC_spatial_metadata.pdf
Natural Resources	groundfish and shellfish EFH	NOAA	https://www.northeastoceandata.org/data-download/?data=Fish	http://portal.midatlanticocean.org/static/data_manager/metadata/html/efh_overlay_update.htm
Natural Resources	Loggerhead Turtle Sargassum CH	NOAA NMFS	https://www.fisheries.noaa.gov/resource/map/loggerhead-turtle-northwest-atlantic-ocean-dps-critical-habitat-map	https://www.fisheries.noaa.gov/resource/map/loggerhead-turtle-northwest-atlantic-ocean-dps-critical-habitat-map
Natural Resources	SAV (eelgrass)	NEOD Portal Working Group	https://www.northeastoceandata.org/data-download/?data=Habitathttps://www.northeastoceandata.org/data-download/?data=HabitatTNV	This data was compiled by SeaPlan using datasets from the Maine Department of Marine Resources, Bureau of Resource Management, Maine Office of GIS,

				University of New Hampshire, New Hampshire Department of Environmental Services, NH GRANIT (New Hampshire Geographically Referenced Analysis and Information Transfer System), Massachusetts Department of Environmental Protection, MassGIS, Rhode Island Eelgrass Task Force, Virginia Tech University/US Fish and Wildlife Inventory, National Wetlands Inventory Program, Connecticut Department of Energy and Environmental Protection
Natural Resources	Greater Atlantic Region NOAA Statistical Areas	NOAA NMFS	ftp://ftp.nefsc.noaa.gov/pub/gis/	https://www.fisheries.noaa.gov/region/new-england-mid-atlantic
Natural Resources	EFH Layers	NOAA	https://www.habitat.noaa.gov/protection/efh/newInv/index.html	https://www.habitat.noaa.gov/protection/efh/newInv/index.html
Natural Resources	HAPCs	NOAA	https://www.habitat.noaa.gov/protection/efh/newInv/index.html	https://www.habitat.noaa.gov/protection/efh/newInv/index.html
Natural Resources	EFH Highly Migratory Spp	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/EFH_HighlyMigratorySpecies.zip	https://catalog.data.gov/harvest/object/bdac4f60-d14d-4558-992e-a72e054e90f1/html
Natural Resources	Other benthic fauna (sand dollars, copepod *Calanus finmarchicus*, Euphausiids (a group of zooplankton), Gammarid amphipods (a group of zooplankton) , , mysid shrimp (fall and spring), hermit crab, moon snail, seastar, Bryozoans or Hydrozoans, sponges	SMAST	https://www.northeastoceandata.org/data-download/?data=Habitathttps://www.northeastoceandata.org/data-download/?data=HabitatTNV	http://easterndivision.s3.amazonaws.com/Marine/MooreGrant/AveragePresenceAbundanceSMAST.pdf
Natural Resources	MPAs	NOAA	https://marineprotectedareas.noaa.gov/media/data/MPAI2017gdb.zip	https://nmsmarineprotectedareas.blob.core.windows.net/marineprotectedareas-prod/media/data/MPAI_2017_metadata.pdf
Natural Resources	HMS	NOAA	https://catalog.data.gov/dataset/highly-migratory-species	https://www.fisheries.noaa.gov/topic/atlantic-highly-migratory-species

Natural Resources	NERRs	NOAA NERRs	http://cdmo.baruch.sc.edu/get/gis.cfm	
Natural Resources	Restoration Project areas	GRID-Arendal, Geoscience Australia, Conservation International	https://www.northeastoceandata.org/data/data-download/?data=Habitat	https://www.northeastoceandata.org/files/metadata/Themes/Restoration/PotentialRestorationProjects.pdf
Natural Resources	Protected Areas	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/ProtectedAreas.gdb.zip	https://inport.nmfs.noaa.gov/inport/item/54398
Natural Resources	NY aerial survey sea turtle and whale data	NYSDEC Whale Monitoring Aerial Survey Report (Meghan Rickard)		Reports monthly -
Natural Resources	Communities at Sea*	Total bottom trawl; total dredge activity; total gillnet activity; total longline activity; total pots and traps, lobster, shrimp, boats>65', boats<65' activity over time; Original data provided by NOAA NMFS Northeast Fisheries Science Center; data processed by the Grant F. Walton Center for Remote Sensing and Spatial Analysis (CRSSA), Rutgers, the State University of New Jersey	Spoke with Kevin St. Martin; followed up with Kevin Madley and James Morris to reach out to coordinate data transfer; he will be back in office first week in Jan	http://portal.midatlanticocean.org/static/data_manager/metadata/html/CASMetadata.html
Natural Resources	VMS Heat Maps	VMS NROC Heat Maps (Multispecies, Squid, Herring, Mackerel, Scallops, Clams, Monkfish, Pelagics)	CASS gdb	(Northeast Regional Ocean Council (NROC) - Northeast Ocean Data Working Group
Natural Resources	VMS (south of Long Island) 2009 - 2019; NH state/fed	NOAA OLE	CASS gdb	NMFS OLE - Dennis Trager and Kelley Spalding
Navigation	Pilot Boarding Stations	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/PilotBoarding.zip	https://inport.nmfs.noaa.gov/inport/item/54394
Navigation	Coastal Maintained Channels	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/CoastalMaintainedChannels.zip	https://inport.nmfs.noaa.gov/inport/item/54372
Navigation	Pilot Boarding Areas	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/PilotBoarding.zip	https://inport.nmfs.noaa.gov/inport/item/54393
Navigation	Aids to Navigation	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/AidsToNavigation.zip	https://inport.nmfs.noaa.gov/inport/item/56120
Navigation	Anchorage Areas	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/AnchorageAreas.zip	https://inport.nmfs.noaa.gov/inport/item/48849

Navigation	RULET wrecks (Polluting)	National Marine Sanctuaries	https://sanctuaries.noaa.gov/protect/ppw/	Data available by request
Navigation	AWOIS wrecks	NOAA	https://nauticalcharts.noaa.gov/data/wrecks-and-obstructions.html	
Navigation	AWOIS obstructions	NOAA	https://nauticalcharts.noaa.gov/data/wrecks-and-obstructions.html	
Navigation	ENC wrecks	NOAA	https://www.northeastoceandata.org/data/data-download/?data=Marine+Transportation	https://www.nauticalcharts.noaa.gov
Navigation/Transportation	Shipping Fairways, Traffic Separation Zones	NOAA	http://encdirect.noaa.gov/theme_layers/data/shipping_lanes/shippinglanes.zip	https://inport.nmfs.noaa.gov/inport/item/39986
Navigation	Areas to be avoided	NOAA Office of General Council (MPAs)	https://www.northeastoceandata.org/data/data-download/?data=Marine+Transportation	https://www.gc.noaa.gov/gcil_mpa-aa.html
Navigation	Recommended Route	NOAA (whale avoidance)	https://www.northeastoceandata.org/data/data-download/?data=Marine+Transportation	https://inport.nmfs.noaa.gov/inport/item/48921
Navigation	Safety, Security, and Regulated Zone	USCG	https://www.northeastoceandata.org/data/data-download/?data=Marine+Transportation	https://www.northeastoceandata.org/files/metadata/Themes/MarineTransportation/SafetySecurityRegulatedAreas.pdf
Navigation	Restricted Speed Areas (North Atlantic Right Whale)	NOAA (whale avoidance)	https://www.northeastoceandata.org/data/data-download/?data=Marine+Transportation	https://www.northeastoceandata.org/files/metadata/Themes/MarineTransportation/right_whale_SMA_all_ln.htm
Navigation	Precautionary Areas	USCG	https://www.northeastoceandata.org/data/data-download/?data=Marine+Transportation	https://www.northeastoceandata.org/data-download/?data=Marine%20Transportation
Navigation	Navigable Waters	US Department of Transportation (USDOT)/Bureau of Transportation Statistics (BTS's) National Transportation Atlas Database (NTAD)	https://hifld-geoplatform.opendata.arcgis.com/datasets/navigable-waterway-network-lines	https://hifld-geoplatform.opendata.arcgis.com/datasets/navigable-waterway-network-lines
Navigation	Ferry Routes	National Atlas of the US	https://geo.nyu.edu/catalog/stanford-gd729dg1947	https://www.lib.ncsu.edu/gis/search/datainfo.php?datasetid=520_NTAD&rk=1&s=ds&e=
Navigation	AIS Data (2017) Zones 18-19	NOAA/USCG	marinecadastre.gov; Daniel Martin	Office for Coastal Management, 2018: 2014 United States Automatic Identification System Database, https://inport.nmfs.noaa.gov/inport/item/48845

Navigation	No discharge zones	GRID-Arendal, Geoscience Australia, Conservation International	http://www.northeastoceandata.org/files/metadata/Themes/WaterQuality.zip	http://www.northeastoceandata.org/files/metadata/Themes/WaterQuality/NoDischargeZones.pdf
Oceanographic	Bathymetry	NOAA - 2013 (CRM), 2015 (GEBCO)	https://www.ngdc.noaa.gov/mgg/coastal/crm.html; https://www.gebco.net/data_and_products/historical_data_sets/	
Oceanographic	Submarine canyons	GRID-Arendal, Geoscience Australia, Conservation International	https://www.northeastoceandata.org/data-download/?data=Habitat	https://www.northeastoceandata.org/files/metadata/Themes/PhysicalOceanography/Metadata/SubmarineCanyons.xml
Oceanographic	Environmental Sensors and Buoys (i.e., Montauk Point buoy; Station 44017, 40.693, -72.049)	Northeastern Regional Association of Coastal Ocean Observing Systems	https://www.northeastoceandata.org/data-download/?data=Physical%20Oceanography	Northeastern Regional Association of Coastal Ocean Observing Systems (2017)
Oceanographic	Current Speed & Direction (FVCOM)	SMAST	https://www.northeastoceandata.org/data-download/?data=Habitathttps://www.northeastoceandata.org/data-download/?data=HabitatTNV	University of Massachusetts-Dartmouth School for Marine Science and Technology (SMAST), Woods Hole Oceanographic Institution (WHOI), RPS Applied Science Associates (RPS ASA)
Oceanographic	Sig Wave Height and Direction (FVCOM)	SMAST	https://www.northeastoceandata.org/data-download/?data=Habitathttps://www.northeastoceandata.org/data-download/?data=HabitatTNV	University of Massachusetts-Dartmouth School for Marine Science and Technology (SMAST), Woods Hole Oceanographic Institution (WHOI), RPS Applied Science Associates (RPS ASA); Buoy data can be used as well
Oceanographic	Water Temperature (FVCOM)	SMAST	https://www.northeastoceandata.org/data-download/?data=Habitathttps://www.northeastoceandata.org/data-download/?data=HabitatTNV	Water temperature from the FVCOM model
Oceanographic	Salinity (FVCOM)	SMAST	https://www.northeastoceandata.org/data-download/?data=Habitathttps://www.northeastoceandata.org/data-download/?data=HabitatTNV	University of Massachusetts-Dartmouth School for Marine Science and Technology (SMAST), Woods Hole Oceanographic Institution (WHOI), RPS Applied Science Associates (RPS ASA)
Oceanographic	Aragonite saturation state	NOAA NCEI	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/SurfaceAragonite.zip	https://inport.nmfs.noaa.gov/inport/item/54405

Oceanographic	% Light Transmissivity Kd (par)	NOAA	ftp://ftp.star.nesdis.noaa.gov/pub/socd1/mecb/coastwatch/viirs/science/L3/global/kd/monthly/WW00/	
Oceanographic	Kd (490)	NOAA	ftp://ftp.star.nesdis.noaa.gov/pub/socd1/mecb/coastwatch/viirs/science/L3/global/kd/monthly/WW00/	
Oceanographic	Nutrients at Depth (Silicate, Phosphate, Nitrate)	BioOracle	as new data becomes available	http://bio-oracle.org/downloads-to-email.php
Oceanographic	Dissolved Oxygen	BioOracle	http://bio-oracle.org/downloads-to-email.php	http://bio-oracle.org/downloads-to-email.php
Oceanographic	Iron Concentration	BioOracle	http://bio-oracle.org/downloads-to-email.php	http://bio-oracle.org/downloads-to-email.php
Oceanographic	Sediment thickness	NOAA	https://www.ngdc.noaa.gov/mgg/sedthick/index.html	https://www.ngdc.noaa.gov/mgg/sedthick/sedthick.html
Oceanographic	Sediment - Seabed Forms	TNC (includes SMAST, TNC) - based on usSEABED and USGS sediment texture database	https://www.northeastoceandata.org/data-download/?data=Habitat	Anderson, M. G., Greene, J., Morse, D., Shumway, D. and Clark, M (2010) Benthic Habitats of the Northwest Atlantic in Greene, J.K., M.G. Anderson, J. Odell, and N. Steinberg, eds. The Northwest Atlantic Marine Ecoregional Assessment: Species, Habitats and Ecosystems. Phase One. The Nature Conservancy, Eastern US Division, Boston, MA.
Oceanographic	Sediment - Stability SMAST	TNC (includes SMAST, TNC) - based on usSEABED and USGS sediment texture database	https://www.northeastoceandata.org/data-download/?data=Habitat	
Oceanographic	Sediment - Soft Sediment Grain Size	TNC (includes SMAST, TNC) - based on usSEABED and USGS sediment texture database	https://www.northeastoceandata.org/data-download/?data=Habitat	
Oceanographic	Chlorophyll a concentration (NASA)	NASA OceanColor L3 SMI Product	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/Chlorophyll_a.zip ; https://oceandata.sci.gsfc.nasa.gov/MODIS-Aqua/Binned/Monthly/	https://inport.nmfs.noaa.gov/inport/item/54369
Social/cultural	Paddle Board Events	The Board and Paddle Events layer depicts event point locations as mapped by participants in	https://www.northeastoceandata.org/data-download/?data=Culture	https://www.northeastoceandata.org/files/metadata/Themes/Recreation/CompetitiveBoardAndPaddleEvents.pdf

		Northeast Coastal and Marine Recreational Use Characterization Study, which was conducted by SeaPlan, Surfrider Foundation, and Point 97 under the direction of the Northeast Regional Planning Body (NE RPB).		
Social/cultural	Boat launches	Northeast Regional Ocean Council (Data from States)	https://www.northeastoceandata.org/data-download/?data=Culture	https://www.northeastoceandata.org/files/metadata/Themes/Recreation/BoatLaunches.pdf
Social/cultural	Commercial Whale watching areas	The Commercial Whale Watching Areas layer depicts event point locations as mapped by participants in Northeast Coastal and Marine Recreational Use Characterization Study, which was conducted by SeaPlan, Surfrider Foundation, and Point 97 under the direction of the Northeast Regional Planning Body (NE RPB).	https://www.northeastoceandata.org/data-download/?data=Culture	SeaPlan, Surfrider, and Point 97
Social/cultural	Distance sailing races	The Distance Sailing Races layer depicts activity areas mapped by participants in the Northeast Coastal and Marine Recreational Use Characterization Study, which was conducted by SeaPlan, Surfrider Foundation, and Point 97 under the direction of the Northeast Regional Planning Body (NE RPB).	https://www.northeastoceandata.org/data-download/?data=Culture	http://www.northeastoceandata.org/files/metadata/Themes/Recreation/DistanceSailingRaces.pdf
Social/cultural	Secured Lands	TNC	https://www.northeastoceandata.org/data-download/?data=Culture	https://www.northeastoceandata.org/files/metadata/Themes/Culture/SecuredLands.pdf
Social/cultural	Federally recognized tribes	EPA	https://www.northeastoceandata.org/data-download/?data=Culture	https://www.northeastoceandata.org/files/metadata/Themes/Culture/FedRecTribalLocations.pdf

Social/cultural	Individual Ocean Uses	The Individual Ocean Uses layer depicts activity areas mapped by participants in the Northeast Coastal and Marine Recreational Use Characterization Study, which was conducted by Surfrider Foundation, SeaPlan, and Point 97 under the direction of the Northeast Regional Planning Body (NE RPB).	https://www.northeastoceandata.org/data-download/?data=Culture	https://www.northeastoceandata.org/files/metadata/Themes/Recreation/IndividualOceanUses.pdf
Social/cultural	National Register of Historic Places (pts and poly)	Maine Historic Preservation Commission, Massachusetts Historical Commission Preservation Planning Division, New York State Office of Parks Recreation and Historic Preservation: State Historic Preservation Office, and Rhode Island Historic Preservation Commission	https://www.northeastoceandata.org/data-download/?data=Culture	https://www.northeastoceandata.org/files/metadata/Themes/Culture/NationalRegisterHistoricPlacesPoints.pdf
Social/cultural	National Register of Historic Places (pts and poly)	Maine Historic Preservation Commission, Massachusetts Historical Commission Preservation Planning Division, New York State Office of Parks Recreation and Historic Preservation: State Historic Preservation Office, and Rhode Island Historic Preservation Commission	https://www.northeastoceandata.org/data-download/?data=Culture	https://www.northeastoceandata.org/files/metadata/Themes/Culture/NationalRegisterHistoricPlacesPoints.pdf
Social/cultural	Recreational fishing areas	GARFO	http://portal.midatlanticocean.org/data-catalog/fishing/#layer-info-management-areas292	http://opdgig.dos.ny.gov/geoportal/catalog/search/resource/detailsnoheader.page?uuid={3B5083DA-2060-4F5D-8416-201A0A2B962B}
Social/cultural	Rec Boater activities	The Northeast Recreational Boater Activities Layer depicts activity points plotted by participants in the 2012 Northeast	https://www.northeastoceandata.org/data-download/?data=Culture	http://www.northeastoceandata.org/files/metadata/Themes/Recreation/RecreationalBoaterActivities.pdf

		Recreational Boater Survey, which was conducted by SeaPlan, the Northeast Regional Ocean Council (NROC), states' coastal agencies, marine trade associations composed of many private industry representatives, and the First Coast Guard District		
Social/cultural	Rec Boater routes	The Northeast Recreational Boater Routes displays recreational boater routes that were mapped by participants in the 2012 Northeast Recreational Boater Survey, which was conducted by SeaPlan, the Northeast Regional Ocean Council (NROC), states' coastal agencies, marine trade associations composed of many private industry representatives, and the First Coast Guard District.	https://www.northeastoceandata.org/data-download/?data=Culture	http://www.northeastoceandata.org/files/metadata/Themes/Recreation/RecreationalBoaterRoutes.pdf
Social/cultural	Scuba Diving Areas	The Recreational SCUBA Diving Areas layer depicts activity areas mapped by participants in the Northeast Coastal and Marine Recreational Use Characterization Study, which was conducted by SeaPlan, Surfrider Foundation, and Point 97 under the direction of the Northeast Regional Planning Body (NE RPB)	https://www.northeastoceandata.org/data-download/?data=Culture	https://www.northeastoceandata.org/files/metadata/Themes/Recreation/RecreationalSCUBADivingAreas.pdf
Social/cultural	Water Trails	Northeast Regional Ocean Council	https://www.northeastoceandata.org/data-download/?data=Culture	https://www.northeastoceandata.org/files/metadata/Themes/Recreation/WaterTrails.pdf
Administrative boundaries	EPA Regional Boundaries	EPA	https://www.epa.gov/frs/epa-regional-kml-download	https://www.epa.gov/ceam/metadata-epa-regional-boundaries

Administrative boundaries	National Parks	National Park Service	https://irma.nps.gov/DataStore/Reference/Profile/2225713	https://www.arcgis.com/sharing/rest/content/items/b1598d3df2c047ef88251016af5b0f1e/info/metadata/metadata.xml?format=default&output=html
Administrative boundaries	Federal Consistency Location Descriptions	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/GeographicLocationDescriptions.zip	https://inport.nmfs.noaa.gov/inport/item/51544
Administrative boundaries	US Coast Guard Districts	USCG	https://www.northeastoceandata.org/data-download/?data=Administrative%20Boundaries	https://services.northeastoceandata.org/arcgis1/rest/services/Administrative/MapServer/5
Administrative boundaries	USACE Districts	USACE	https://www.northeastoceandata.org/data-download/?data=Administrative%20Boundaries	https://www.arcgis.com/sharing/rest/content/items/70805e1a8fd74e42b0a9585088d6d151/info/metadata/metadata.xml?format=default&output=html
Administrative boundaries	Federal/State Boundary (Submerged Lands Act)	NOAA	https://coast.noaa.gov/data/Documents/OceanLawSearch/Summary%20of%20Law%20-%20Submerged%20Lands%20Act.pdf	https://data.noaa.gov/waf/NOAA/NESDIS/ncei/
Administrative boundaries	EEZ	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/CoastalCounties.zip	https://inport.nmfs.noaa.gov/inport/item/54383
Administrative boundaries	Coastal State Legislative Districts House	NOAA NMFS	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/CoastalStateLegislativeDistricts.zip	https://inport.nmfs.noaa.gov/inport/item/54373
Administrative boundaries	Coastal State Legislative Districts Senate	NOAA NMFS	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/CoastalStateLegislativeDistricts.zip	https://inport.nmfs.noaa.gov/inport/item/54374
Administrative boundaries	Coastal Counties	US Census Bureau	http://www2.census.gov/geo/tiger/TIGER2017/COUNTY/tl_2017_us_county.zip	https://inport.nmfs.noaa.gov/inport/item/54371
Administrative boundaries	Coastal States	NOAA	ftp://ftp.coast.noaa.gov/pub/MSP/ORT/CoastalStates.zip	https://inport.nmfs.noaa.gov/inport/item/54375
Administrative boundaries	COLREGS Demarcation line	USCG	https://www.northeastoceandata.org/data-download/?data=Marine%20Transportation	https://inport.nmfs.noaa.gov/inport/item/56121

Table A-2: Characterization of fisheries species, regional distribution, and regional contacts from the NMFS GARFO Sustainable Fisheries Division. Spatial Distributions are from modeled data.[20] Contact information for specific species leads can be located at the GARFO contacts page.[21] Due to the overlap of the AOI with the Northeast and Mid-Atlantic regions, species descriptions, spatial distribution, or fisheries management plans (FMPs) may come from either region. Importantly, not all species described herein have a spatial distribution model available or a specific FMP in place.

1) **Atlantic Herring**:
    a. FMP: https://www.fisheries.noaa.gov/management-plan/atlantic-herring-management-plan
    b. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/pelagic/atlantic-herring.html
    c. Contact at NMFS Sustainable Fisheries Division: Carrie Nordeen
2) **Longfin Squid**:
    a. FMP: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/invertebrate/longfin-squid.html
    b. Contact at NMFS Sustainable Fisheries Division: Doug Christel
3) **Shortfin Squid:**
    a. FMP: https://www.fisheries.noaa.gov/management-plan/atlantic-mackerel-squid-and-butterfish-management-plan
    b. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/invertebrate/shortfin-squid.html
    c. Contact at NMFS Sustainable Fisheries Division: Doug Christel
4) **Butterfish:**
    a. FMP: https://www.fisheries.noaa.gov/management-plan/atlantic-mackerel-squid-and-butterfish-management-plan
    b. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/pelagic/butterfish.html
    c. Contact at NMFS Sustainable Fisheries Division: Doug Christel
5) **Atlantic Mackerel**
    a. FMP: https://www.fisheries.noaa.gov/management-plan/atlantic-mackerel-squid-and-butterfish-management-plan
    b. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/pelagic/atlantic-mackerel.html
    c. Contact at NMFS Sustainable Fisheries Division: Doug Christel
6) **Scup**:
    a. FMP: https://www.fisheries.noaa.gov/management-plan/summer-flounder-scup-and-black-sea-bass-management-plan
    b. https://www.nefsc.noaa.gov/ecosys/spatial-analyses/other/scup.html
    c. Contact at NMFS Sustainable Fisheries Division: Emily Keiley
7) **Tilefish**:
    a. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/other/tilefish.html
    b. Contact at NMFS Sustainable Fisheries Division: Doug Potts
8) **Summer Flounder (Fluke)**:
    a. FMP: https://www.fisheries.noaa.gov/management-plan/summer-flounder-scup-and-black-sea-bass-management-plan
    b. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/flatfish/summer-flounder.html
    c. Contact at NMFS Sustainable Fisheries Division: Emily Keiley

[20] Please see https://www.nefsc.noaa.gov/ecosys/modeling/ for more information.
[21] Contacts list: https://www.fisheries.noaa.gov/contact/greater-atlantic-region-sustainable-fisheries-office

9) **Atlantic Sea Scallop**:
    a. Original FMP: http://s3.amazonaws.com/nefmc.org/scallop_fmp.pdf
    b. FMP most recent amendments: https://www.fisheries.noaa.gov/management-plan/atlantic-sea-scallop-management-plan
    c. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/invertebrate/sea-scallop.html
    d. Contact at NMFS Sustainable Fisheries Division: Shannah Jaburek and Travis Ford
10) **Black Sea Bass**:
    a. FMP: https://www.fisheries.noaa.gov/management-plan/summer-flounder-scup-and-black-sea-bass-management-plan
    b. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/other/black-sea-bass.html
    c. Contact at NMFS Sustainable Fisheries Division: Emily Keiley
11) **Red Hake**:
    a. Northeast Multispecies FMP: https://www.fisheries.noaa.gov/management-plan/northeast-multispecies-management-plan
    b. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/gadoid/red-hake.html
    c. Contact at NMFS Sustainable Fisheries Division: Michael Ruccio
    d. Other species in the Northeast Multispecies FMP: Atlantic Cod, Winter Flounder, Atlantic Halibut, Witch Flounder, Haddock, Yellowtail Flounder, Wolffish, Windowpane Flounder, Atlantic Pollock, White Hake, Ocean Pout, Acadian Redfish, Silver Hake, and the American Plaice. Some spatial distributions for these species are located at: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/flatfish.html; https://www.nefsc.noaa.gov/ecosys/spatial-analyses/demersal/ocean-pout.html; https://www.nefsc.noaa.gov/ecosys/spatial-analyses/gadoid.html
12) **Lobster**:
    a. States and NOAA Fisheries cooperatively manage the American Lobster resource and fishery under the framework of the Atlantic States Marine Fisheries Commission (ASMFC). More information can be found at: https://www.fisheries.noaa.gov/species/american-lobster; the interstate FMP can be found at: http://www.asmfc.org/species/american-lobster; https://www.asmfc.org/uploads/file//5a0f06afLobsterDraftAddXXVI_JonahDraftAddIII_PublicComment.pdf
    b. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/invertebrate/american-lobster.html
    c. Published literature includes: https://web.northeastern.edu/grabowskilab/wp-content/uploads/2012/04/Chang-et-al-2010-MEPS.pdf; http://www.asmfc.org/uploads/file/5bdb531a2018AmLobsterFMPReview.pdf; https://www.boem.gov/sites/default/files/environmental-stewardship/Environmental-Studies/Renewable-Energy/BOEM-final-report-formatted_12072016.pdf ; https://seagrant.noaa.gov/News/Article/ArtMID/1660/ArticleID/2753/Sea-Grant-awards-2-million-to-advance-understanding-of-American-lobster-support-industry
    d. Contact at NMFS Sustainable Fisheries Division: Allison Murphy and Laura Hansen

13) **Surf Clams/ Ocean Quahogs:**
    a. FMP: https://www.fisheries.noaa.gov/management-plan/atlantic-surfclam-and-ocean-quahog-management-plan
    b. Spatial Distribution: Model not found
    c. Contact at NMFS Sustainable Fisheries Division: Doug Potts

14) **Red Crab**:
    a. FMP: https://www.nefmc.org/management-plans/red-crab
    b. Spatial Distribution: Unavailable
    c. Contacts at NMFS Sustainable Fisheries Division: Michael Ruccio and Allison Murphy
15) **Monkfish**:
    a. FMP: https://www.fisheries.noaa.gov/management-plan/monkfish-management-plan
    b. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/demersal/monkfish.html
    c. Contacts at NMFS Sustainable Fisheries Division: Peter Christopher, Mark Grant, Liz Sullivan
    d. Other demersal fishes include the Longfin Sculpin, Northern Puffer, Northern Sea Robin, Sea Raven, and Stripped Sea Robin. Spatial distributions for these species are located at: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/demersal.html
16) **Northern Skate Complex** (Winter Skate, Thorny Skate, Barndoor Skate, Rosette Skate, Little Skate, Smooth Skate, Clearnose skate)
    a. FMP: https://www.fisheries.noaa.gov/management-plan/northeast-skate-complex-management-plan
    b. Spatial Distributions: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/elasmobranch.html
    c. Contact at NMFS Sustainable Fisheries Division: Michael Ruccio
17) **Jonah Crab**:
    a. FMP: https://www.fisheries.noaa.gov/action/jonah-crab-fishery-interstate-fishery-management-plan-jonah-crab
    b. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/invertebrate/jonah-crab.html
    c. Contacts at NMFS Sustainable Fisheries Division: Allison Murphy
18) **Atlantic Bluefish:**
    a. FMP: https://www.fisheries.noaa.gov/management-plan/bluefish-management-plan
    b. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/pelagic/bluefish.html
    c. Contacts at NMFS Sustainable Fisheries Division: unknown
    d. Other pelagic fish: Alewife (anadromous), American Eel (catadromous), American Shad (anadromous), Atlantic Sturgeon (anadromous and ESA listed), Blueback Herring (anadromous), and the Northern Kingfish. Spatial distributions for these species are located at: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/pelagic.html
19) **Spiny Dogfish:**
    a. FMP: https://www.fisheries.noaa.gov/management-plan/spiny-dogfish-management-plan
    b. Spatial Distribution: https://www.nefsc.noaa.gov/ecosys/spatial-analyses/elasmobranch/spiny-dogfish.html
    c. Contacts at NMFS Sustainable Fisheries Division: unknown
20) **Atlantic Salmon (protected)**
    a. FMP: https://www.fisheries.noaa.gov/species/atlantic-salmon-protected
    b. Spatial Distribution: model not available (anadromous species)
    c. Contacts at NMFS Sustainable Fisheries Division: unknown

Table A-3: Fisheries Management Areas in the Northeast and Mid-Atlantic regions. Yes indicates that an identified suitable area overlaps or intersects with the management area, while No indicates the suitable area does not overlap or intersect with that particular management area.

Management Area	**Area A**	**Area B**	**Area C**	**Area D**
ALWTRP Regulated and Exempt Waters	Yes	Yes	Yes	Yes
Lobster Management Areas	Yes	Yes	Yes	Yes
Summer Flounder, Scup, Black Sea Bass Management Units	Yes	Yes	Yes	Yes
January-February River Herring Monitoring/Avoidance Sub-Area 3	Yes	Yes	Yes	No
Mar-April River Herring Monitoring-Avoidance Areas	Yes	Yes	Yes	No
Monkfish Fishery management Area	Yes	Yes	Yes	Yes
NE Multispecies Broad Stock Areas (SNE/MA Stock Area 4)	Yes	Yes	Yes	Yes
Cod, American Plaice, Yellowtail Flounder, Winter Flounder, Witch Flounder, White Hake, Pollock Stock Areas	Yes	Yes	Yes	Yes
Differential DAS Counting Areas (Effort-control program for NE multispecies limited access vessels)	Yes	Yes	Yes	Yes
Herring Fishery Management Area (Areas are necessary for the reporting of herring catch to track against sub-ACLs in the herring fishery)	Yes	Yes	Yes	Yes
Harbor Porpoise Take Reduction Plan Mid-Atlantic Exempted Waters	Yes	Yes	Yes	Yes
Other Northeast Gillnet Waters Area (Sep 1 - May 31)	Yes	Yes	Yes	No
Red Crab Management Unit [Red Crab Trap/Pot Fishery (Sep 1 - May 31)]	Yes	Yes	Yes	Yes
Red Hake Southern Stock Area (Defines the southern stock area for red hake for assessment and quota purposes)	Yes	Yes	Yes	Yes
Southern New England/Mid-Atlantic Catch Cap Area (River Herring and Shad Catch Cap Area)	Yes	Yes	Yes	Yes
Southern New England/Mid-Atlantic Catch Cap Closure Area (River Herring and Shad Catch Cap Closure area; more specific to River Herring)	Yes	Yes	Yes	Yes
Mid-Atlantic Sea Scallop Accountability Measure Area (If the scallop fishery exceeds its Southern New England yellowtail or southern windowpane flounder allocation in a given fishing year, this area will become a gear restricted area for part of the following fishing year to minimize flounder catch.)	Yes	Yes	Yes	Yes
Sector Stock Areas (SNE/MA Yellowtail Flounder Stock Area, GB Haddock Sector Stock Area, Redfish Sector Stock Area)	Yes	Yes	Yes	Yes
Silver Hake Southern Stock Area	Yes	Yes	Yes	Yes
Skate Management Unit	Yes	Yes	Yes	Yes
SNE Dogfish Gillnet Exemption Area (Vessel may fish with 6 in gillnet outside of DAS with possession restrictions)	Yes	Yes	Yes	No
Southern New England Exemption Area (NE Multispecies regulated mesh areas and restrictions on gear and methods of fishing)	Yes	Yes	Yes	No
Windowpane Flounder AM Gear Restricted Area (If the scallop fishery exceeds its SNE/MA windowpane flounder allocation, vessels may only fish in this area following specific gear restrictions.)	Yes	Yes	Yes	Yes
SNE Monkfish and Skate Gillnet Exemption Area (vessel may fish with 10 in gillnet outside of DAS with possession restrictions, provided the vessel has an LOA)	Yes	Yes	Yes	No
SNE (Southern New England) Regulated Mesh Area	Yes	Yes	Yes	Yes

Management Area	Area A	Area B	Area C	Area D
SNE Scallop Dredge Exemption Area	Yes	Yes	Yes	No
Offshore Trap/Pot Waters Area (Sep 1 - May 31)	Yes	Yes	Yes	Yes
Southern New England Management Area (Authorization for Commercial Fisheries Under the Marine Mammal Protection Act of 1972)	Yes	Yes	Yes	No
Summer Flounder Small-Mesh Exemption Area	Yes	Yes	Yes	No
Tilefish Management Unit (Geographic area of golden tilefish managed under the FMP)	Yes	Yes	Yes	Yes
SNE/MA Yellowtail Flounder Trimester TAC Area (Trimester TAC area for SNE/MA YT flounder with separate common pool quota. NMFS must close the area for the trimester when 90% of the quota is reached.)	Yes	Yes	Yes	Yes
Turtle Deflector Dredge Area (must have deflector)	Yes	Yes	Yes	Yes
Chain Mat-Modified Scallop Dredge Area (Restrictions applicable to the Atlantic sea scallop dredge fishery to help protect sea turtles)	Yes	Yes	Yes	Yes
Weakfish Prohibition Area	No	No	No	No
Atlantic Halibut Flynet Fishing Prohibition Area	No	No	No	No
Atlantic Sturgeon CH River	No	No	No	No
May-June River Herring Monitoring-Avoidance Areas	No	No	No	No
Mid-South Atlantic Gillnet Waters	No	No	No	Yes
MA Exemption Area (Vessels may fish without DAS west of the SNE Exemption Area)	No	No	No	Yes
Scup Gear Restricted Areas (Northern Gear Restricted Area 1)	No	No	No	No
Waters Off New Jersey Management Area	No	No	No	Yes
Atlantic Red Drum Fishery Harvest or Possession Prohibition Area	No	No	No	No
Atlantic Striped Bass Possession Area (Identifies striped bass legal possession area in EEZ portion of Block Island Sound to allow for the transit of striped bass over Federal waters between two areas of state waters)	No	No	No	No
Atlantic Wolffish Fixed Gear AM Area 1	No	No	No	No
Block Island Sound Lighthouses	No	No	No	No
Cape Cod Bay Restricted Area	No	No	No	No
Cape Cod South Closure Area	No	No	No	No
Cape Cod Spiny Dogfish Exemption Areas	No	No	No	No
Cashes Ledge Closure Area	No	No	No	No
Closed Area II Yellowtail Flounder/Haddock SAP Area	No	No	No	No
Cultivator Shoal Whiting Fishery Exemption Area	No	No	No	No
Stellwagen Dedicated Habitat Research Area	No	No	No	No
Delaware Special Management Areas (Artificial Reefs)	No	No	No	No
Eastern US-Canada Haddock SAP Area	No	No	No	No
Environmental Degradation Closures	No	No	No	No
Fippennies Ledge Area (Area under consideration for permanent closure for habitat protection)	No	No	No	No
Frank R. Lautenberg Deep-Sea Coral Protection Area	No	No	No	No
GB (Georges Bank) Spawning Groundfish Closure	No	No	No	No

Management Area	Area A	Area B	Area C	Area D
GOM/GB Dogfish and Monkfish Gillnet Fishery Exemption Area	No	No	No	No
GOM/GB Exemption Area	No	No	No	No
GOM/GB Inshore Restricted Roller Gear Area	No	No	No	No
GB Regulated Mesh Area	No	No	No	No
GOM Cod Protection Closures	No	No	No	No
GOM Grate Raised Footrope Trawl Whiting Fishery Exemption Area (Jul 1 - Nov 30) (Small-mesh multispecies directed fishery)	No	No	No	No
GOM Scallop Dredge Exemption Area	No	No	No	No
GOM Spawning Groundfish Closure	No	No	No	No
Great South Channel Restricted Gillnet Area	No	No	No	No
Great South Channel Restricted Trap/Pot Area	No	No	No	No
Great South Channel Scallop Dredge Exemption Area	No	No	No	No
Western Gulf of Maine Habitat Management Area	No	No	No	No
Herring GB Haddock Accountability Measure Area	No	No	No	No
Illex Fishery Mesh Exemption Area	No	No	No	No
Jeffrey's Ledge Restricted Area	No	No	No	No
Jordan Basin Restricted Area	No	No	No	No
Large Mesh Gillnet Restricted Waters	No	No	No	No
Lobster Gear Marking Areas	No	No	No	No
Lobster restricted gear areas	No	No	No	No
MA Regulated Mesh Area	No	No	No	No
Maine Mahogany Quahog Zone	No	No	No	No
Massachusetts Bay Management Area	No	No	No	No
Massachusetts Bay Restricted Area	No	No	No	No
May-June River Herring Monitoring/Avoidance Sub-Area 1	No	No	No	No
Mid-Coast Management Area	No	No	No	No
Modified Haddock Stock Areas	No	No	No	No
Monkfish Canyon Closed Area	No	No	No	No
Mudhole North Management Area (Gillnet closure/Gear modification requirements)	No	No	No	No
Mudhole South Management Area (Gillnet closure/Gear modification requirements)	No	No	No	No
Nantucket Lightship Closed Area - Western Exemption Area	No	No	No	No
Nantucket Shoals Dogfish Fishery Exemption Area	No	No	No	No
Nantucket Shoals Mussel and Sea Urchin Dredge Exemption Area	No	No	No	No
Northern Gulf of Maine (NGOM) Scallop Management Area	No	No	No	No
Critical Habitat for North Atlantic Right Whale	No	No	No	No
Northeast Canyons and Seamounts Marine National Monument Seamount Unit	No	No	No	No
Northeast Closure Area	No	No	No	No
Northern Inshore State Trap/Pot Waters Area	No	No	No	No
Northern Nearshore Trap/Pot Waters Area	No	No	No	No
Offshore Fishery Program Area	No	No	No	No

Management Area	Area A	Area B	Area C	Area D
Offshore Management Area	No	No	No	No
Other Southeast Gillnet Waters Area - Southeastern US Atlantic Shark Gillnet Fishery North of 29°N (Nov 15 - Apr 15)	No	No	No	No
Maine Pocket Waters separating state/federal waters	No	No	No	No
Raised Footrope Trawl Whiting Fishery Exemption Area (Sept 1 - Nov 20)	No	No	No	No
Redfish Exemption Area	No	No	No	No
Scallop Days-at-Sea Change to Declare Out of Fishery Transit with Product On Board Area	No	No	No	No
Restricted Gear Area III	No	No	No	No
Mid-Atlantic Scallop Rotational Area	No	No	No	No
Sector Small-Mesh Fishery Exemption Area 1 (relatively close)	No	No	No	No
Small Mesh Area 2	No	No	No	No
SNE/MA Winter Flounder Trawl Gear AM Area 1	No	No	No	No
SNE Little Tunny Gillnet Exemption Area	No	No	No	No
SNE Monkfish and Skate Trawl Exemption Area	No	No	No	No
SNE Skate Bait Trawl Exemption Area	No	No	No	No
Southern Mid-Atlantic Management Area	No	No	No	No
Stellwagen Bank/Jeffrey’s Ledge Restricted Area (Gillnet)	No	No	No	No
Stellwagen Bank Management Area	No	No	No	No
Summer Flounder Fishery - Sea Turtle Protection Area	No	No	No	No
Tilefish Gear Restricted Areas	No	No	No	No
Waters Exempted from Minimum Traps per Trawl Requirement	No	No	No	No
West of Cutler Set-Aside Area	No	No	No	No
Southern Windowpane Large AM Area	No	No	No	No

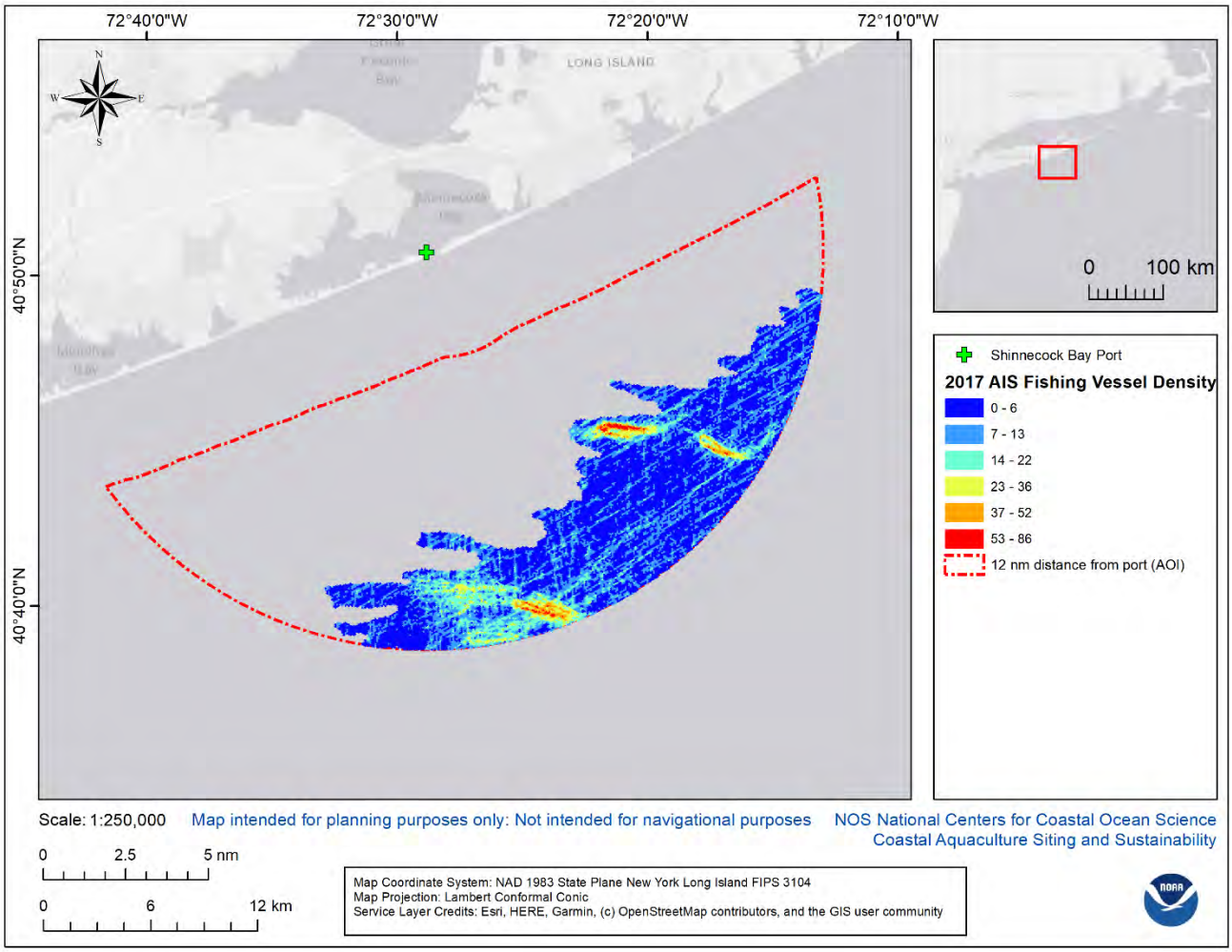


Figure A-1 (A). AIS fishing vessel transits/grid cell in the AOI in 2017.

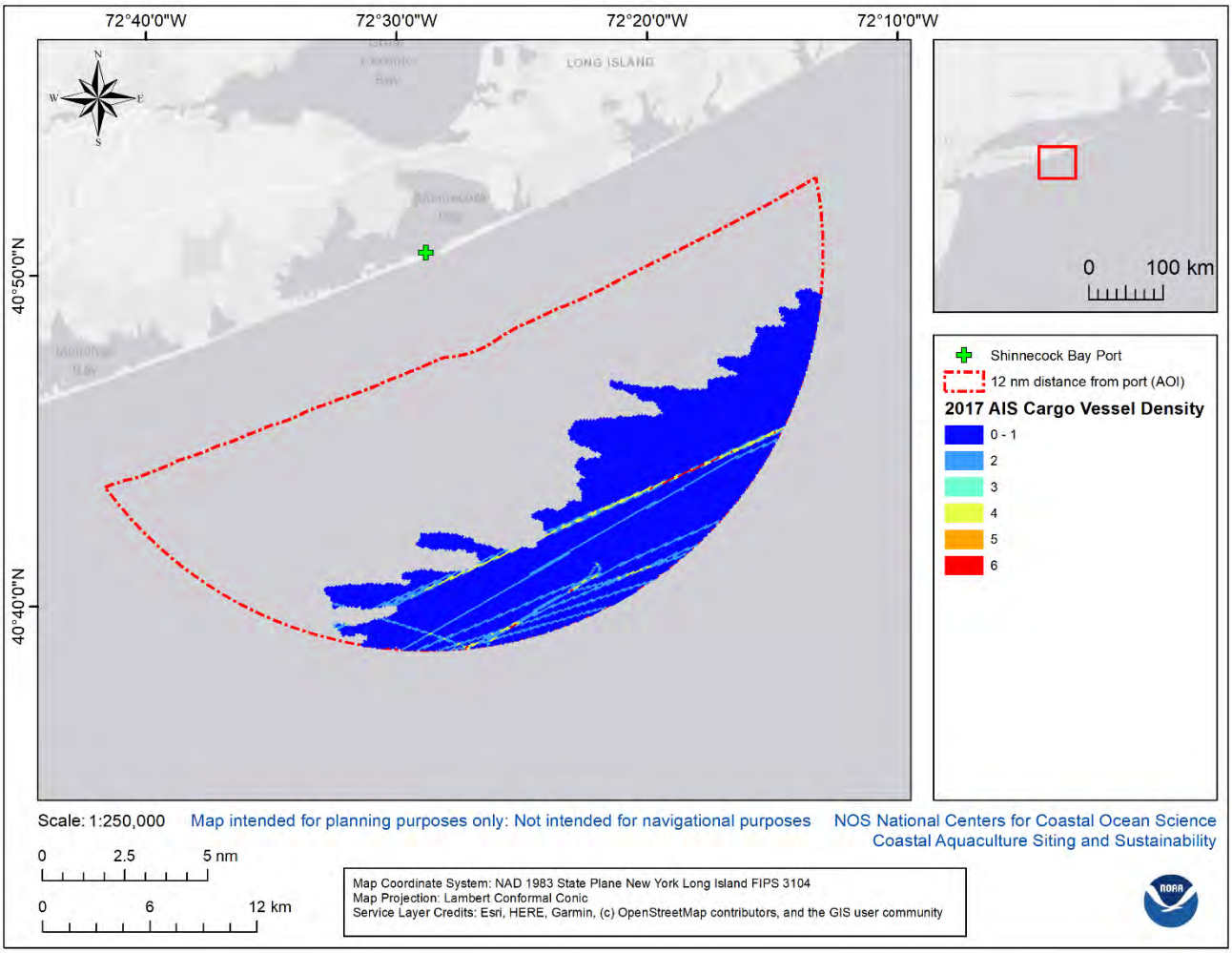


Figure A-1 (B). AIS cargo vessel transits/grid cell in the AOI in 2017.

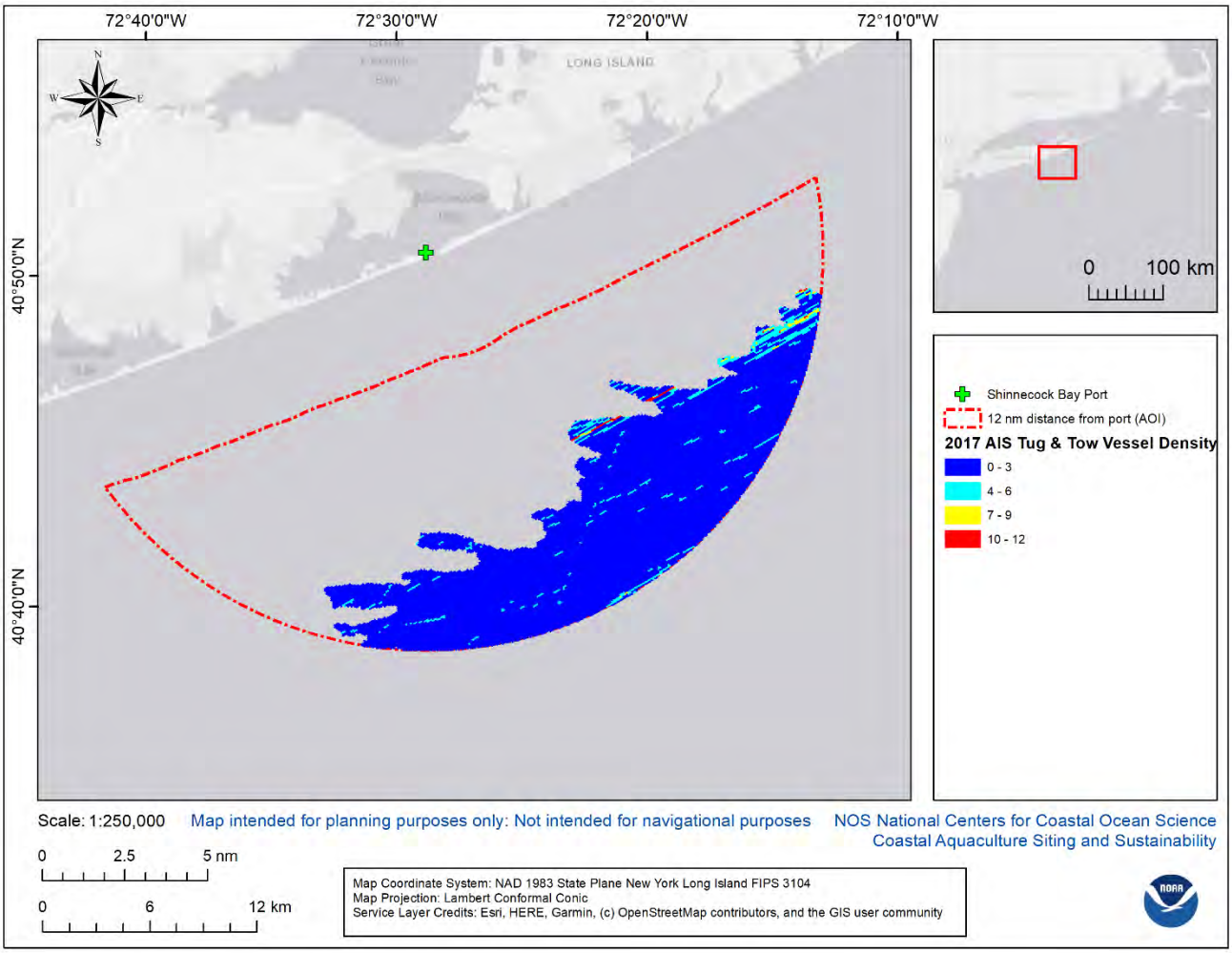


Figure A-1 (C). AIS tug and tow vessel transits/grid cell in the AOI in 2017.

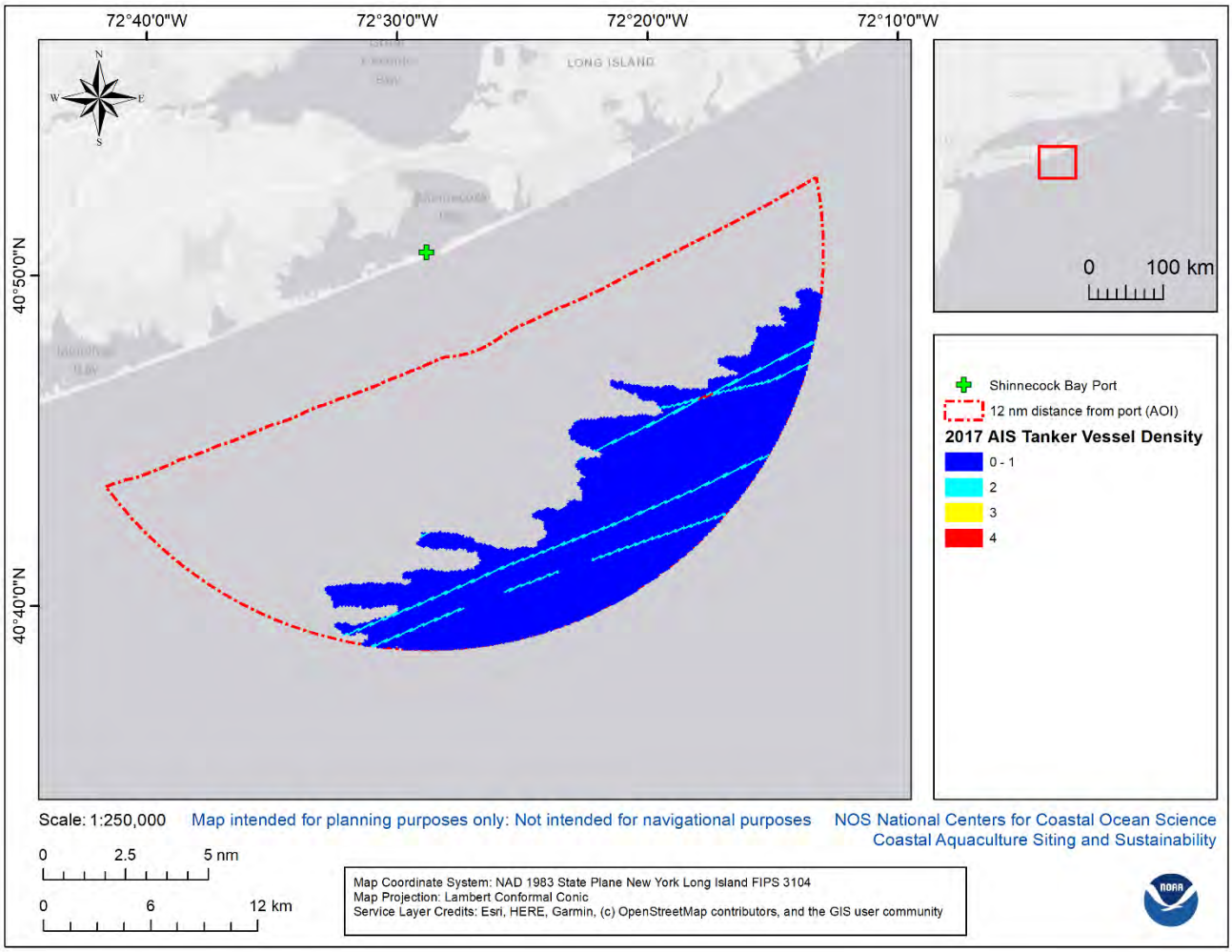


Figure A-1 (D). AIS tanker vessel transits/grid cell in the AOI in 2017.

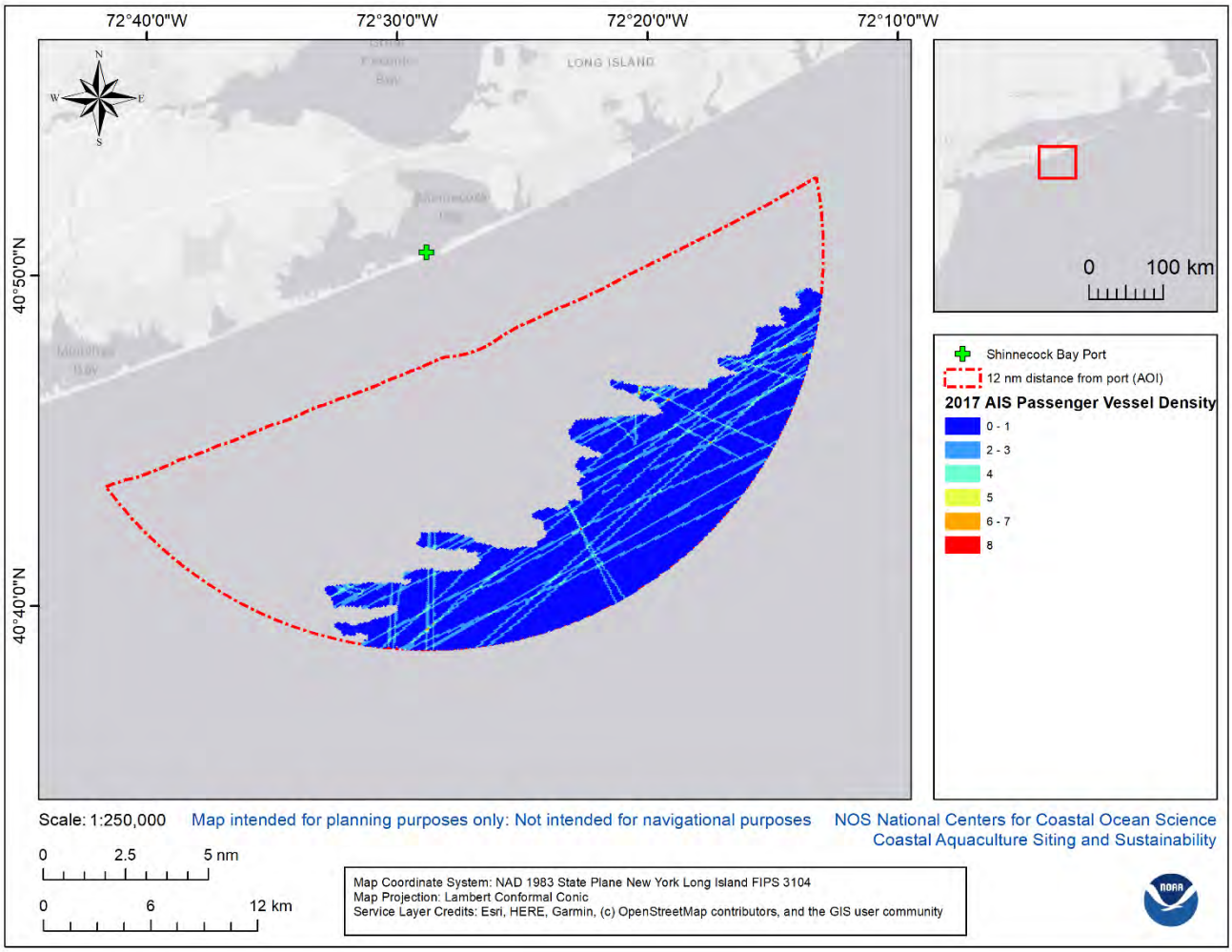


Figure A-1 (E). AIS passenger vessel transits/grid cell in the AOI in 2017.

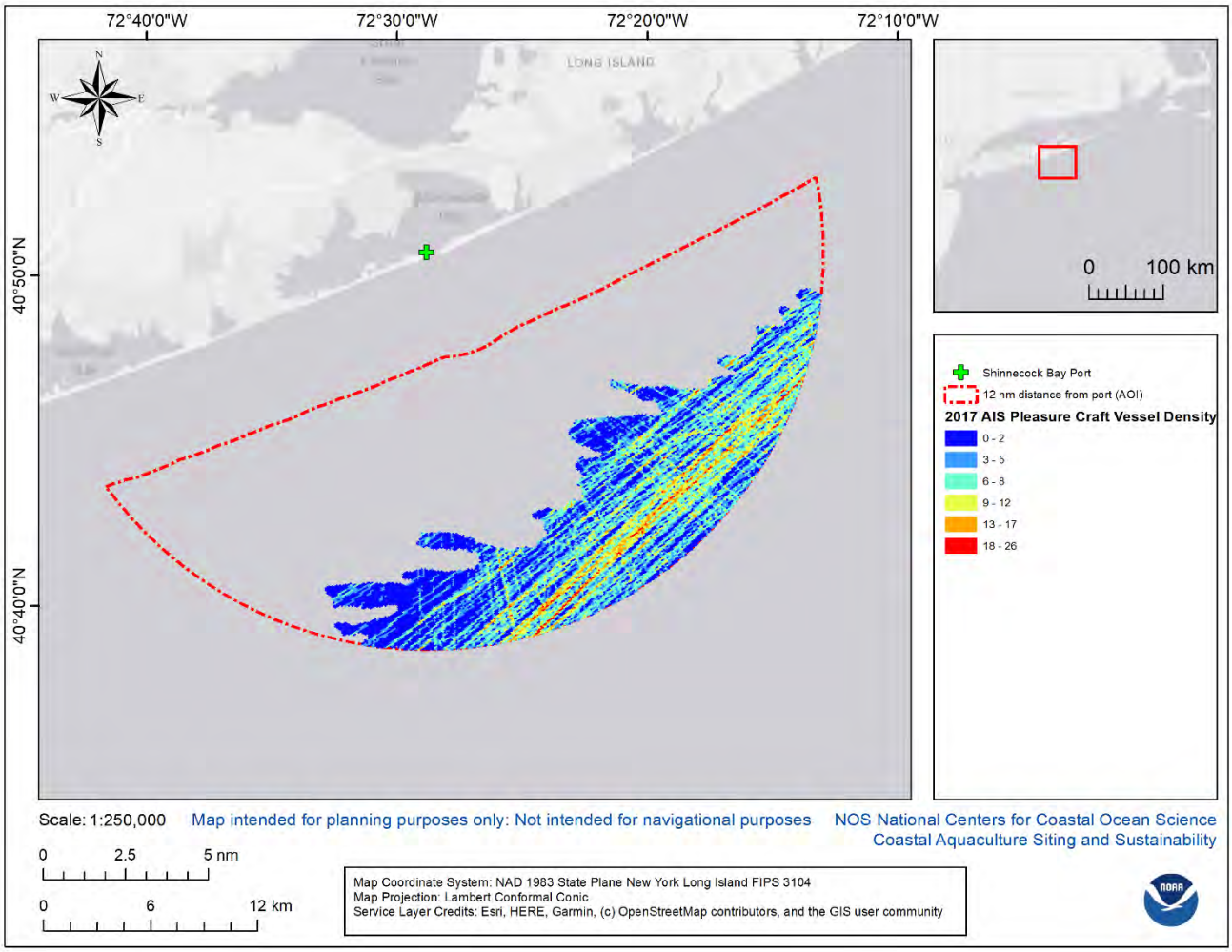


Figure A-1 (F). AIS pleasure and sailing vessel transits/grid cell in the AOI in 2017.

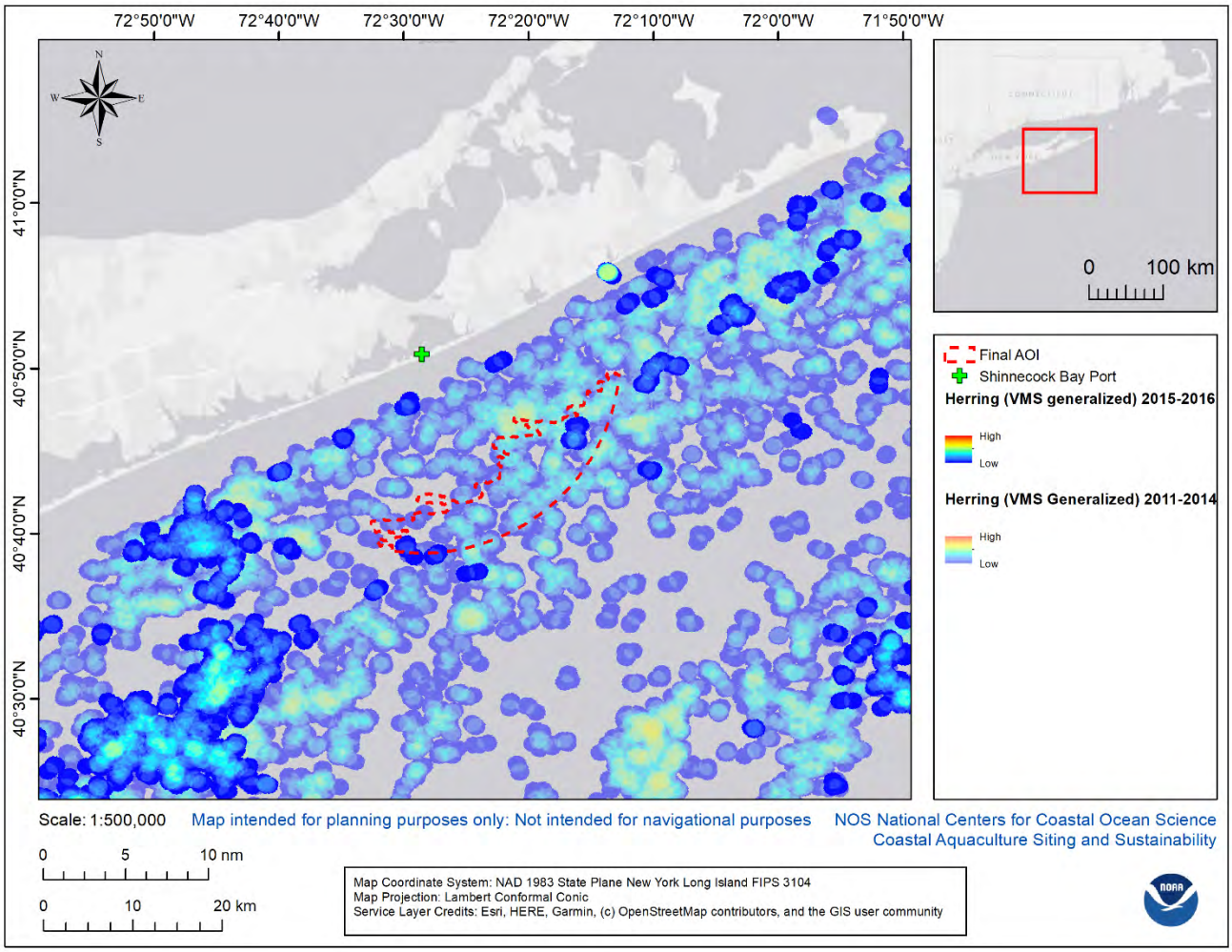


Figure A-2 (A). Generalized Vessel Monitoring System (VMS) data (NEOD 2018) for Herring (2011 – 2016).

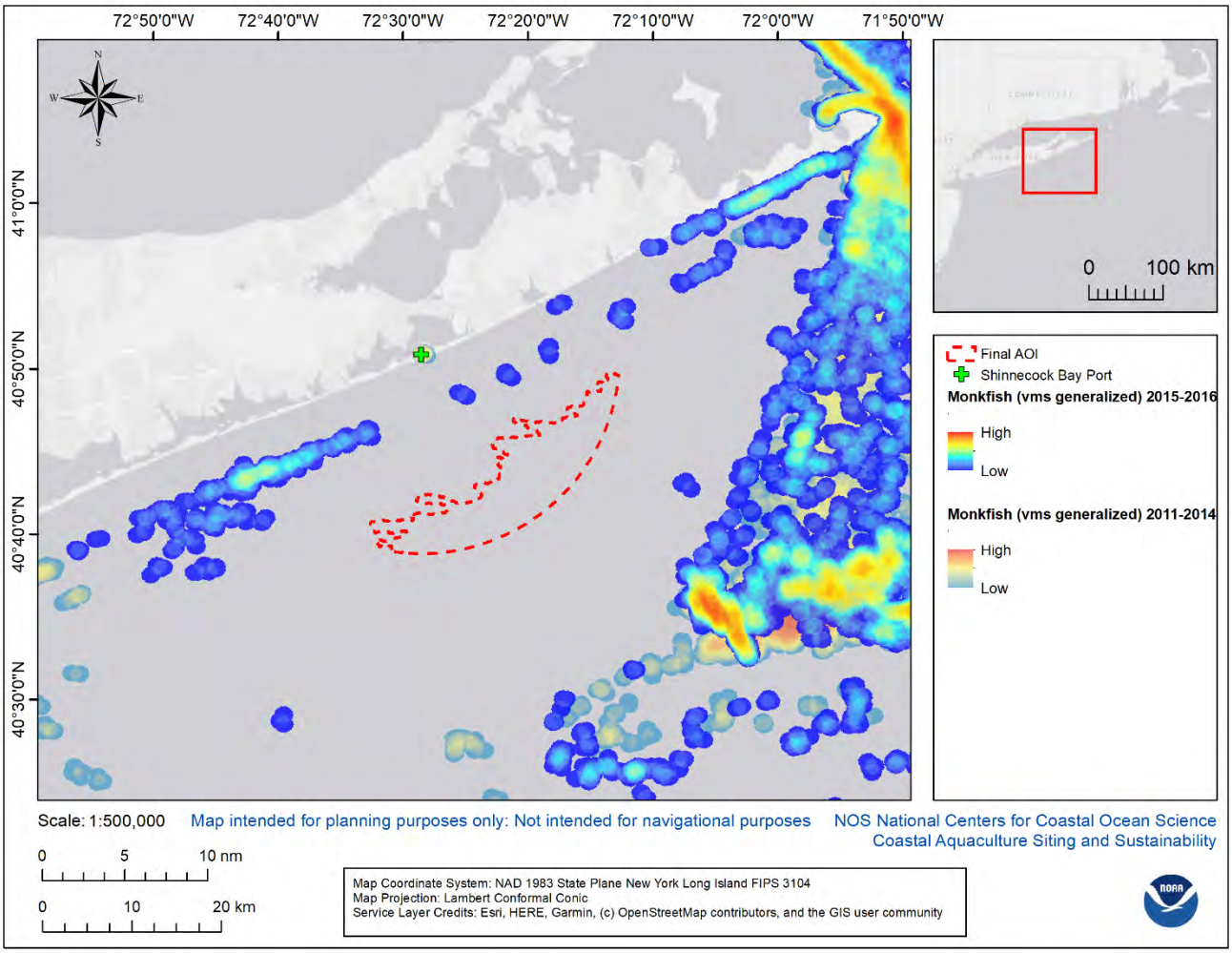


Figure A-2 (B). Generalized Vessel Monitoring System (VMS) data (NEOD 2018) for Monkfish (2011-2016)

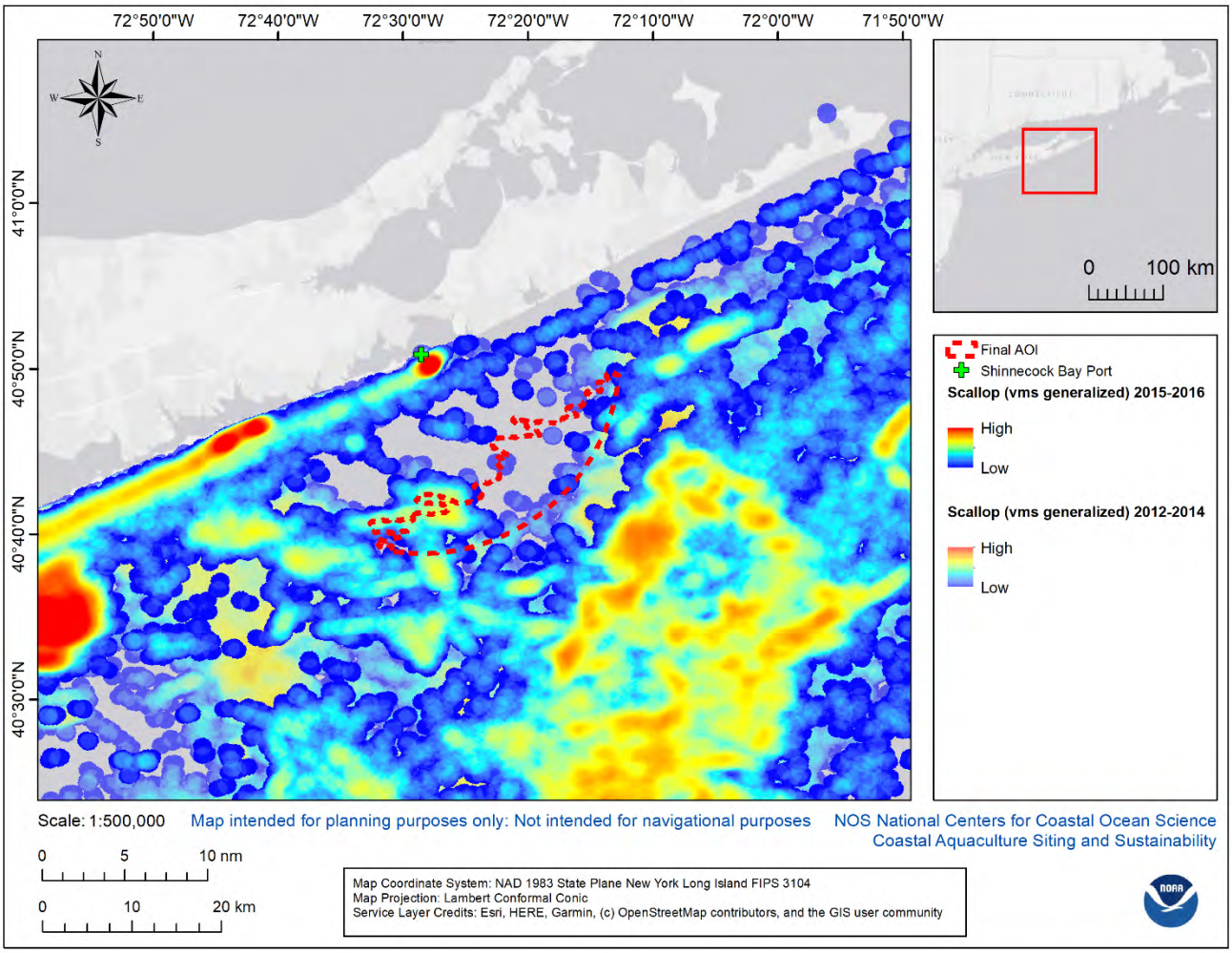


Figure A-2 (C). Generalized Vessel Monitoring System (VMS) data (NEOD 2018) for Sea Scallops (2012- 2016).

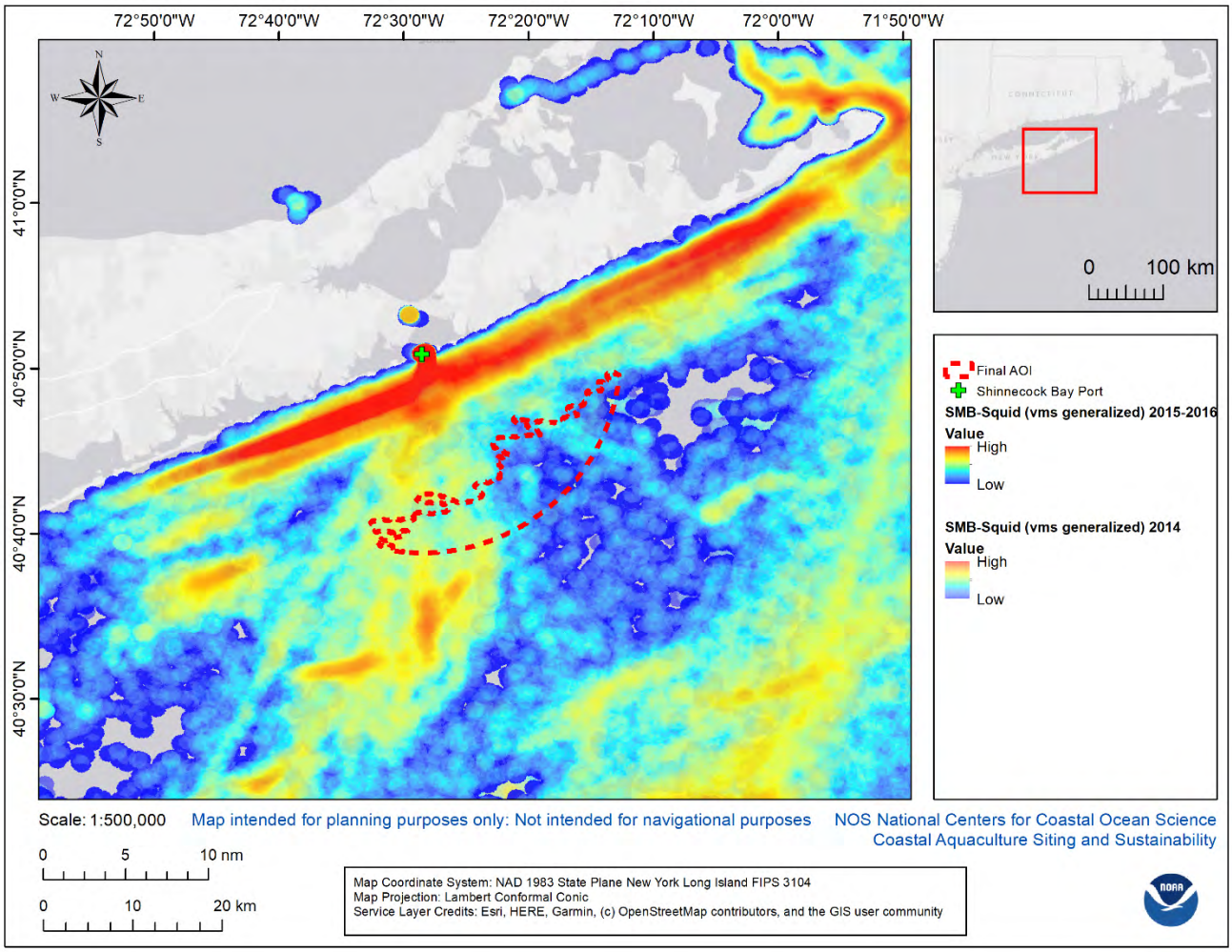


Figure A-2 (D). Generalized Vessel Monitoring System (VMS) data (NEOD 2018) for squid from the Squid-Mackerel-Butterfish complex.

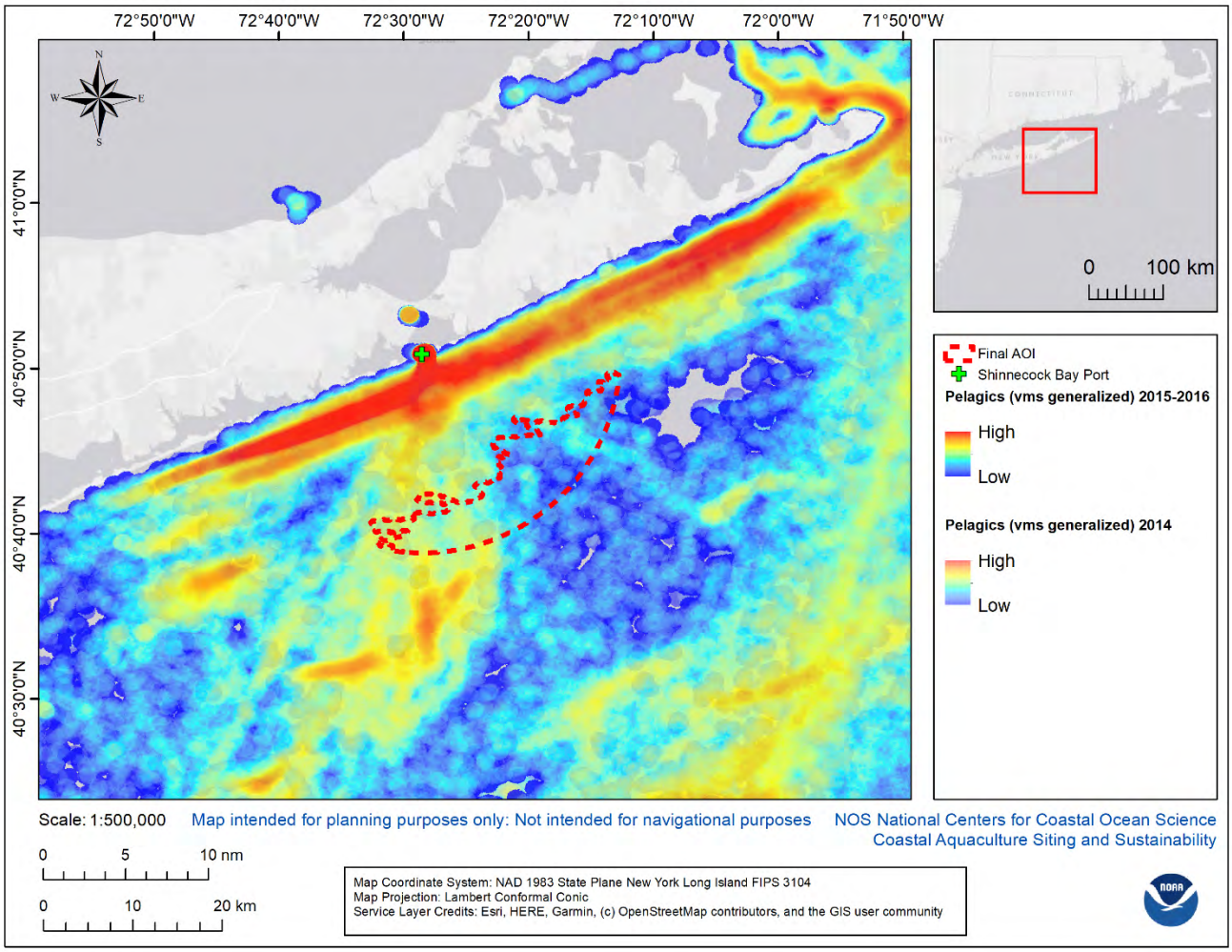


Figure A-2 (E). Generalized Vessel Monitoring System (VMS) data (NEOD 2018) for pelagic species (Herring/Mackerel/Squid) (2014- 2016).

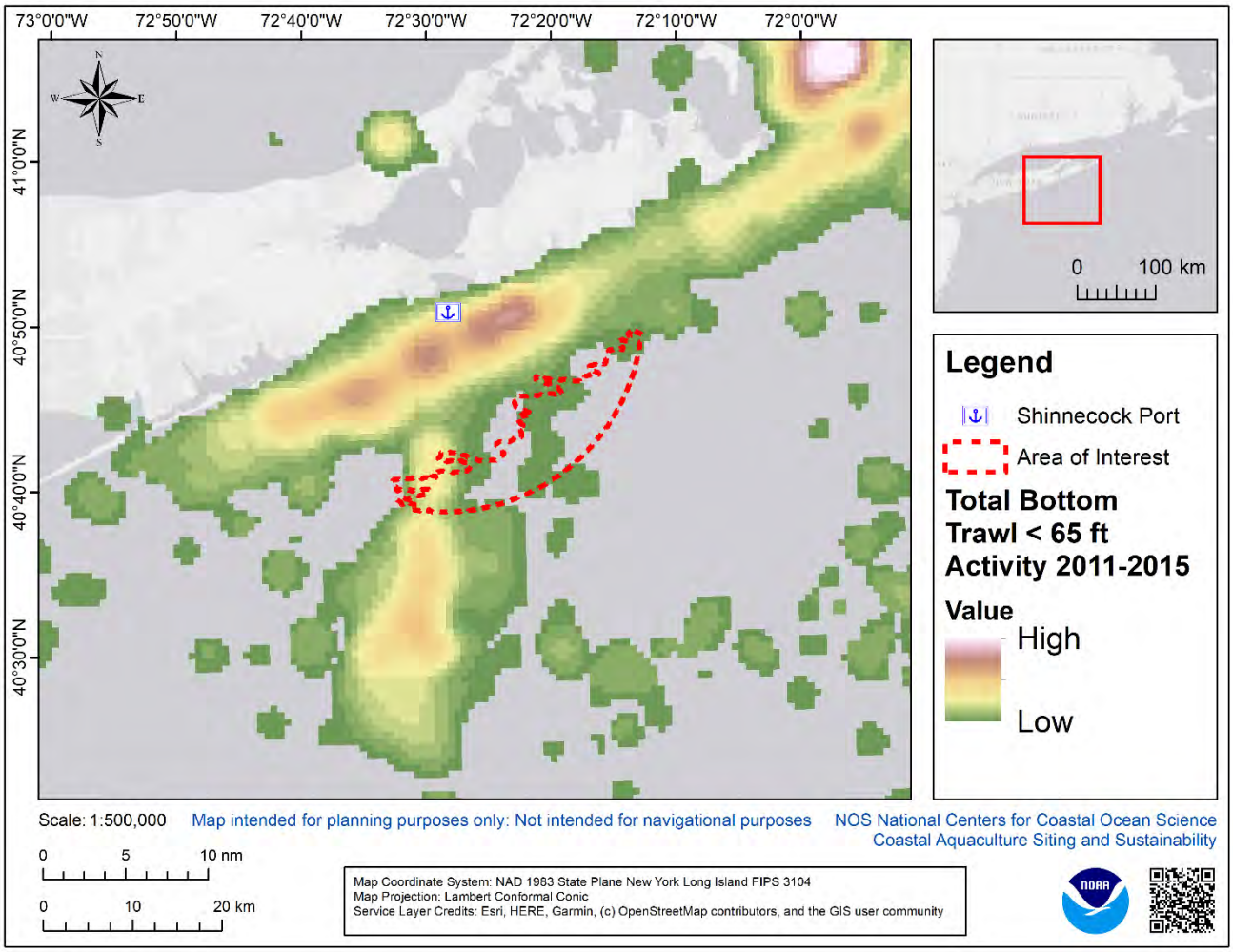


Figure A-3 (A). Generalized data using Vessel Trip Reports (VTR) to show different fishing gear types and effort over time. Total bottom trawls (vessels < 65' from 2011 – 2015) are illustrated here. These heat maps indicating effort (green is lower effort, while red is higher effort) were then overlaid (using the web service from Northeast Ocean Data) with the AOI to determine where the largest areas of usage for these gears occurred within the AOI.

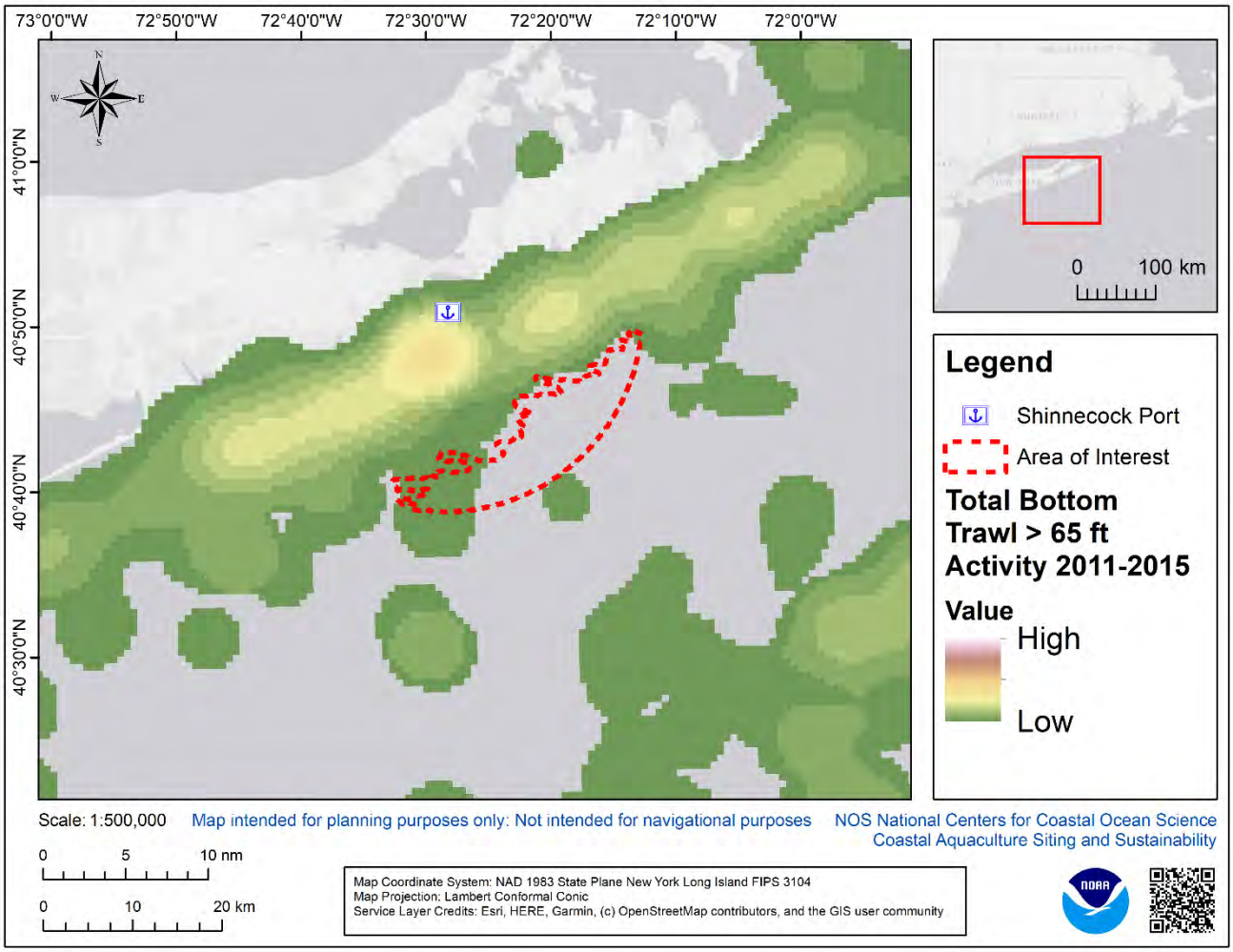


Figure A-3 (B). Generalized data using Vessel Trip Reports (VTR) to show different fishing gear types and effort over time. Total bottom trawls (vessels > 65' from 2011 – 2015) are illustrated here. These heat maps indicating effort (green is lower effort, while red is higher effort) were then overlaid (using the web service from Northeast Ocean Data) with the AOI to determine where the largest areas of usage for these gears occurred within the AOI.

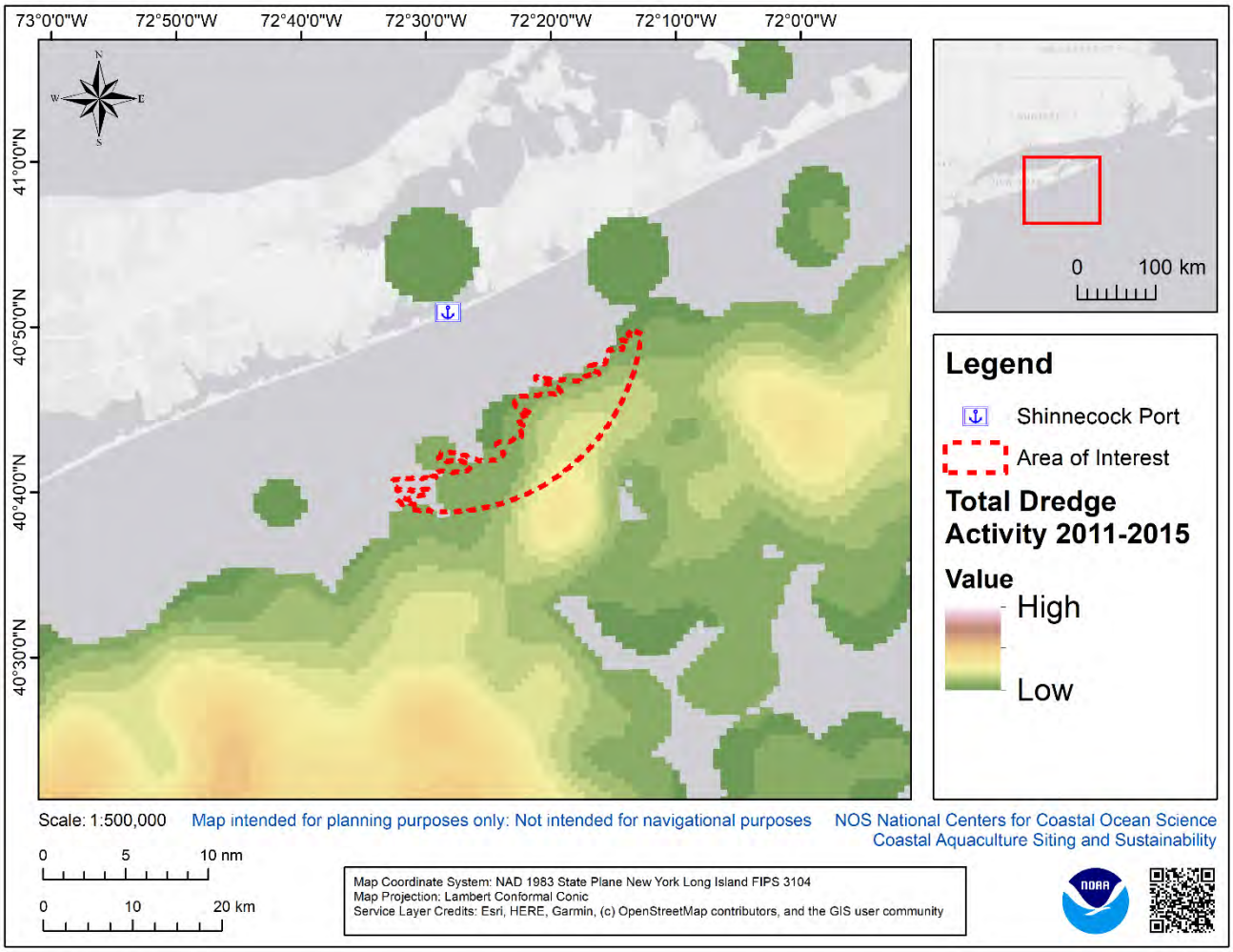


Figure A-3 (C). Generalized data using Vessel Trip Reports (VTR) to show different fishing gear types and effort over time. Total dredge activity is illustrated here. These heat maps indicating effort (green is lower effort, while red is higher effort) were then overlaid (using the web service from Northeast Ocean Data) with the AOI to determine where the largest areas of usage for these gears occurred within the AOI.

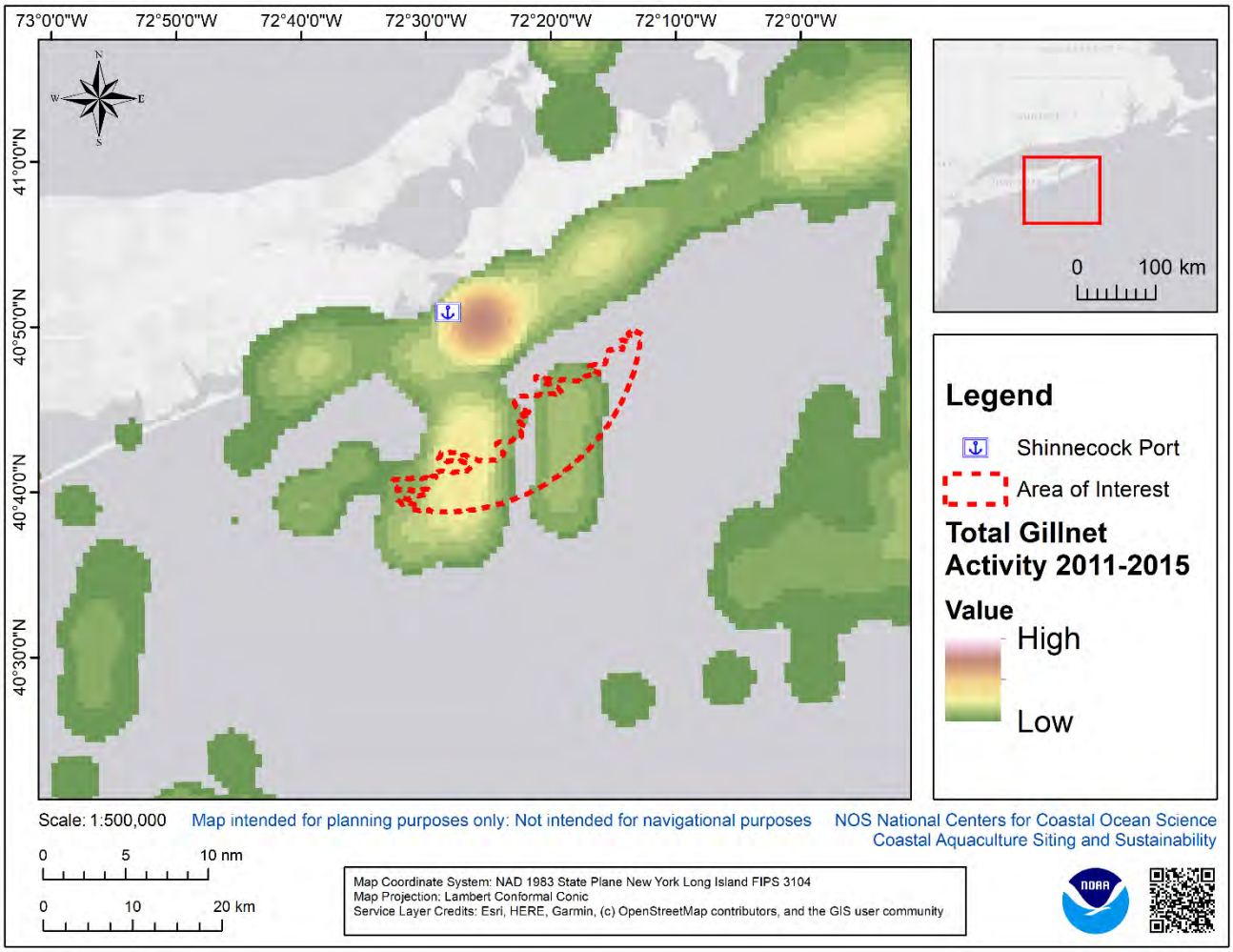


Figure A-3 (D). Generalized data using Vessel Trip Reports (VTR) to show different fishing gear types and effort over time. Total gillnet activity between 2011 and 2015 is illustrated here. These heat maps indicating effort (green is lower effort, while red is higher effort) were then overlaid (using the web service from Northeast Ocean Data) with the AOI to determine where the largest areas of usage for these gears occurred within the AOI.

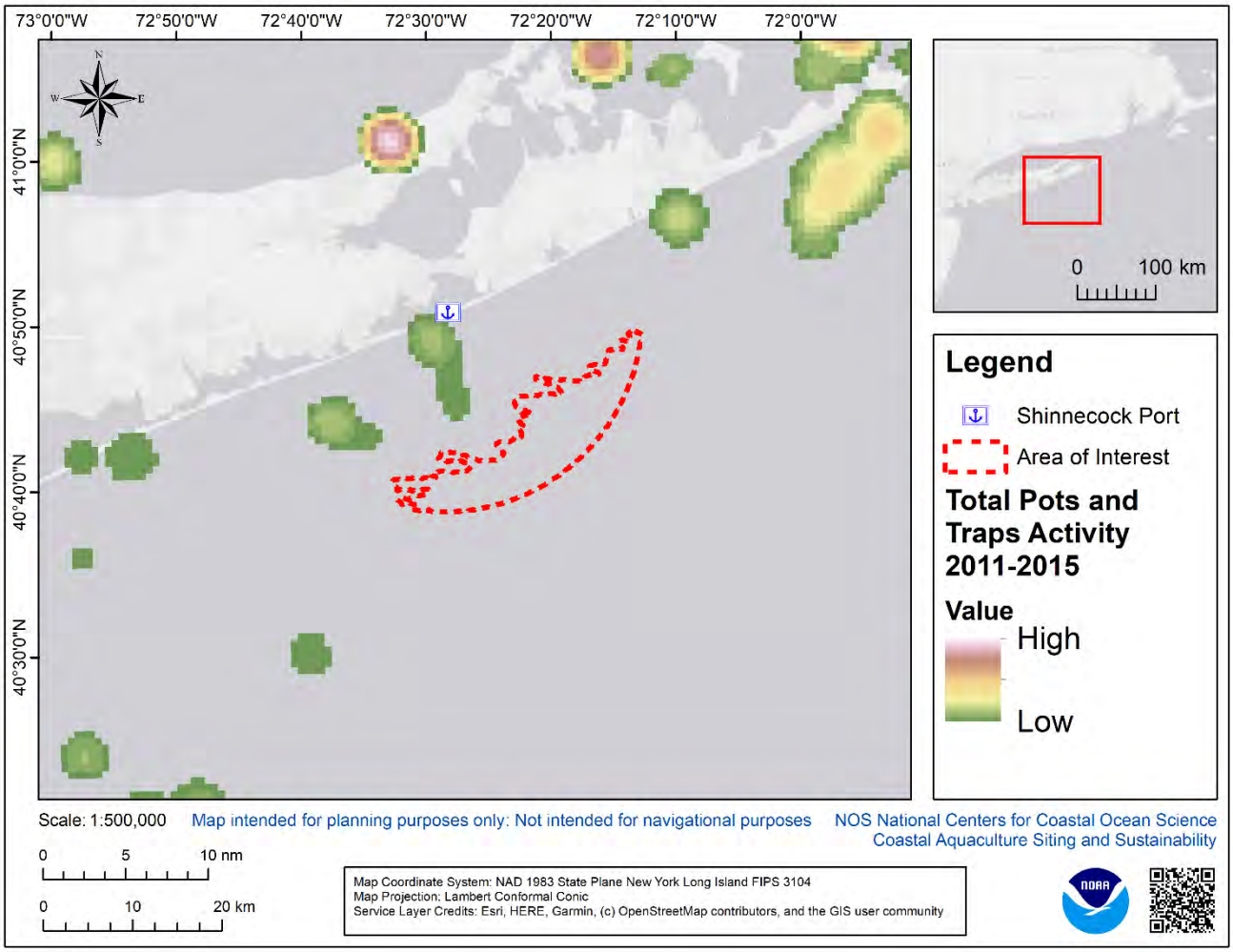


Figure A-3 (E). Generalized data using Vessel Trip Reports (VTR) to show different fishing gear types and effort over time. Total pots and traps data from 2011 – 2015 are illustrated here. These heat maps indicating effort (green is lower effort, while red is higher effort) were then overlaid (using the web service from Northeast Ocean Data) with the AOI to determine where the largest areas of usage for these gears occurred within the AOI.

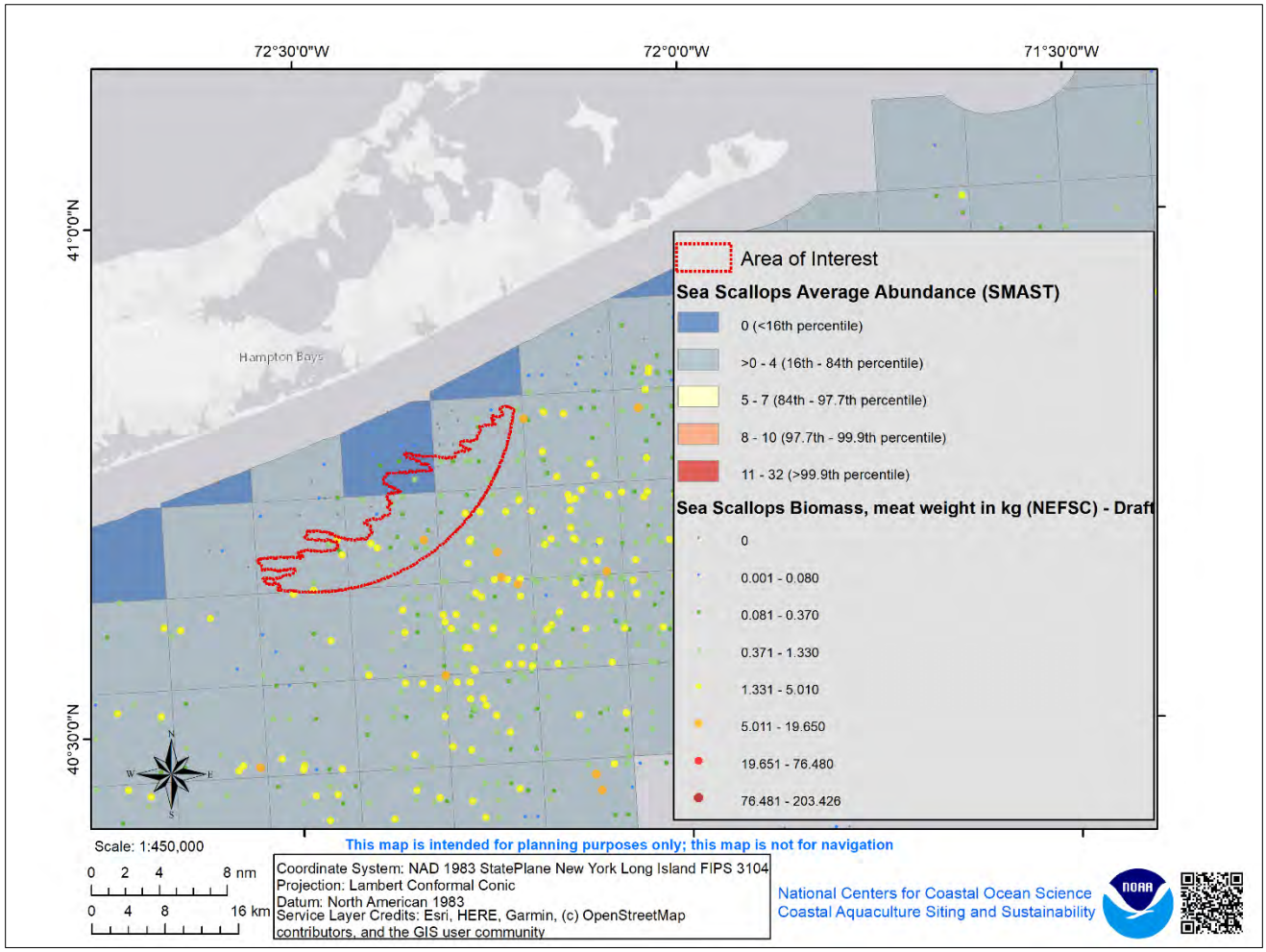


Figure A-4. The original area of interest for area screening and neighborhood analysis (red, dotted line), overlaid with sea scallop average abundance data from (University of Massachusetts, Dartmouth, SMAST), and the draft layer from the NEFSC for sea scallop biomass (kg) (point data). At the regional scale, the AOI overlaps mostly with relatively low biomass areas, and low average abundance. The average abundance data is too coarse for precision siting of aquaculture, but does provide information relative to other sea scallop mean abundance in the region.

MANNA FISH FARM BASELINE ENVIRONMENTAL STUDIES

Introduction

The development of a globally competitive and sustainable aquaculture industry has been promoted for decades (e.g. the National Aquaculture Act of 1980 and DOC, 1999) to meet the growing demand for safe and nutritious seafood products, as well as support economic opportunities for working waterfront communities. While the United States remains a major seafood consumer in the global marketplace, NMFS (2015) estimates that more than 90% of seafood products consumed in the U.S. are imported, with roughly 50% of these imports coming from aquaculture production. With aquaculture being the fastest growing animal food production sector in the world (FAO 2016), only 0.76% of global aquaculture production occurs in North American waters (FAO 2016). This presents a tremendous opportunity for collaborations to create measurable and sustainable development of this industry, while simultaneously developing a gold standard aquaculture ethic for offshore farming across the United States. This proposal builds on the great strides that NOAA has made in developing the Gulf Aquaculture Plan (GMFMC 2009), which became effective on February 12, 2016 (NOAA 2016). It is anticipated that similar plans will be developed for other U.S. regions (Rust et al. 2014), but this task will require significant investment and efforts in basic environmental data collection (MidA RPB 2016).

The primary objective of our preliminary survey is to collect unbiased baseline environmental data prior to implementation of offshore marine aquaculture at a site off the south shore of Long Island. Collection of baseline environmental data via survey work will be carried out by scientists at Stony Brook University (SBU). All data from these independent scientific surveys will be synthesized and reported to Manna Fish Farms, and will be discoverable, transparent, and available for review by resource agencies and stakeholders. Baseline environmental surveys are a necessary part of the permitting process and include completing a comprehensive seafloor survey, as well as robust hydrological and water quality surveys. The seafloor survey will include acoustic mapping and sub-bottom penetration profiling; the hydrological survey will measure the local currents and waves; and the water quality survey will analyze the water's nutrients, dissolved oxygen levels, as well as plankton diversity and relative abundance.

Proposed Work

All scientific surveys will be led by independent, third-party scientists from SBU's School of Marine and Atmospheric Sciences (SoMaS) in order to ensure complete scientific objectivity in the surveys. Dr. Roger Flood and Dr. Christopher J. Gobler are experts in their fields and routinely work along the Long Island shore. They will be subcontracted to perform this research. All baseline scientific studies including seafloor, hydrological, and water quality surveys will be conducted at the proposed site of Manna Fish Farms offshore farm area located within 10.1 nautical miles southeast of Shinnecock Inlet. The specific components of the scientific surveys are discussed below.

Seafloor Survey

A seafloor survey will be performed at the site of the proposed offshore marine aquaculture farm to ensure that the site is clear of benthic and subsurface (i.e., pipelines, buried debris, vessels etc.) features that would preclude the siting of an offshore marine aquaculture operation. The survey will document the depth of the seafloor, the nature and distribution of seafloor sediments, and the shallow sediment structure to support the design of the anchoring system. The planned seafloor survey will also provide a detailed characterization of seafloor bathymetry, sedimentary features such as bed forms, and acoustic backscatter that will provide a baseline for characterizing possible future changes in seafloor character caused by currents or biological activity.

The seafloor at the Manna Fish Farms site likely consists of sand or coarser sediment with a series of low-amplitude sedimentary ridges, which are thought to be the erosional remnants of bed forms created at the shoreline during the post-glacial sea-level rise (Goff et al., 2015; see also Schwab et al., 2014a; 2014b; 2014c; 2016 and references therein). The inner continental shelf in this area has been studied by workers at the U.S. Geological Survey (USGS) in Woods Hole who focused on the inner three to five nautical miles with an interest on understanding the evolution, sedimentary processes, and potential sand resources in primarily NY State waters (see Schwab et al., 2014a; 2014b; 2014c; 2016 and references therein). More work has recently been done in Federal waters from three to eight nautical miles offshore as part of the Bureau of Ocean Energy Management (BOEM) Atlantic Sand Assessment Project (ASAP) project along the Eastern Atlantic shoreline (https://www.boem.gov/Marine-Minerals-Program-offshore-sand-resources/). The BOEM ASAP is part of an effort to understand sand resources in near-shore Federal waters, and one initial result of the BOEM and USGS-Woods Hole work is that, while sand may be present at the Manna Fish Farms site, this site is not a promising area for offshore borrow pits. Dr. Flood has been involved in this BOEM effort as part of a SoMAS collaboration with the New York State Department of State and has analyzed the NY ASAP seismic data. Unfortunately, none of this new BOEM ASAP data is near the Manna Fish Farms site. However, new, detailed geophysical survey and other environmental data at the Manna Fish Farms site designed to support permitting will provide important new insights into the geological origin of seafloor topography in this area.

The planned survey will follow the general guidance described by the NOAA Fisheries Southeast Regional Office, although somewhat modified as a result of previous discussions with US Army Corps of Engineers (ACE). It is anticipated that the survey will be conducted during a 4 to 5-day field effort on the SBU research 80-foot ship R/V Seawolf, or similar, using geophysical instrumentation at SBU supplemented by equipment leased from a geophysical survey company which is experienced in this kind of effort. By working with such a geophysical survey company, we gain access to geophysical equipment not available at SBU as well as operators who can ensure high-quality data during this survey. We anticipate that the survey itself will require two days, but a third day is planned in case obstructions are found in the study area or because of adverse

weather. Two days are expected to be needed for the vessel to transit from the home port at Port Jefferson, NY, to the study area. The survey will consist of the following components.

Seafloor Surface

Multibeam Bathymetry: A 100% coverage multibeam bathymetry and backscatter survey will be conducted at the proposed offshore marine aquaculture site to determine water depth, seafloor morphology, and acoustic backscatter. We will use a Kongsberg EM-3000D multibeam system which operates at 300 kilohertz (kHz), or a similar system, to map the study area. Multibeam mapping will be done following guidance such as National Ocean Service (2016) or USACE (2013). Bathymetric data will be corrected for vessel motion, sound velocity, and tides. Navigation will be done using an integrated global positioning system (GPS) navigation system using available differential GPS corrections. Tides will be determined by reference to a bottom-mounted pressure gauge supplemented by real-time kinematic (RTK) GPS elevations using corrections provided by NYSNet which is managed by the NYS Department of Transportation (http://cors.dot.ny.gov/).

Side-scan Sonar: A 100% coverage side-scan sonar survey will be conducted using a high-resolution side-scan sonar system (Klein Side Scan Sonar 3000 or 3900 depending on availability) to identify and locate seafloor discrete surface features as well as sedimentary features such as bed forms. The frequency and range settings will be adjusted to provide the best image quality. If any significant, discrete features are discovered on the seafloor surface during the acoustic survey, they will be further resolved by adjusting range settings and frequency. The discovery of significant discrete seabed features may necessitate extending the size of the survey area so that those features can be avoided. If appropriate, follow-up studies may be necessary to obtain photographic/video identification of discrete features. The side-scan sonar will be navigated using an ultra-short baseline system mounted on the research vessel.

Sub-Surface

Sub-bottom Profiler: A very high-frequency sub-bottom acoustic profiler will be used to gather continuous and very high-resolution information of near-surface geological features. Due to the coarse nature of the sediment expected at the offshore marine aquaculture site, we expect sub-bottom penetration to be in the range of 3-6 meters (10-20 feet). This estimate is based on the results of sub-bottom surveys by the USGS in nearby areas of the inner continental shelf south of Long Island (Schwab et al., 2014a; 2014b; 2014c; 2016). During those surveys, the maximum sub-bottom penetration rarely exceeded 10 meters (32 feet). While sub-bottom penetration will be limited, it is expected to be greater than the anchor penetration depth of a few meters. The sub-bottom profilers available to the project include a DataSonics CHIRP system, a Geo Acoustics 3.5 kHz system, and an Edgetech CHIRP system. The choice of system will depend on our understanding of how well the system will perform in the expected sediments as well as equipment availability. All of these systems are expected to have a sub-bottom resolution of about 0.3 meter

(1 foot) or better. The sub-bottom data will be digitally recorded and subject to post-processing to improve data quality and allow for display and interpretation. The offset between the navigation source and the sub-bottom profiler will be determined and monitored in order to correctly position the sub-bottom profiler.

Magnetometer: A magnetometer will be towed approximately 10 meters behind the side-scan sonar in order to detect ferrous and other magnetically susceptible metals that may be buried beneath the seabed. We plan to use a Geo Metrics Model 882 magnetometer, and we will follow the guidance of the geophysical survey company regarding the best survey parameters. The magnetic data will be digitally recorded.

Acoustical Equipment

The following acoustic equipment will be used during the seafloor survey.

Survey Task	**Sample Equipment Model Type**	**Frequency (kHz)**	**Estimated Sound Pressure Levels at Source (dB re 1µPa RMS at 1 m)**	**Directionality**
Multibeam Depth Sounder	Kongsberg EM 3000 or similar	300 kHz	214 dB	across-track swath
Side-Scan Sonar	Klein Side-Scan Sonar 3000 or similar	445 and 900 kHz	220 dB	across-track swath
Shallow-Penetration Sub-bottom Profiler	Edgetech CHIRP or similar	2-15 kHz	189 dB	vertical

Data Acquisition, Processing, Analysis and Reporting

At this time, we anticipate that survey data will be collected on the 80-foot SoMAS R/V Seawolf which has been used for similar surveys in this general area. The ship is quite stable in moderate weather and has appropriate winch and lab space to support the geophysical equipment. SoMAS and contractor personnel will operate the survey equipment under the overall direction of Dr. Flood. We will follow NOAA guidelines regarding noise levels and marine mammals. We will survey only during daylight hours and an appropriate look-out will be maintained to ensure that we take preventative action if marine mammals are observed in the area.

The survey data will be processed at SoMAS using available software products. Multibeam data will be processed using software such as the SwathEd software package developed at the University of New Brunswick, and we also have access to CARIS HIPS and SIPS as well as Fledermaus. Side-scan sonar data will be processed using SwathEd software (http://omg.unb.ca/omg/research/swath_sonar_analysis_software.html), and we also have access to SonarWiz. Sub-bottom data will be processed and analyzed using Seismic Unix and can also be displayed with Fledermaus and in ArcMap. Magnetometer data will be analyzed using MagMap and MagPick, Hypack Magnetometer Editor, or similar software. Mapping products will be produced in ESRI GIS-compatible formats with appropriate metadata. Bathymetric data in grid format, backscatter data in georeferenced tiff format, navigation as shapefiles, sub-bottom features such as channels as sediment thickness grids and as channel thalweg and boundary shapefiles, and discrete side-scan sonar and magnetometer targets as tables. Maps created to support the permit application will be in the requested format and projection. The NOAA Fisheries guidance document now available suggests permit maps be in DWG format with NAD 27 coordinates, and these details will be confirmed when the permit maps are being created.

A final report that follows NOAA Fisheries guidance will be prepared for the survey, but the specific items to be included will be confirmed with the USACE. The report is expected to contain a description of the area surveyed; a list of individuals involved with survey planning, fieldwork and report preparation; a discussion of the field survey methodology; and results of representative data samples from each survey instrument. Data products will include a navigation post-plot for the sub-bottom data, information on the vertical and horizontal extent of all relict geomorphologic features having potential for associated prehistoric sites, including details of any relict fluvial systems that are recorded, and listings of magnetic anomalies and acoustic survey (side-scan sonar) contacts.

One role of the seafloor survey is to identify potential cultural artifacts. The anchors to be used with the Manna Fish Farms net pens are expected to be within the upper few meters of the sediment and not disturb deeper layers. Thus, we expect that any cultural features present in the area will be primarily modern features such as shipwrecks and we do not expect disturbance to deeper layers.

Hydrological and Water Quality Surveys

The proposed fish farm area will be approximately 4 km^2 (396 hectares). Based on the results of a recently completed analysis of site alternatives by the National Center for Coastal Ocean Science (Wickliffe et al. 2020), the preferred location of the farm is Site A (Figure 1), which is the deepest of the four sites analyzed and 8.6 nautical miles (nm) from the port at Shinnecock Inlet. Following approval of the preferred site, Dr. Gobler will oversee and utilize the RV Paumanok from SBU to initiate the hydrological and water quality surveys.

To capture the fine-scale variability in water quality and current conditions at the proposed fish farm site, a sensor array will be deployed in the center of the proposed site for at least 21 days during late summer to be representative of worse-case conditions. This follows the duration recommended for baseline surveys in the Gulf of Mexico Aquaculture Plan. The sensor array will include a series of three YSI EXO2 data logging sondes (near surface, mid-depth, and 1 m off the seafloor) that will record continuous measurements of temperature, salinity, dissolved oxygen, pH, and in vivo chlorophyll *a* every 10 minutes. The benthic array will also include three SonTek acoustic Doppler profilers (ADP: a 1.5-MHz) to measure surface, mid-depth, and bottom currents. Measurements will be recorded hourly for at least 40 tidal cycles. These data will be supplemented with wave data from the nearest Wave Information Study site (Station ID 63109).

Professors Christopher J. Gobler and Roger Flood will oversee and have primary responsibility for the design, implementation, and interpretation of SBU's portion of the project. Dr. Flood will lead and manage the seafloor survey work, while Dr. Gobler will lead and manage the hydrological and water quality research. Technical reports will be submitted to Manna Fish Farm for review before they will be integrated into Manna Fish Farms' permitting application for offshore marine aquaculture permits.

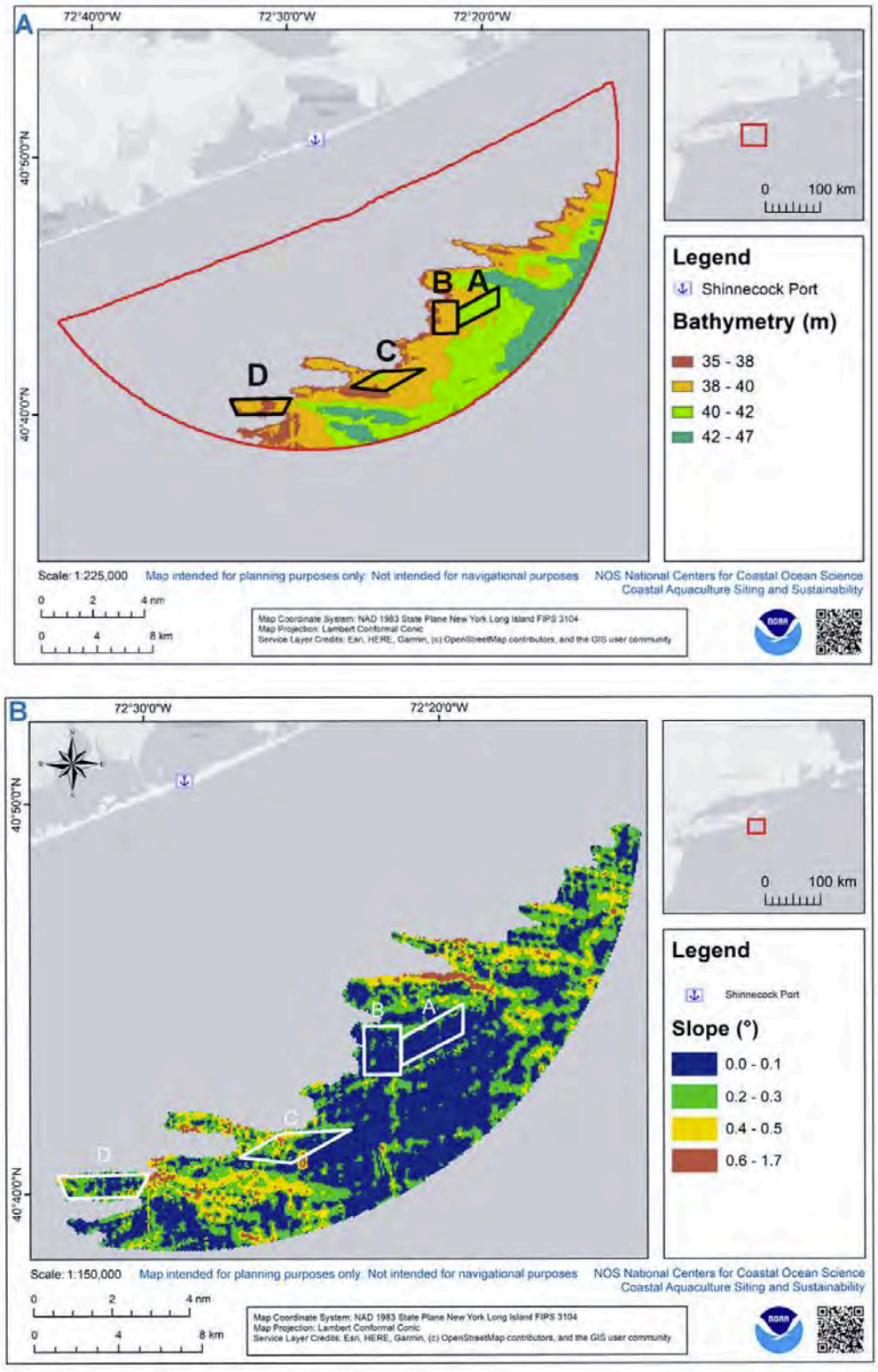


Figure 1. Depth (A) and seafloor slope (B) of the four alternative site locations for the proposed MFF.

Literature Cited

Bell, R.E., Flood, R.D., Carbotte, S., Ryan, W.B.F., McHugh, C., Cormier, M., Versteeg, R., Bokuniewicz, H., Ferrini, V.L., Thissen, J., Ladd, J.W., and Blair, E.A. 2006. Benthic Habitat Mapping in the Hudson River Estuary. In: J.S. Levinton and J. Waldman, eds. The Hudson River Estuary. Cambridge University Press, pp. 51-64.

FAO. 2016. The State of World Fisheries and Aquaculture: Contributing to Food Security and Nutrition for All. Food and Agriculture Organization, Rome, p 204.

GMFMC. 2009. Fishery Management Plan for Regulating Offshore Marine Aquaculture in the Gulf of Mexico. Includes environmental impact statement and regulatory impact review. January 2009. Gulf of Mexico Fishery Management Council. 452 pp. plus appendices.

Gobler CJ, Berry, D.L., O.R. Anderson, Burson, A., Koch, F., Rodgers, B.S., Moore L.K., Goleski J.A., Allam, B., Bowser, P., Tang, Y., Nuzzi, R. 2008. Characterization, dynamics, and ecological impacts of harmful Cochlodinium polykrikoides blooms on eastern Long Island, NY, USA. Harmful Algae 7: 293–307.

Gobler, C.J., and S.A. Sañudo-Wilhelmy. 2001. Temporal variability of groundwater seepage and Brown Tide bloom in a Long Island embayment. *Marine Ecology Progress Series* 217:299-309.

Goff, J.A., Flood, R.D., Austin., J.A., Jr., Schwab, W.C., Christensen, B., Browne, C.M., Denny, J.F. and Baldwin, W.E. 2015. The Impact of Hurricane Sandy on the Shoreface and Inner Shelf of Fire Island, New York: Large Bedform Migration and Limited Erosion. *Continental Shelf Research*, 98, 13-25.

Harris, R.P., P.H. Wiebe, J. Lenz, H.R. Skjoldal, and M. Huntley (eds). 2000. ICES Zooplankton Methodology Manual. London: Elsevier Academic Press.

Hasle, G.R. 1978. The inverted microscope method. *Monographs on Oceanographic Methodology* 6: 88-96.

Holmer, M. 2010. Environmental issues of fish farming in offshore waters: perspectives, concerns and research needs. *Aquacult Environ Interact*, *1*, 57-70.

Hughes Clarke, J.E., Wildish, D. and Duxfield, A. 2002. Acoustic Imaging of Salmonid Mariculture Sites: Canadian Hydrographic Conference Proceedings CDROM (available at http://omg.unb.ca/omg/papers/CHC2002_paper.pdf).

Merwin, D.E. and Flood, R. 2015. Multibeam Swath Bathymetry for Underwater Archaeological Investigations. Society for American Archaeology 80th Annual Meeting. San Francisco, California.

Mid-Atlantic Regional Planning Body (MidA RPB). 2016. DRAFT Mid-Atlantic Regional Ocean Action Plan. 134 pp.

NOAA. 2016. Fisheries of the Caribbean, Gulf, and South Atlantic; Aquaculture, final rule (Docket No. 080225276-5601-02). Federal Register 81:8 (13 January 2016):1762-1800.

NOS. 2016. NOS Hydrographic Surveys Specifications and Deliverables. Available at http://www.nauticalcharts.noaa.gov/hsd/specs/HSSD_2016.pdf

Olson, R.J., E.R. Zettler, S.W. Chisholm, and J.A. Dusenberry. 1991. Advances in oceanography through flow cytometry. In: Demers, S. (Ed) Particle Analysis in Oceanography. Springer-Verlag, Berlin, p 351-399.

Omori, M., and T. Ikeda. 1984. Methods in marine zooplankton ecology. New York: J. Wiley and Sons.

Parsons, T. R., Y. Maita and C. M. Lalli. 1984. A Manual of Chemical and Biological Methods for Seawater Analysis. Pergamon Press, Elmsford, NY.

Price, C. S., and Morris Jr, J. A. 2013. Marine cage culture and the environment: twenty-first century science informing a sustainable industry. NOAA Technical Memorandum NOS NCCOS 164.

Price, N. and P. Harrison. 1987. Comparison of methods for the analysis of dissolved urea in seawater. *Mar. Biol.* 94: 307-317.

Rust, M. B., Amos, K. H., Bagwill, A. L., Dickhoff, W. W., Juarez, L. M., Price, C. S., Morris Jr, J.A. & Rubino, M. C. 2014. Environmental performance of marine net-pen aquaculture in the United States. *Fisheries*, *39*(11), 508-524.

Schwab, W.C., Baldwin, W.E., and Denny, J.F. 2016. Assessing the impact of Hurricanes Irene and Sandy on the morphology and modern sediment thickness on the inner continental shelf offshore of Fire Island, New York: U.S. Geological Survey Open-File Report 2015–1238, 15 p., http://dx.doi.org/10.3133/ofr20151238.

Schwab, W.C., Baldwin, W.E., and Denny, J.F. 2014a. Maps showing the change in modern sediment thickness on the Inner Continental Shelf Offshore of Fire Island, New York, between 1996–97 and 2011: U.S. Geological Survey Open-File Report 2014–1238, http://dx.doi.org/10.3133/ofr20141238.

Schwab, W.C., Baldwin, W.E., Denny, J.F., Hapke, C.J., Gayes, P.T., List, J.H., and Warner, J.C. 2014b. Modification of the Quaternary Stratigraphic Framework of the Inner-Continental Shelf Offshore of Fire Island by Holocene Marine Transgression: Marine Geology, v. 355, 346-360 p. http://www.sciencedirect.com/science/article/pii/S0025322714001960.

Schwab, W.C., Denny, J.F., and Baldwin, W.E. 2014c. Maps showing bathymetry and modern sediment thickness on the inner continental shelf offshore of Fire Island, New York, pre-Hurricane Sandy: U.S. Geological Survey Open-File Report 2014–1203, http://dx.doi.org/10.3133/ofr20141203.

Sharp, J.H. 1974. Improved analysis for particulate organic carbon and nitrogen in seawater. *Limnology and Oceanography* 19: 984-989.

Stauffer, B. A., Schaffner, R. A., Wazniak, C., & Caron, D. A. 2008. Immunofluorescence flow cytometry technique for enumeration of the brown-tide alga, *Aureococcus anophagefferens*. Applied and environmental microbiology, 74(22), 6931-6940.

USACE. 2013. Hydrographic Surveying. USACE Engineering and Design Manual EM 1110-2-1003. Available at http://www.publications.usace.army.mil/.

Valderrama, J.C. 1981. The simultaneous analysis of total nitrogen and phosphorus in natural waters. *Mar. Chem.* 10: 109-122.

Wickliffe, L.C., J.A. Jossart, K.L. Riley, and J. A. Morris. 2020. Siting analysis for Manna Fish Farms, New York. NOAA NCCOS Revised report. July 2020. 104 PP.