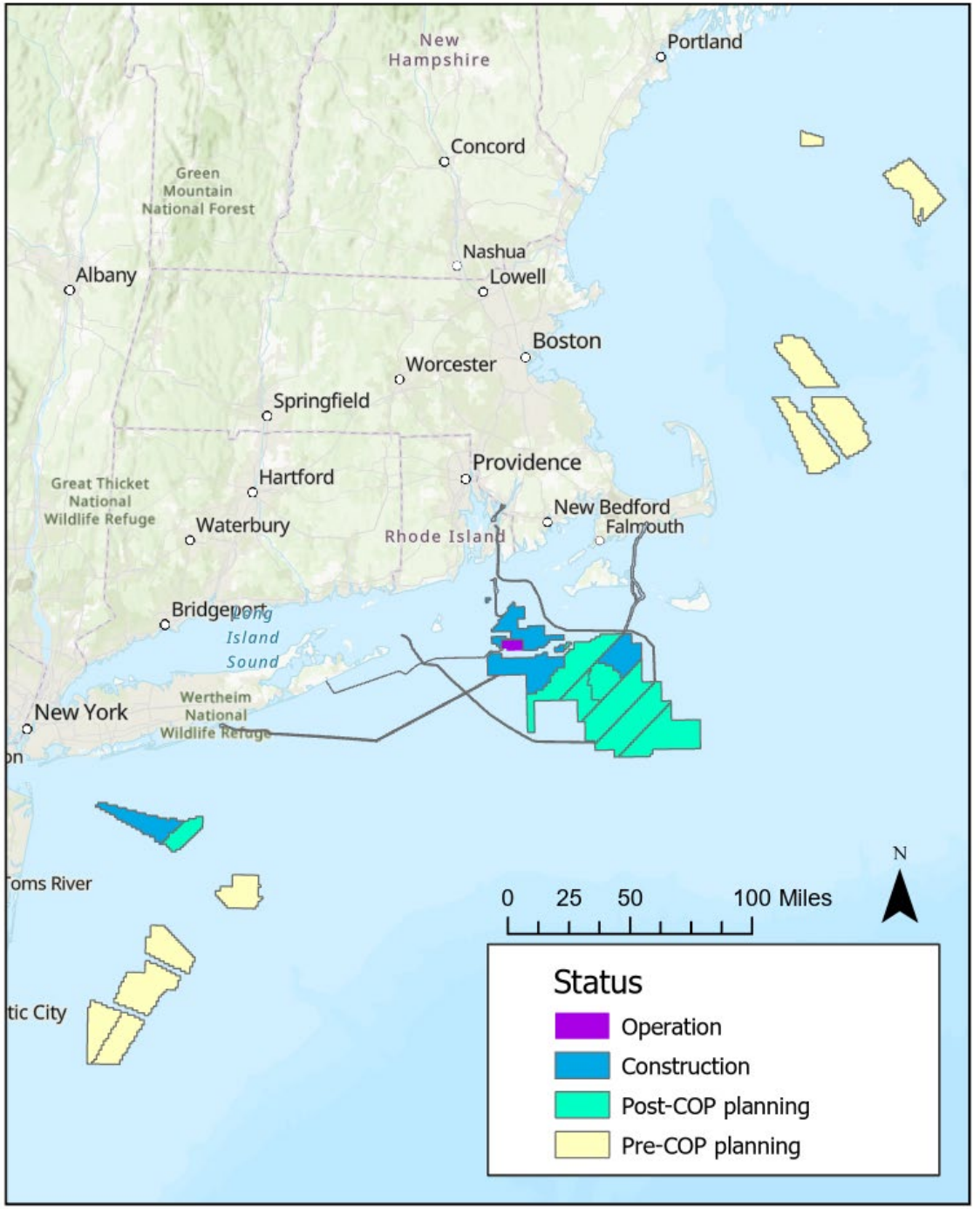
Habitat Working Group – State Updates

June 18, 2025

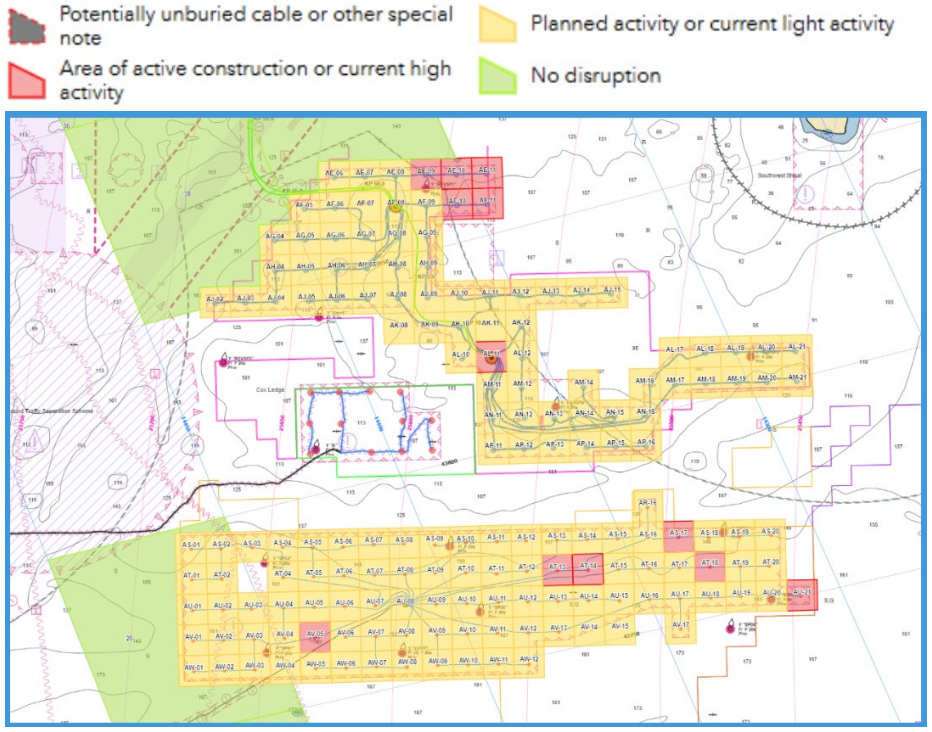
Offshore Wind Project Status

Status	Projects	Activities on the water (lease area and cable routes)
Complete and Operational	South Fork	May see occasional: - post-construction surveys - maintenance operations
Under Construction	Vineyard 1 Revolution Sunrise Empire	Likely to see one or more of: - seabed preparations (e.g., PLGR, boulder relocation) - pile-driving - installation of foundations, monopiles, WTGs - cable-laying
Planning and Permitting (COP is published)	New England 1 & 2 SouthCoast Beacon Starboard Vineyard Northeast Vineyard Mid-Atlantic	May see occasional: - habitat/fisheries surveys - geophysical surveys - metocean buoys
Planning and permitting (pre-COP)	New York Bight (5) Gulf of Maine (5)	May see occasional: - habitat/fisheries surveys - geophysical surveys - metocean buoys



For projects currently Under Construction, activities include:

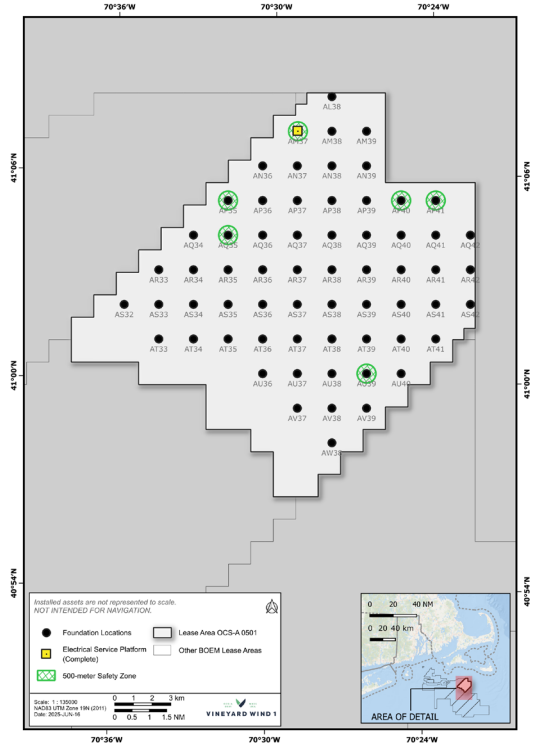
Project	Most recent update	Specific Activities on the water (lease area and cable routes)
Revolution	June 16, 2025	• Installation of towers, nacelles and blades • Commissioning of completed WTGs • Installation and protection of inter-array cables
Sunrise	June 16, 2025	• Installation of monopile WTG foundations • Deployment of bubble curtains, sound monitoring buoys • Installation of WTG transition piece



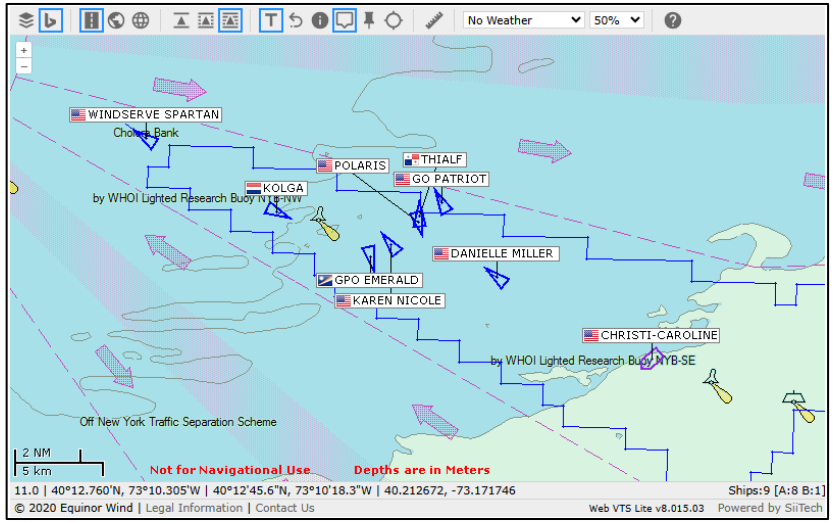
Source: https://a2f3e3.emailsp.com/frontend/nl_preview_window.aspx?idNL=1035

For projects currently Under Construction, activities include:

Project	Most recent update	Specific Activities on the water (lease area and cable routes)
Vineyard 1	June 16, 2025	• Installation of nacelle and blades • Surveys to assess export and inter-array cable burials
Empire	June 6, 2025	• Subsea drilling and testing • Installation of subsea rock and scour protection • Deployment of sound monitoring buoys and bubble curtains • Installation of monopile WTG and jacket OSS foundations



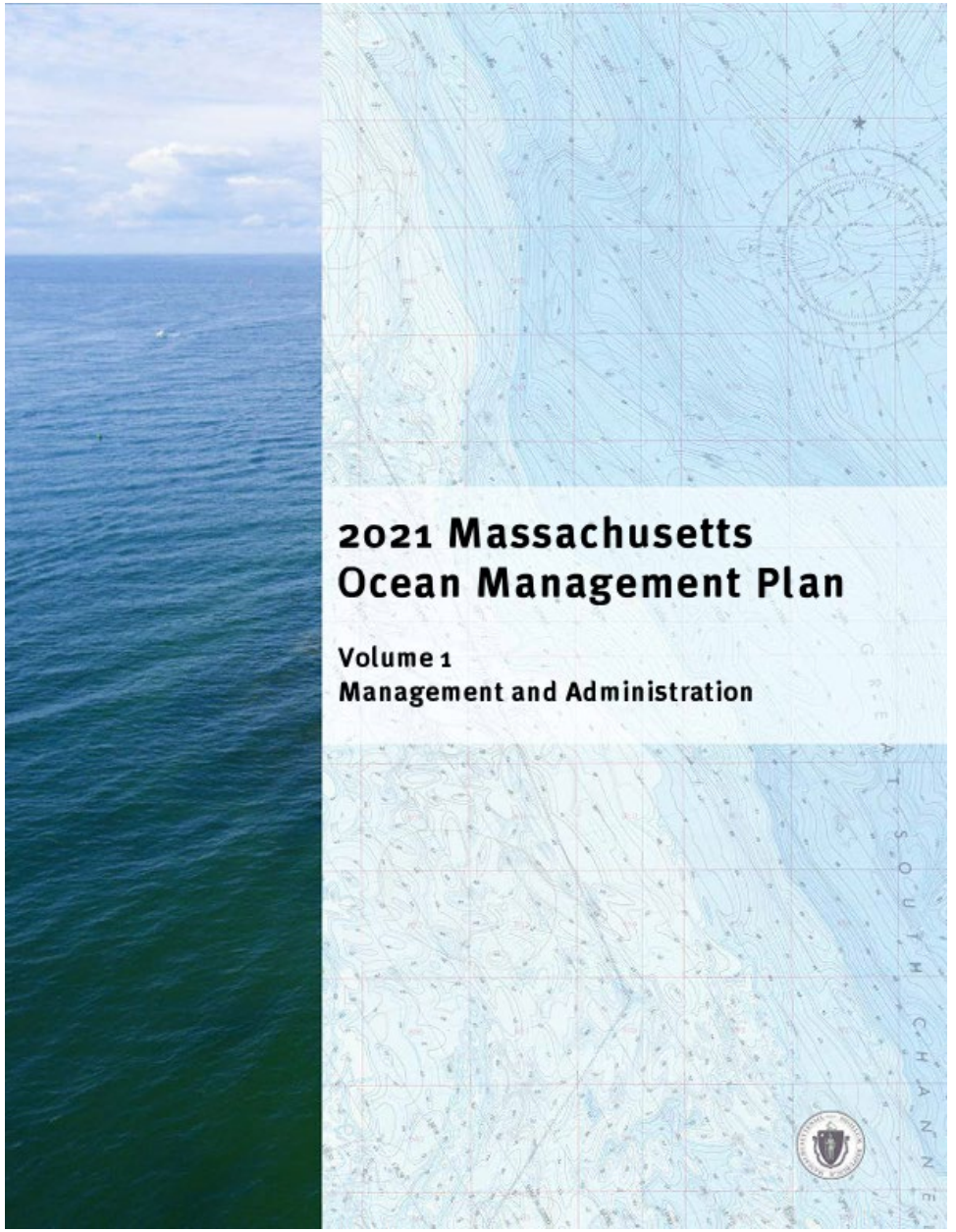
Source: https://www.vineyardwind.com/offshore-wind-mariner-updates



Source: https://www.empirewind.com/environment-and-sustainability/mariners-and-fisheries/

Ocean Management Plan

- Framework for development in state ocean waters
  - Renewable energy
  - Linear infrastructure (cables, pipelines)
  - Sand for beach nourishment
- Sets siting and performance standards to protect:
  - **Special Sensitive and Unique** resources (e.g., including habitats)
  - areas of concentrated **Water Dependent Uses** (e.g., traffic, fishing)
- Data-oriented, science-based
  - Baseline assessment – ongoing trends
  - Science and Data Priorities
- Intentionally adaptive document reviewed every 5 years



Ocean Management Plan Review

- Two-step process: formal review in 2025, possible update in 2026
- Key finding: Does the 2021 Plan need to be updated?
  - New information in past 5 years: science, policy
  - Updated data in past 5 years
- Plan Development and Review advised by 2 groups:
  - Ocean Advisory Commission
  - Ocean Science Advisory Council
- Review undertaken by 6 topical EEA agency-led stakeholder working groups:
  - Fisheries, Habitat, Sediment & Geology, Energy & Infrastructure, Transport & Navigation, Cultural & Recreational
- Public comment period ~ Q4 2025
- https://www.mass.gov/info-details/massachusetts-ocean-management-plan

Massachusetts Fisheries Innovation Fund Update

- Fisheries Innovation Fund (FIF): **$1.75m mitigation fund** created by Vineyard Wind to “support programs and projects that ensure safe and profitable fishing continues” as current and future offshore wind projects are developed
- Other developers will add mitigation funds to FIF, possibly $2.3-4.8m in future

<u>Progress Update</u>

May: Finished FIF Request for Proposals draft for funding Solicitation1

FIF Advisory Panel met to approve RFP priorities, scale, eligibility and evaluation criteria

June: Finalize RFP – Solicitation1 with EEA, post to CommBuys and on DMF site

Fisheries Innovation Fund – Solicitation 1

Project Priorities

Fishing Innovation | Community | Safety

Scale of Funding

- Up to $750,000 funding, with projects ranging from $25,000-$300,000 total
- Projects up to 3 years in duration

Eligible Entities

Commercial fishing businesses, non-profit fishing or research organizations, shoreside infrastructure businesses, academic institutions or public sector entities

Evaluation Criteria

Support for co-existence of marine fisheries and offshore wind development, direct engagement (or collaboration) with commercial or for-hire fishing, etc.

Timeline

Publish RFP: End of June

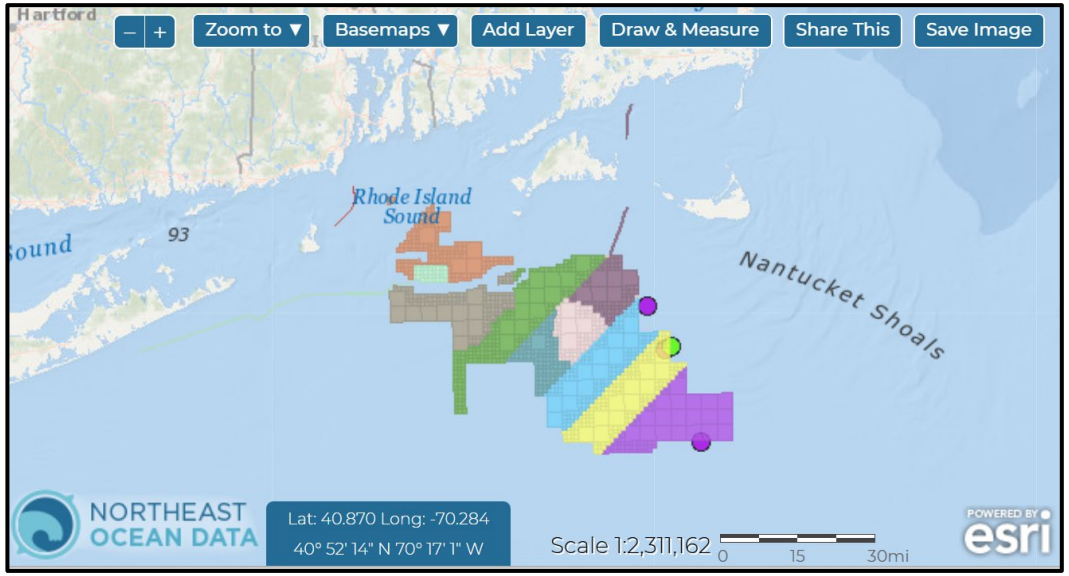
Proposals Due: August 15

Projects Start: January1

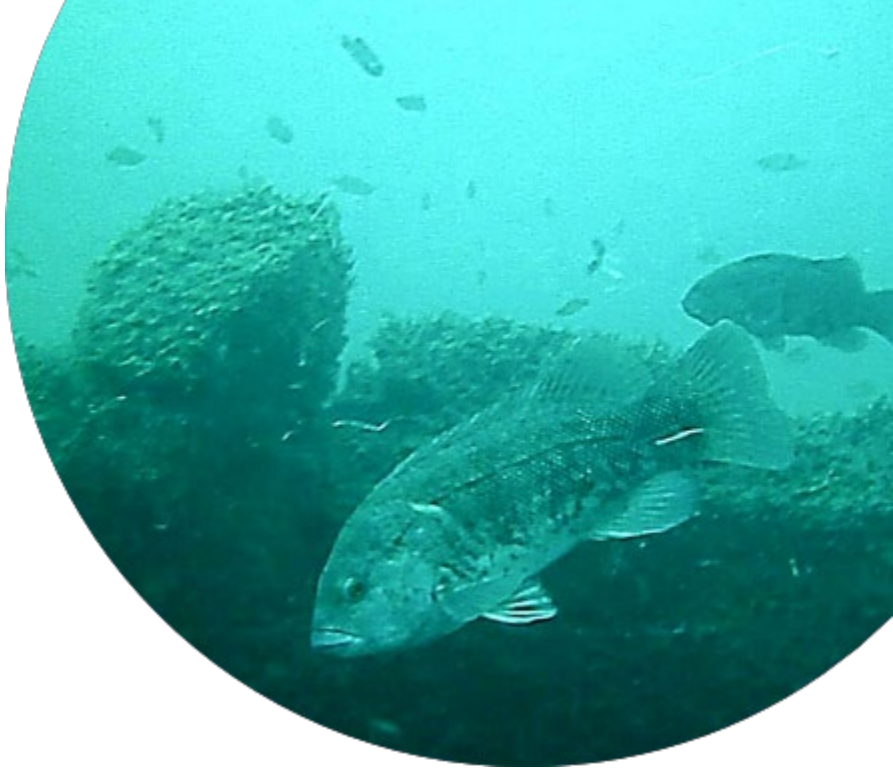
New England Shelf Hydrogeology Project - Expedition 501

ECORD Science Operator

- European Consortium for Ocean Research Drilling (ECORD)
- Began on May 19th via Lift Boat *Robert*
- Currently at MV03 (green dot – in SouthCoast)
- Have drilled to 393 m below seafloor
- Many cores removed
- Water chemistry, sedimentology, microbiology. micropaleontology
- Have had some challenges with glauconite
- 2-month study



Massachusetts Habitat Working Group
on Offshore Wind
Boston, MA
Wednesday, June 18th, 2025

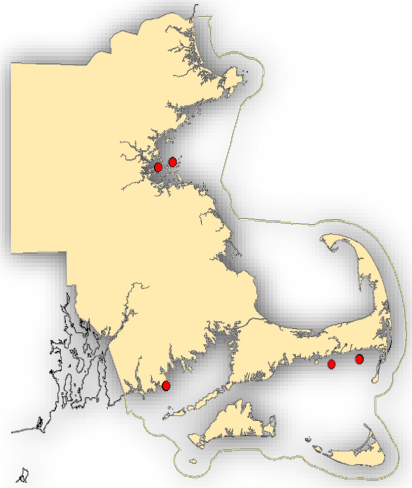


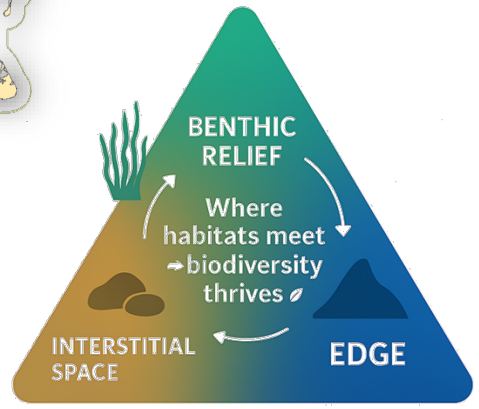
Artificial Reefs in MA

Mark Rousseau

Presentation Objectives

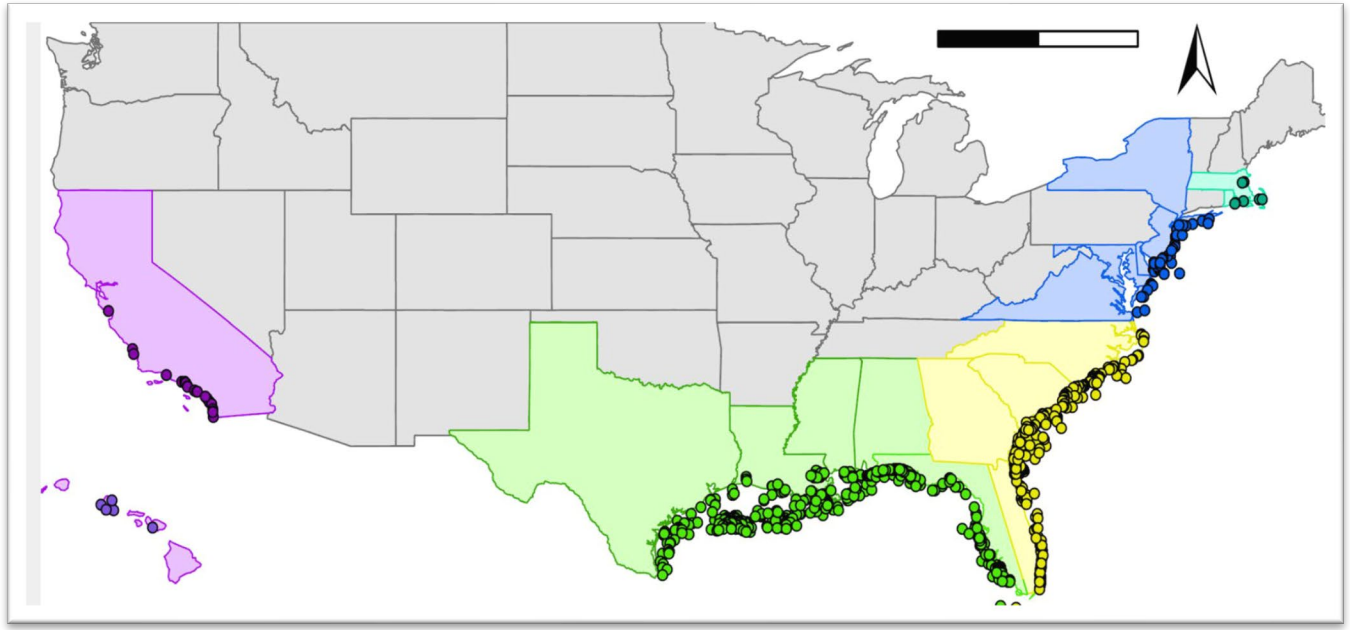
- Provide a brief overview of DMF's artificial reef projects
- Describe DMF's approach to enhancing habitat and biodiversity using artificial reefs
- Discuss techniques and tools utilized by DMF for monitoring benthic habitats

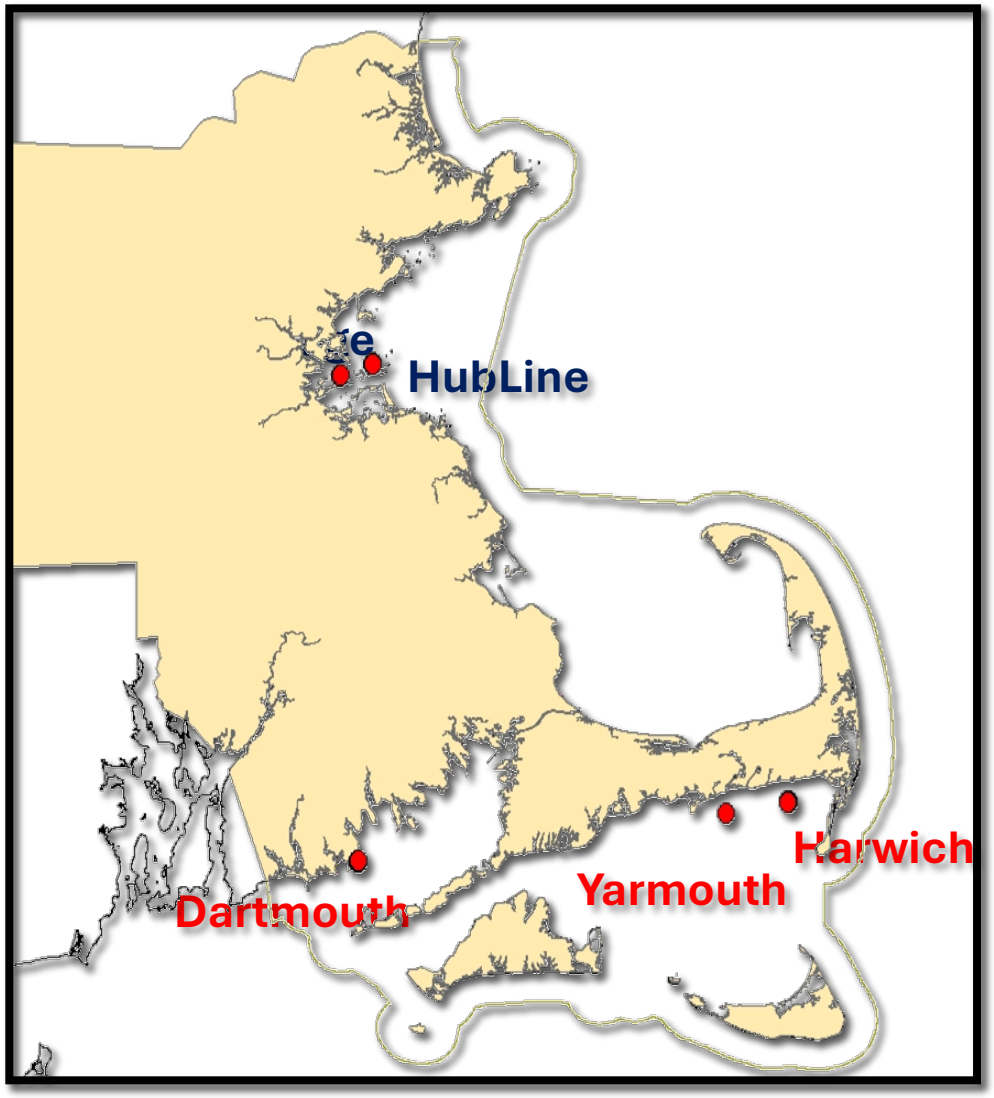




Mobile Species Presence	Pre Deployment		Post Deployment				
	visual	camera	visual	camera	BRUV	Acoustic	eDNA (Teleost's only)
Horseshoe Crab	x	x	x	x			
American Lobster	x	x	x	x	x		x
Northern Sea Robin	x	x	x	x	x		x
Summer Flounder	x	x	x	x	x		x
Winter Flounder (yellow tail ?)	x	x	x	x			x?
Cunner			x	x	x		x
Tautog			x	x	x		x
Black Sea Bass			x	x	x	x	x
Scup			x	x	x		x
Weakfish					x		x
Striped Bass						x	x
White Shark						x	
Atlantic Sturgeon						x	
American butterfish							x
American sand lance							x
Gadidae sp.							x
Atlantic herring							x
Atlantic mackerel							x
Atlantic menhaden							x
Bay anchovy							x
Bigeye scad							x
Bluefish							x
Fourspot flounder							x
Hogchoker							x
Scup							x
Northern kingfish							x
Northern pipefish							x
Northern sand lance							x
Windowpane Flounder							x
Ocean sunfish							x
Hake sp. (red, white, silver, spotted)							x
Seaboard goby							x
Smallmouth flounder							x
Striped sea robin							x
Total	5	5	9	9	8	4	31

Overview

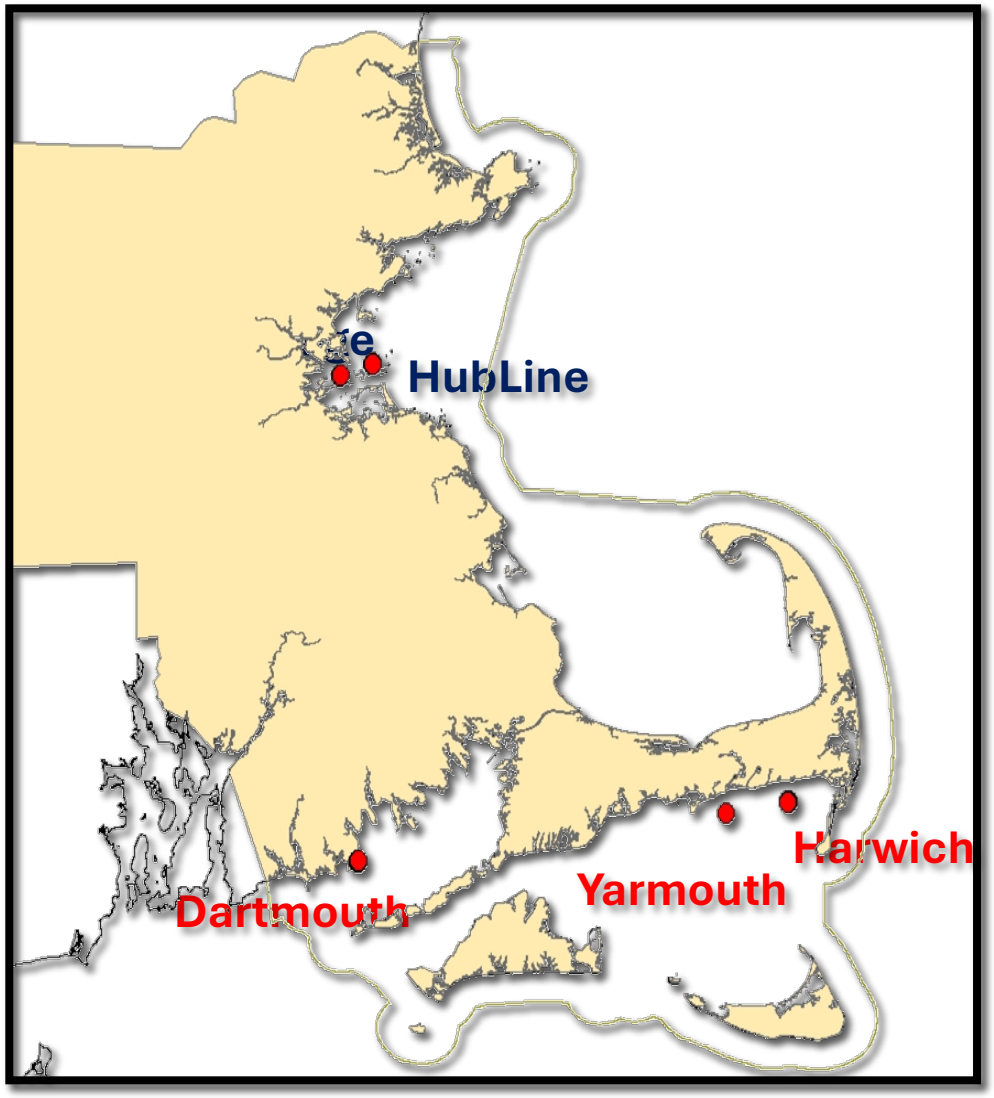




Artificial Reef footprint in the United States Ocean: https://www.nature.com/articles/s41893-023-01258-7

Overview

- 5 Permitted Artificial Reefs in MA
- All reefs located in estuarine waters between 30 and 40 ft depth (MLW)
- 2 sites (Yarmouth and Harwich) have open permits and are available to receive additional materials until 2029
- Yarmouth and Harwich are available for collaborative research opportunities, including for assessing material types and monitoring techniques.

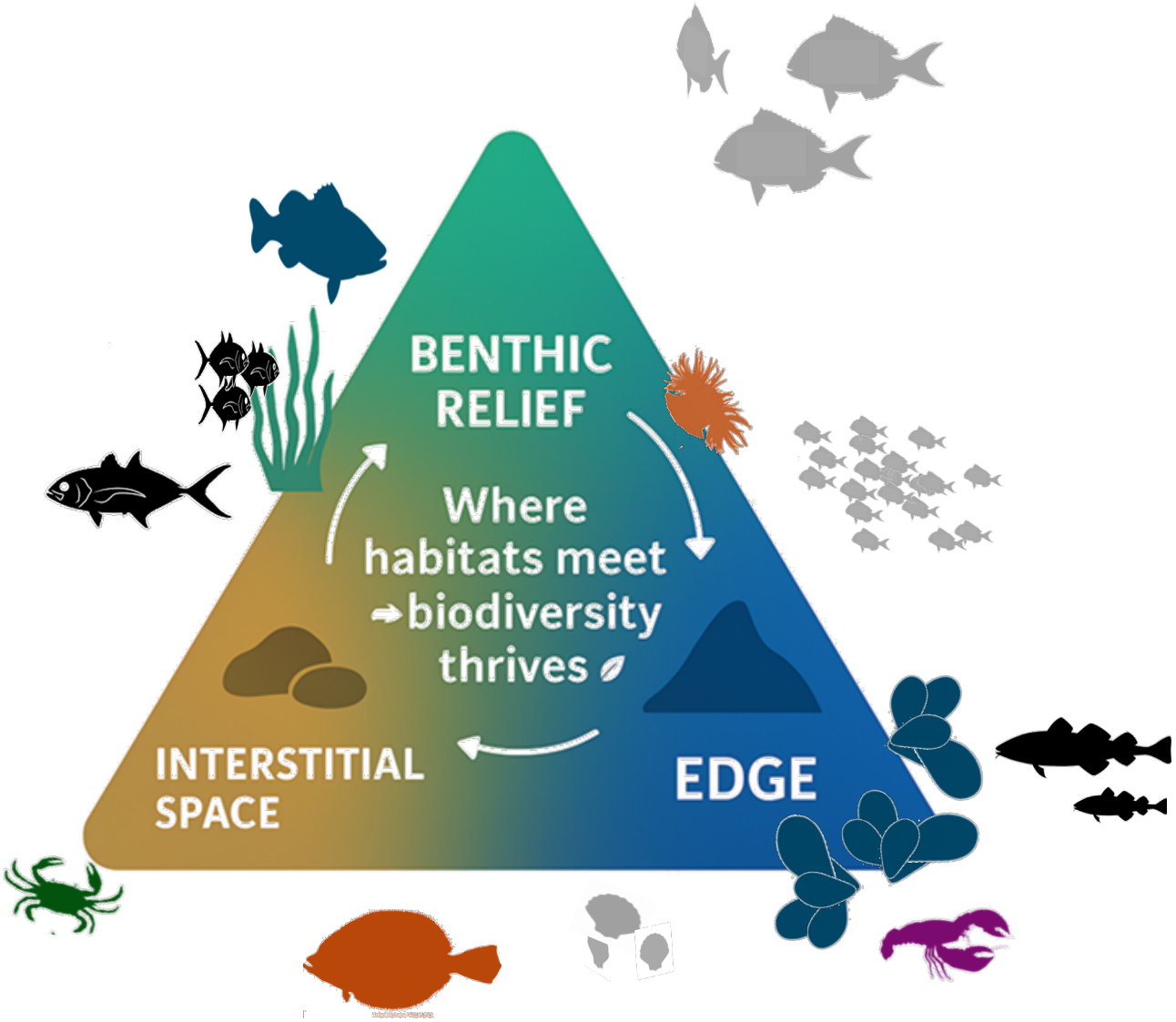


Habitat and Biodiversity Enhancement

Benthic Relief

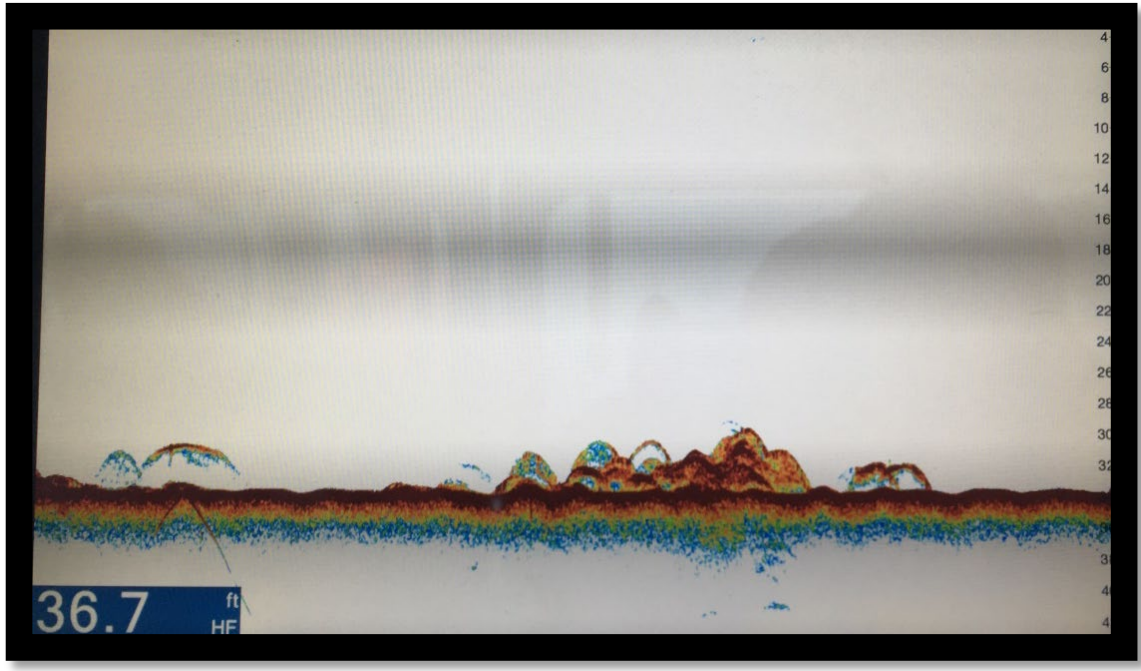
Edge

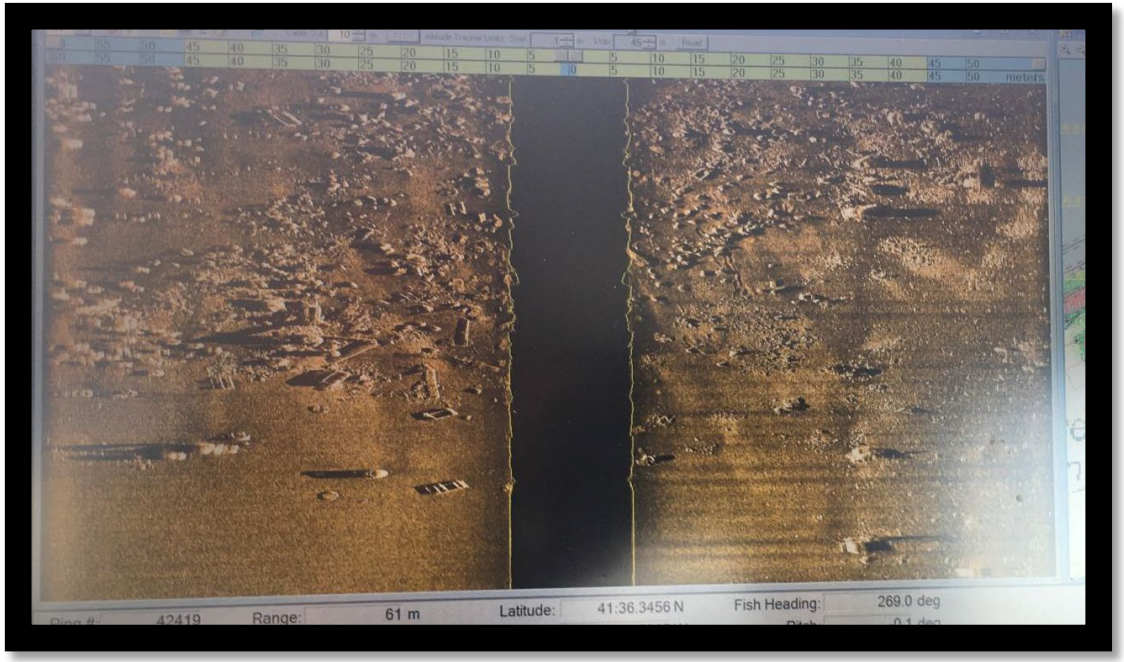
Interstitial Space



Habitat and Biodiversity Enhancement

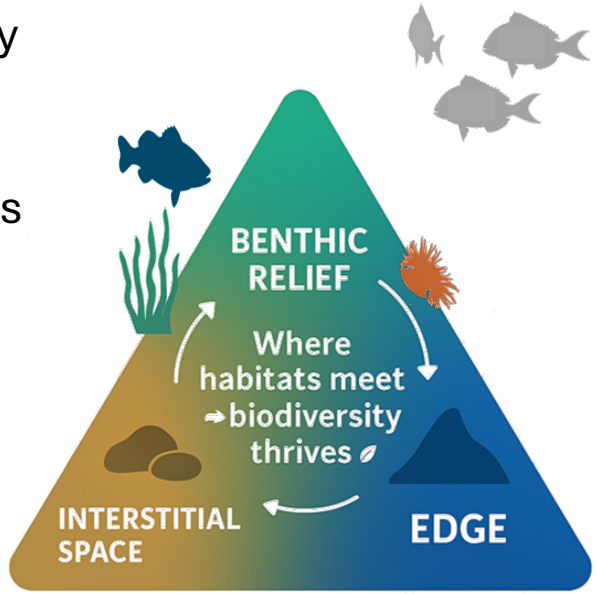
Benthic Relief





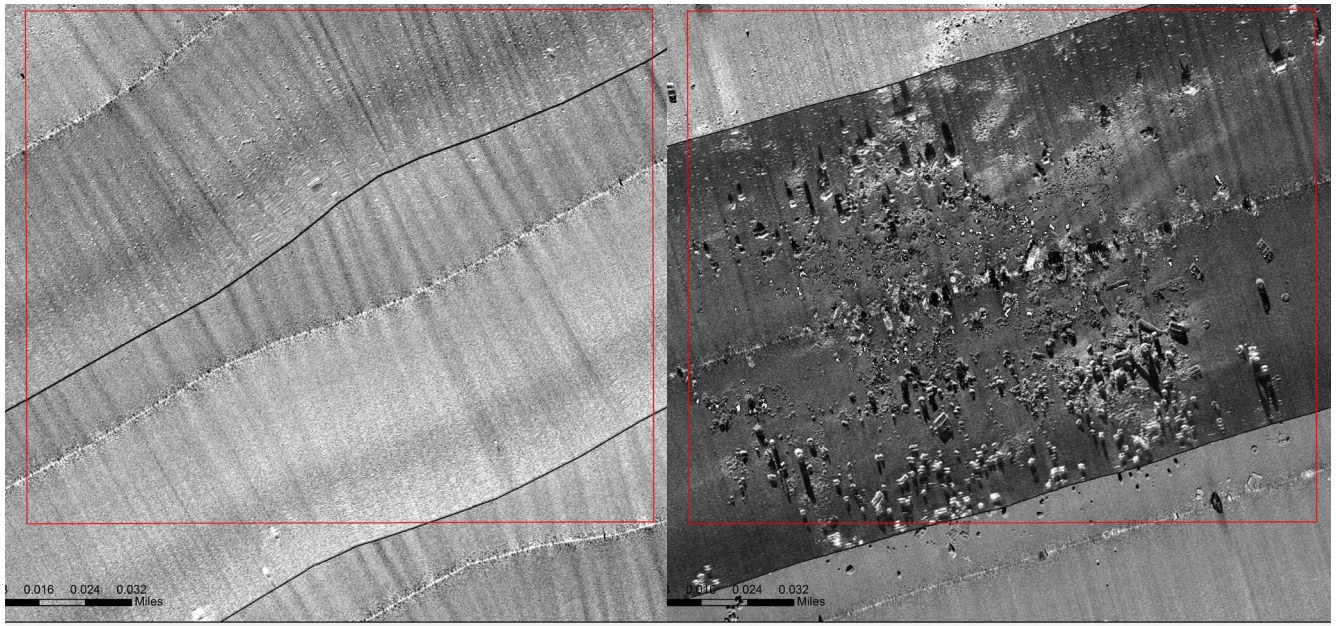
Structure

- Enhances habitat complexity
- Provides stable surfaces for colonization
- Supports higher fish densities compared to unstructured habitats
- Provides EFH for several migratory species, including lobster and black sea bass.

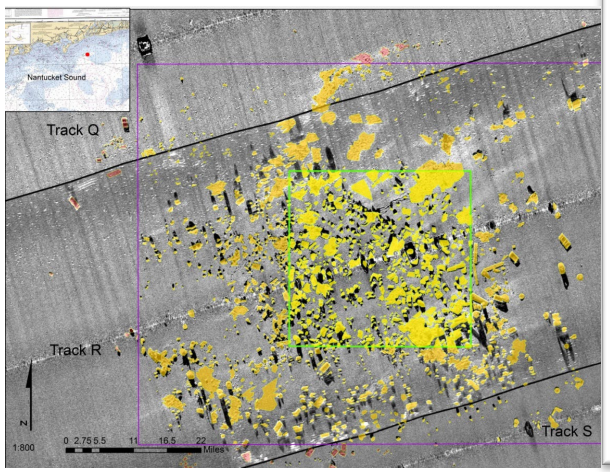


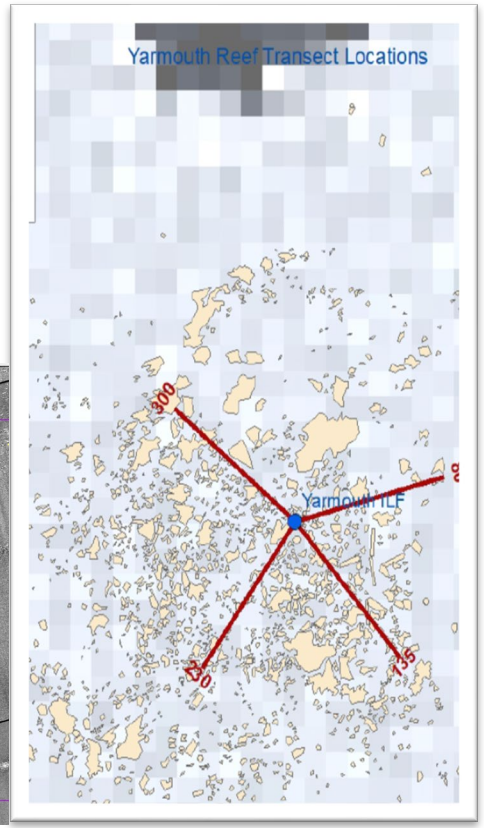
DMF Artificial Reef Reports: https://www.mass.gov/lists/fisheries-habitat-publications#artificial-reef

Habitat and Biodiversity Enhancement



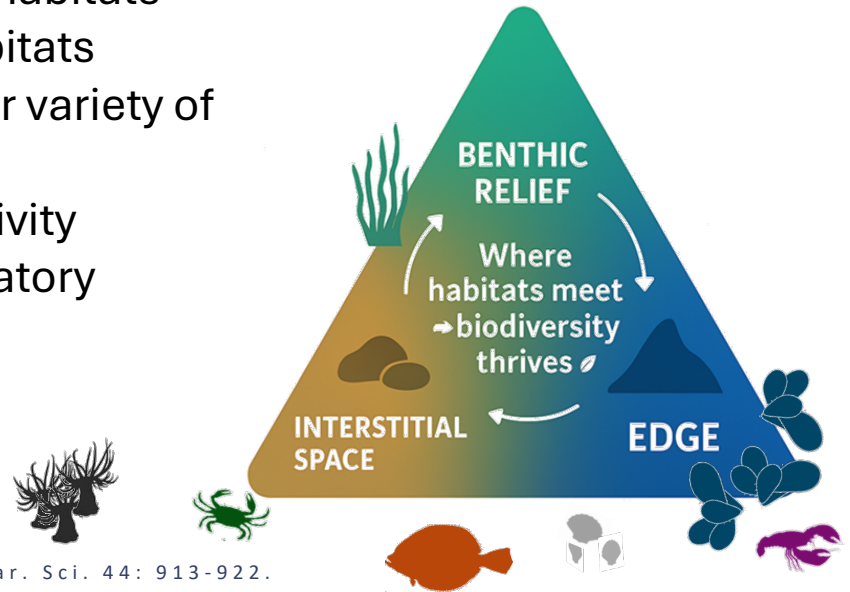
Edge





Edge

- Mixes structured habitats with adjacent habitats
- Supports a greater variety of species
- Provides connectivity corridors for migratory species



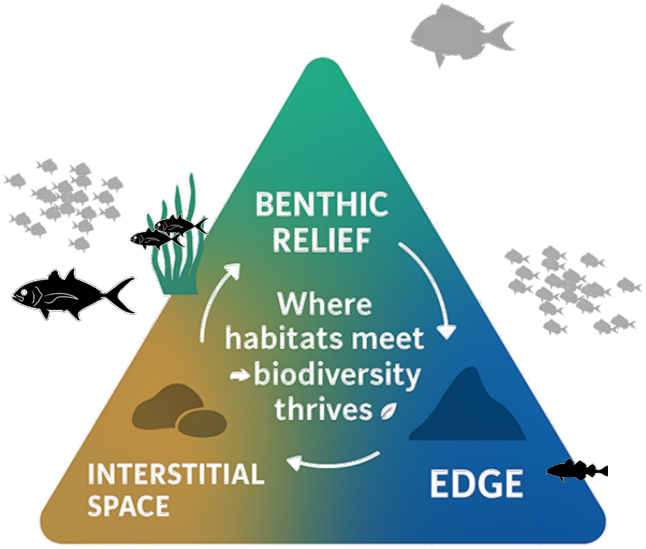
Hueckel, G. J., R. M. Buckley, and B. L. Benson. 1989. Mitigating rocky habitat loss using artificial reefs. Bull. of Mar. Sci. 44: 913-922.

Habitat and Biodiversity Enhancement

Interstitial Space

Interstitial Space

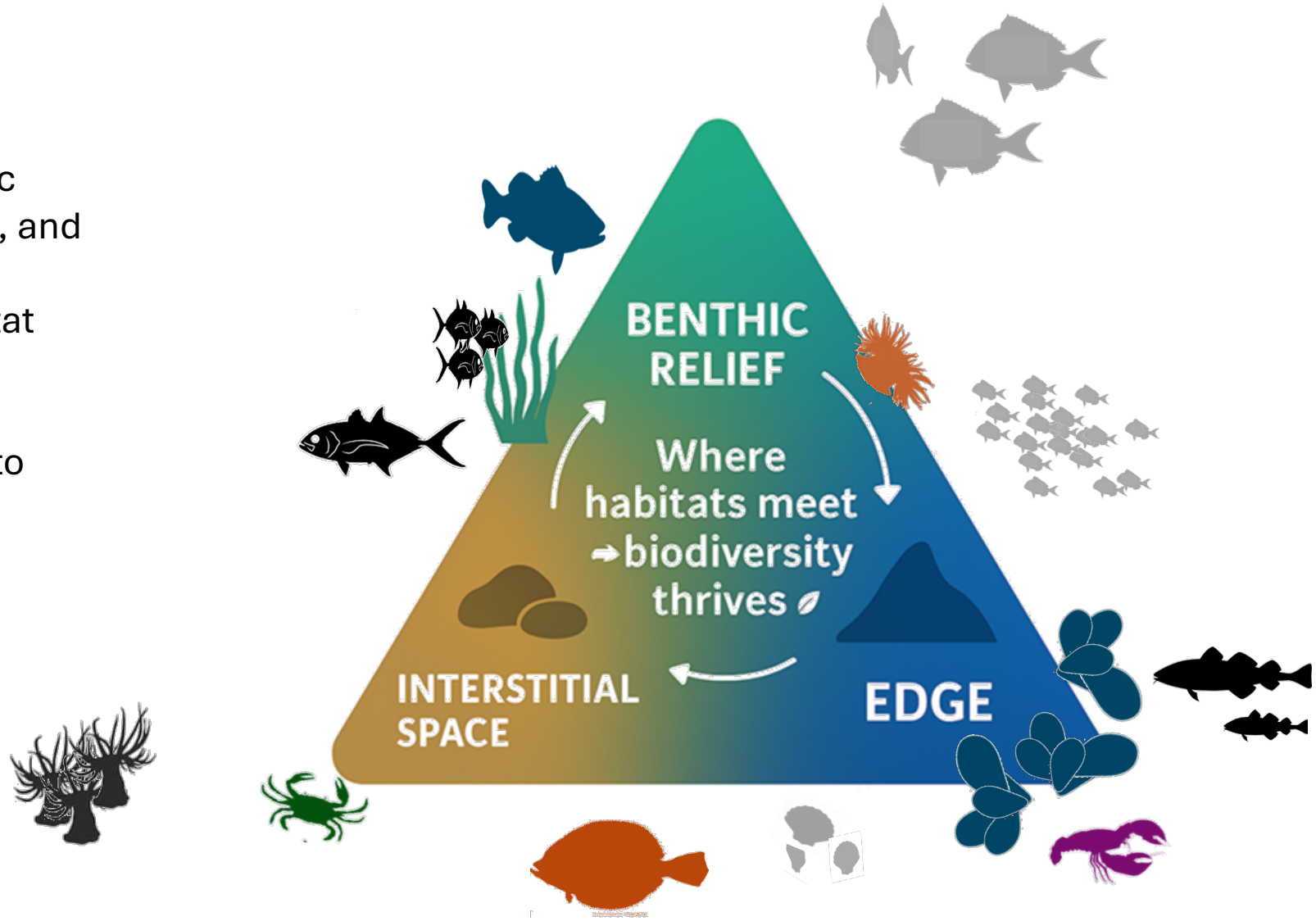
- Affords protection to multiple species and sizes
- Supports diverse microhabitats
- Increases species diversity



Ambrose, R. F., and S. L. Swarbrick. 1989. Comparison of fish assemblages on artificial and natural reefs off the coast of southern California. Bull. Mar. Sci. 44: 718-733.

Habitat and Biodiversity Enhancement

- Condition permits to achieve desired benthic relief, interstitial space, and edge habitats
- Design to include habitat components of natural habitats
- Consider connectivity to surrounding habitats

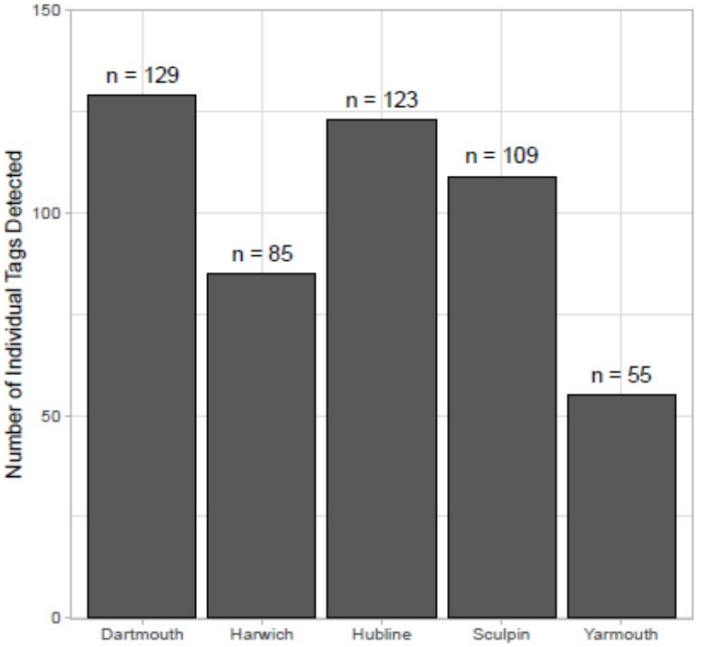


Monitoring

- **Remote Sensing**
- **Snapshots**
- **Data gaps**

Mobile Species Presence		Pre Deployment			Post Deployment				
		visual	camera		visual	camera	BRUV	Acoustic	eDNA (Teleost's only)
Horseshoe Crab		x	x		x	x			
American Lobster		x	x		x	x	x		
Northern Sea Robin		x	x		x	x	x		x
Summer Flounder		x	x		x	x	x		x
Winter Flounder (yellow tail?)		x	x		x	x			x?
Cunner					x	x	x		x
Tautog					x	x	x		x
Black Sea Bass					x	x	x	x	x
Scup					x	x	x		x
Weakfish							x		x
Striped Bass								x	x
White Shark								x	
Atlantic Sturgeon								x	
American butterfish									x
American sand lance									x
Gadidae sp.									x
Atlantic herring									x
Atlantic mackerel									x
Atlantic menhaden									x
Bay anchovy									x
Bigeye scad									x
Bluefish									x
Fourspot flounder									x
Hogchoker									x
Sculpin sp.									x
Northern kingfish									x
Northern pipefish									x
Northern sand lance									x
Windowpane Flounder									x
Ocean sunfish									x
Hake sp. (red, white, silver, spotted)									x
Seaboard goby									x
Smallmouth flounder									x
Striped sea robin									x
Total		5	5		9	9	8	4	31

Remote Sensing

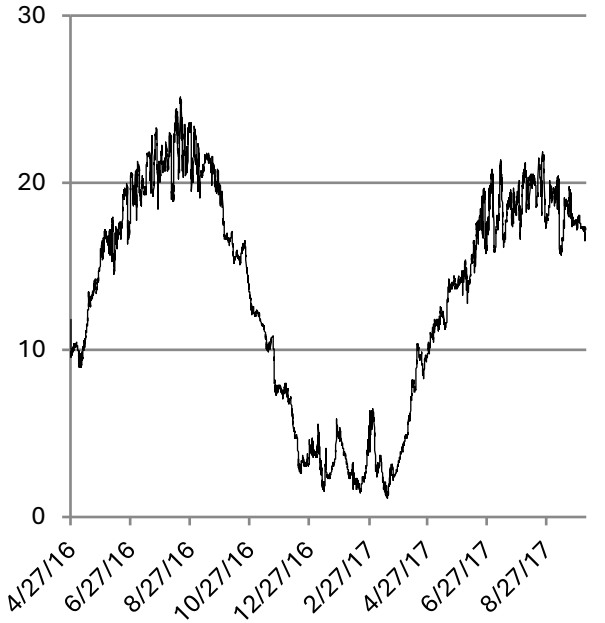


Tag Detections 2016-2024

Bottom Temperature Monitor Housing

Remote sensing

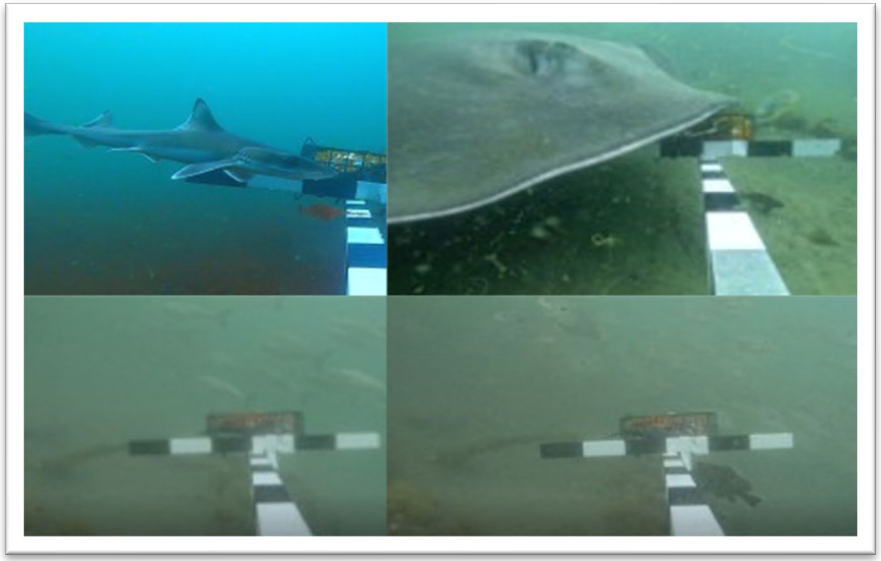
- Enables time-series assessments
- Allows data collection to continue without staff presence
- Documents long-term habitat and/or biodiversity trends

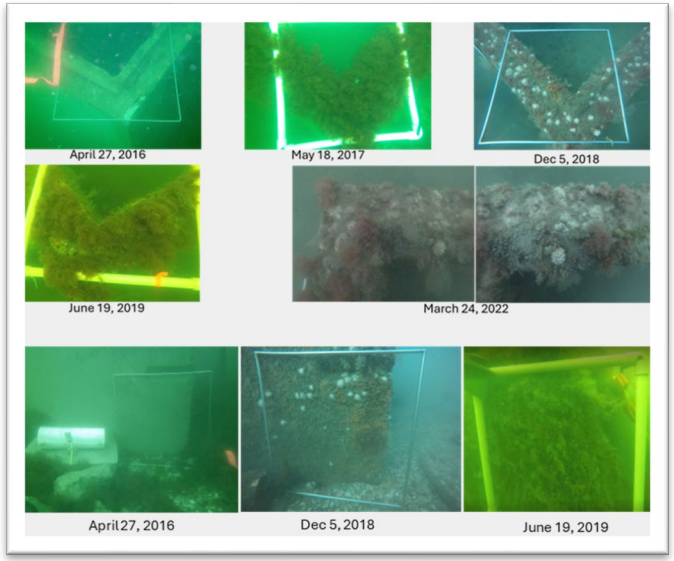


2016-2017 Harwich Reef Bottom Temp

Monitoring

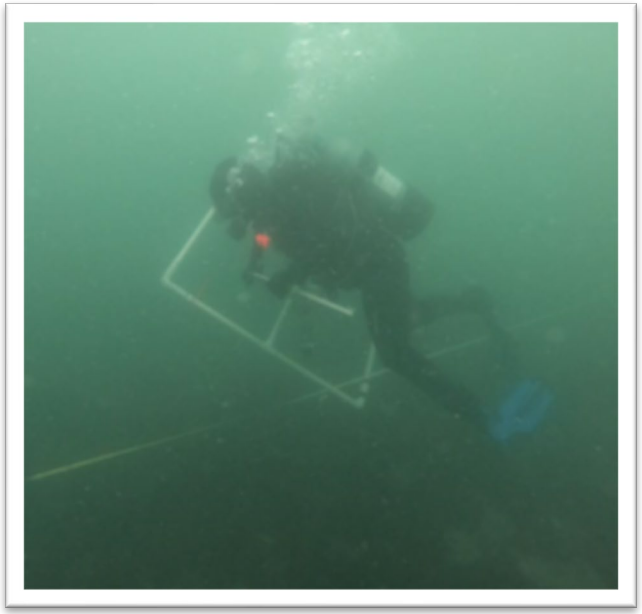
Snap Shots





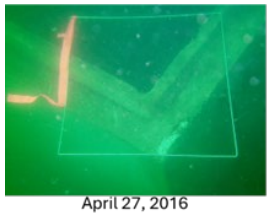
Event data

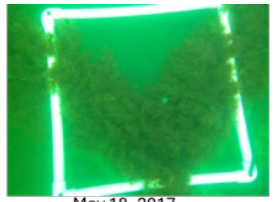
- Data collection is influenced by environmental conditions
- Requires capacity (staff and equipment)
- Involves different tools and techniques
- Monitoring equipment capabilities constantly evolving.



Monitoring

Snap Shots


April 27, 2016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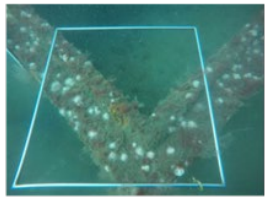
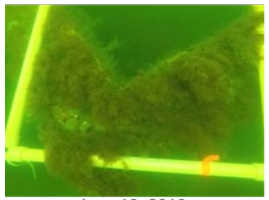
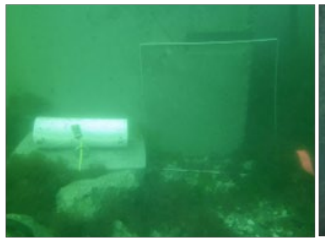

Dec 5, 2018


June 19, 2019


March 24, 2022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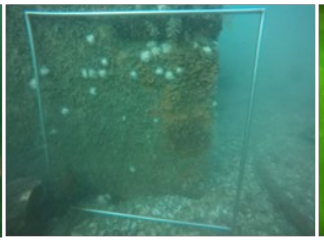
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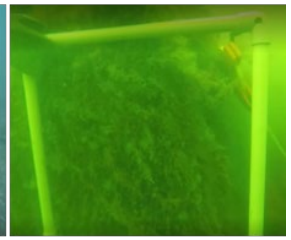
June 19, 2019

Mobile Species Presence		Pre Deployment			Post Deployment				
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Horseshoe Crab		x	x		x	x			
American Lobster		x	x		x	x	x		
Northern Sea Robin		x	x		x	x	x		x
Summer Flounder		x	x		x	x	x		x
Winter Flounder (yellow tail?)		x	x		x	x			x?
Cunner					x	x	x		x
Tautog					x	x	x		x
Black Sea Bass					x	x	x	x	x
Scup					x	x	x		x
Weakfish							x		x
Striped Bass								x	x
White Shark								x	
Atlantic Sturgeon								x	
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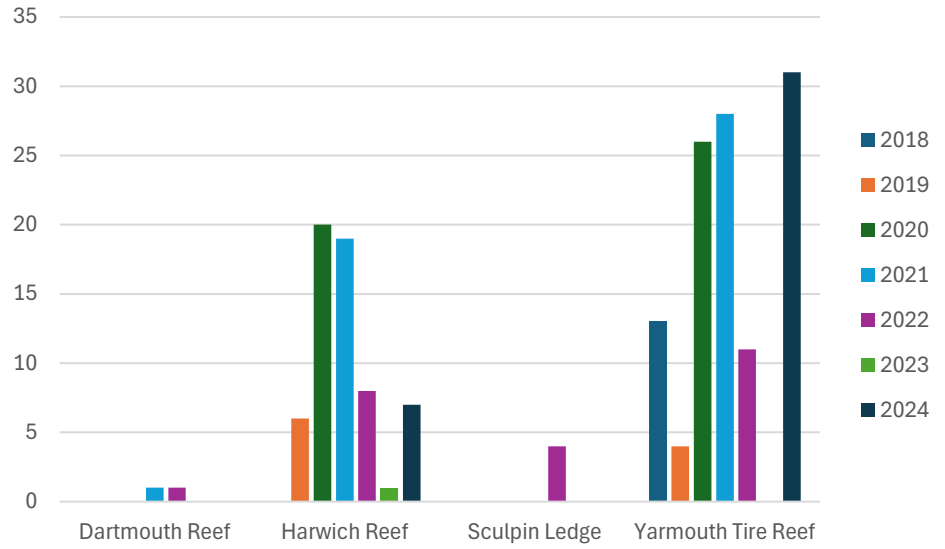
Data Gaps



Sum of n_intercepts_reef	Column Labels							
Row Labels	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**Grand Total**
Dartmouth Reef				1	1			2
Harwich Reef		6	20	19	8	1	7	61
Sculpin Ledge					4			4
Yarmouth Tire Reef	13	4	26	28	11		31	113
Grand Total	**13**	**10**	**46**	**48**	**24**	**1**	**38**	**180**

Thank You
Questions?

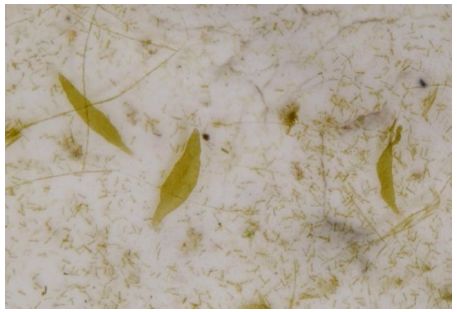
Artificial Reefs

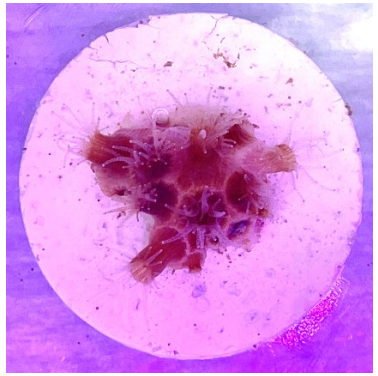
Mark Rousseau

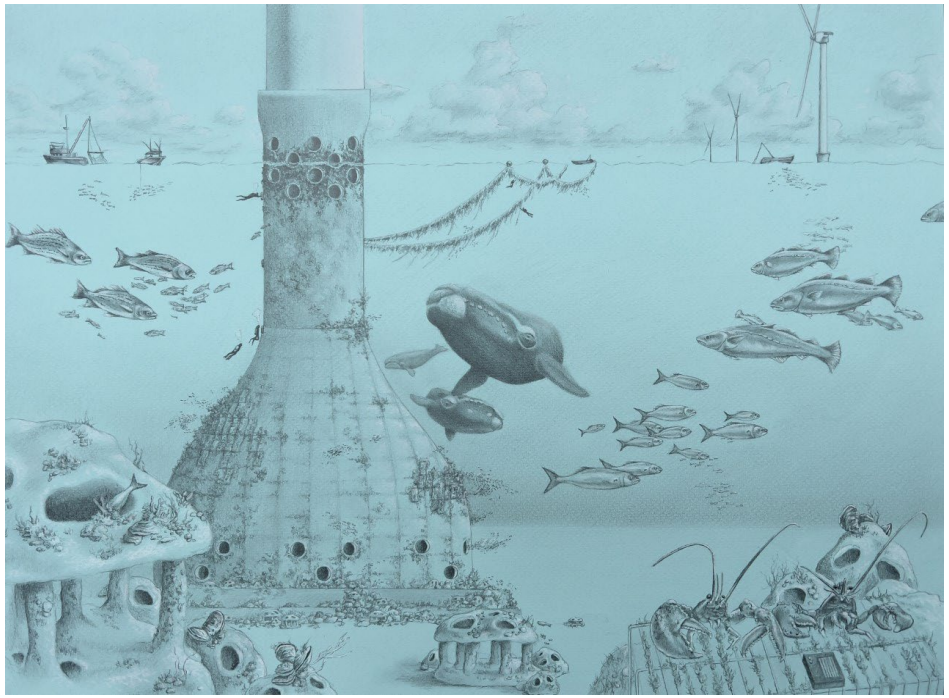
Mark.rousseau@mass.gov

DMF Artificial Reef Reports: https://www.mass.gov/lists/fisheries-habitat-publications#artificial-reef

Promoting beneficial colonization of OSW infrastructure







Loretta Roberson, MBL
lroberson@mbl.edu
Natalie Danek, WHOI
natalie.danek@whoi.edu

Promoting beneficial colonization of OSW infrastructure

MASSACHUSETTS CLEAN ENERGY CENTER®


Annie Murphy


Loretta Roberson


Colleen Hansel


Dan Kuchma


Jamie Lescinski


Anthony Dvarskis

INSPIRE ENVIRONMENTAL

THE UNIVERSITY OF CHICAGO MARINE BIOLOGICAL LABORATORY

WOODS HOLE OCEANOGRAPHIC INSTITUTION

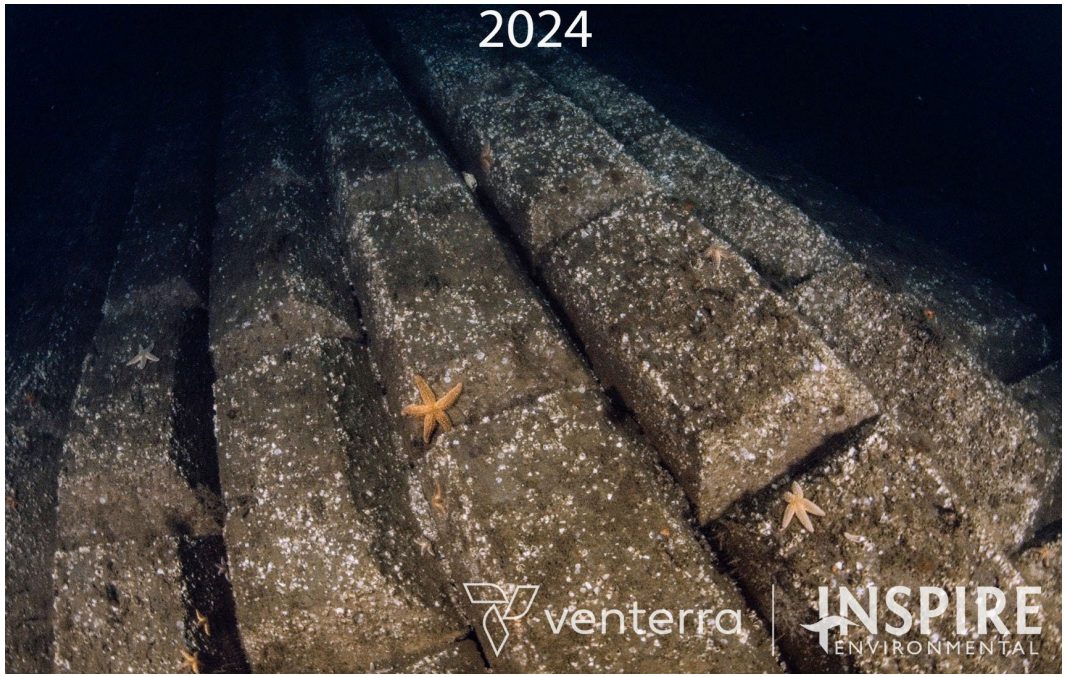
Tufts UNIVERSITY

Boskalis

Ørsted

Project Objectives

- Investigate the effects of micronutrient paints and biological seedings on benthic community development on marine structures
- Develop a roadmap to inform when, where, and how to implement strategies to facilitate diverse and productive benthic communities to support ecosystem services
- Scale and implement these strategies within the design of offshore wind infrastructure and other marine structures



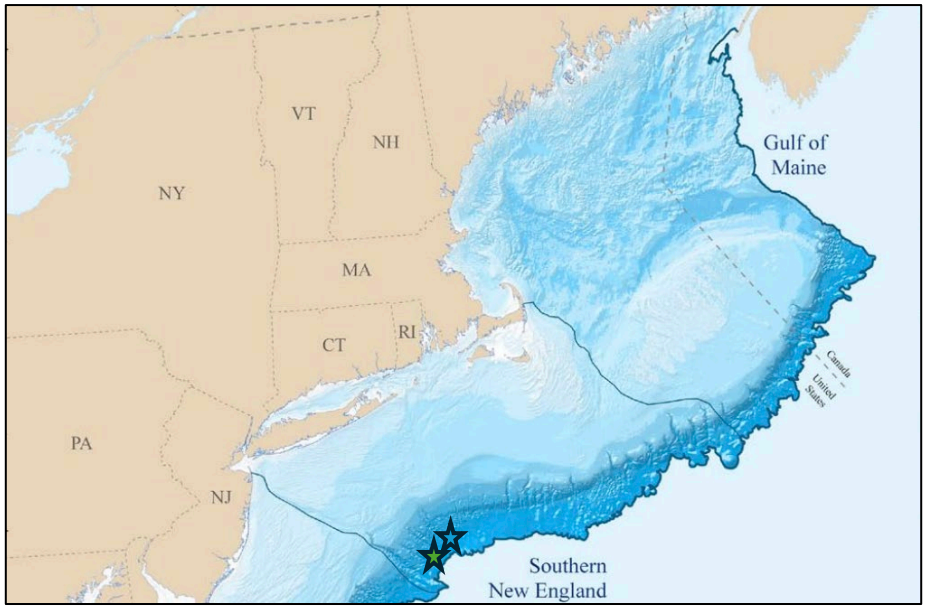
Project Overview

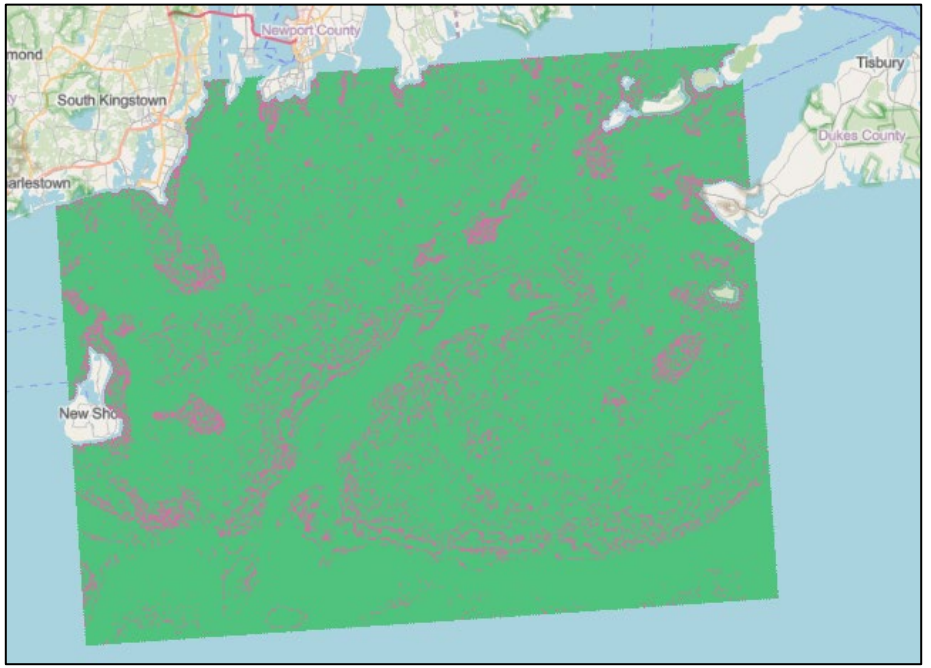
Task 1 – Community Input and Engagement

Task 2 – Test specific mineral/nutrient and biological seeding treatments – deploy off docks

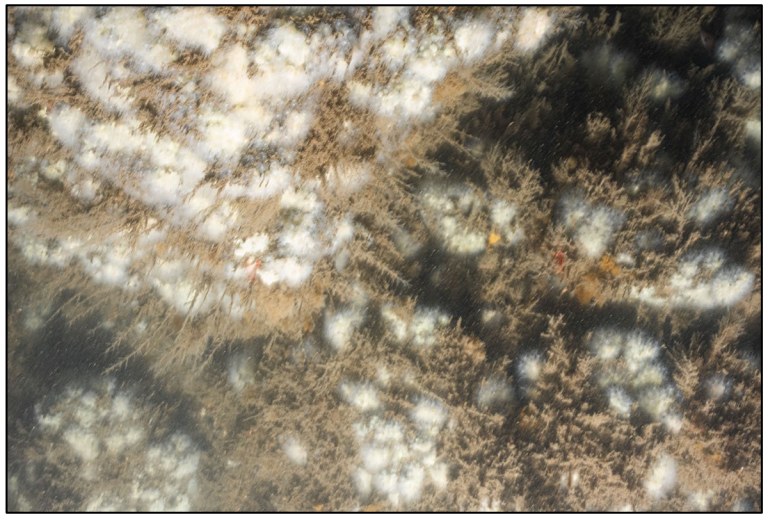
Task 3 – Site Selection Framework

Task 4 – Offshore design, deployment, and evaluation





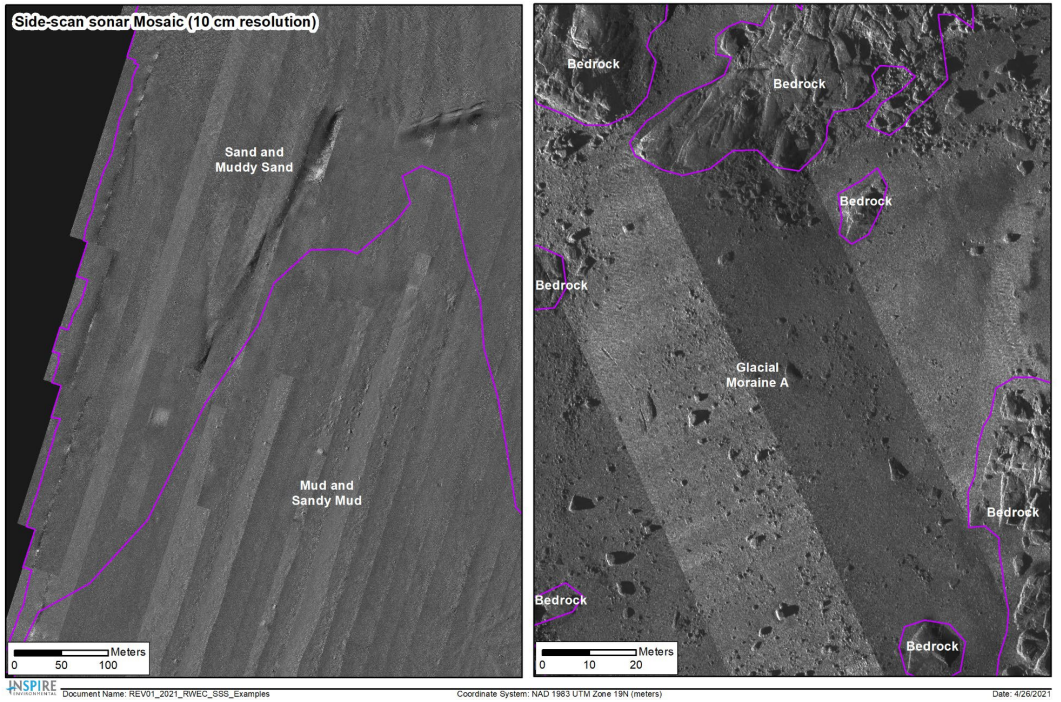
Sugar kelp

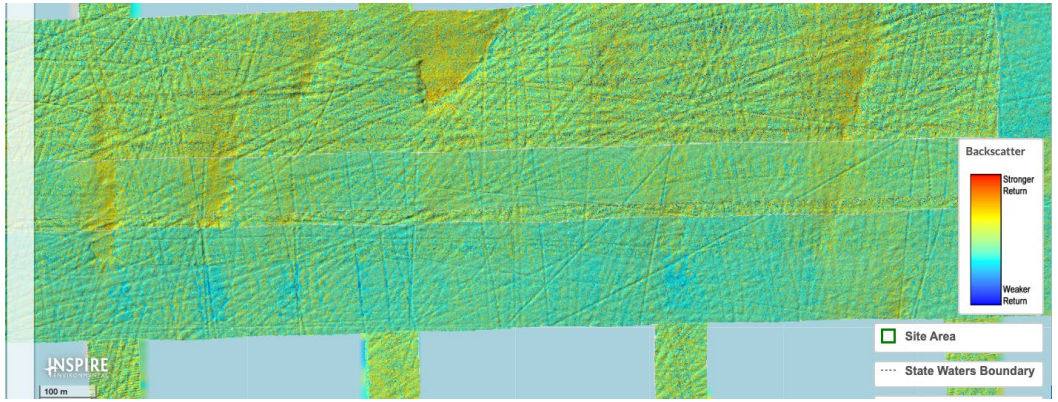


Star coral

Optimal Siting

- Environmental conditions
  - Hydrodynamics
  - Seabed mobility
  - Existing benthic habitat , topographic features
  - Predictive modelling for hard bottom occurrences, species distributions
  - Restoration of habitat loss
- Consider other ocean uses – fisheries, shipping lanes, archaeological features
- Consider project's engineering goals
- Consider results from nearby benthic monitoring programs and other research/databases





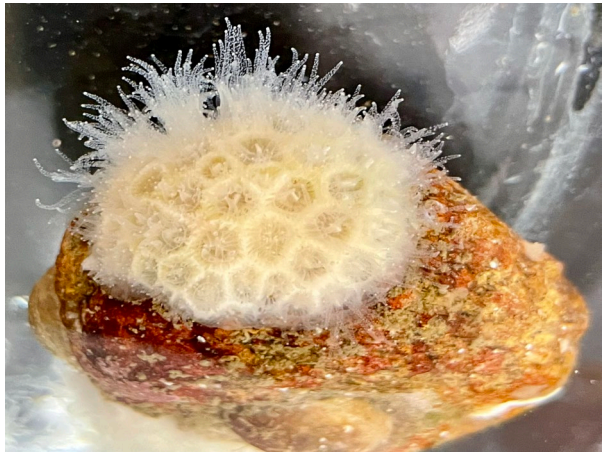
INSPIRE ENVIRONMENTAL

Benefits of Nutrient Additives

- Boost growth and resilience
- Enhance cellular processes
  - Ex. Shell growth
- Attract settlement of species of interest

Scallop

Star coral



Oyster

Nutrient Paint Testing

- Calcium carbonate base
- Lab testing
  - Different nutrient types
  - Dissolution rates
  - Surface porosities
  - Cement composition

SUGGESTED USE: **Adults, take 1 tablet daily with water and a m**
Store tightly closed, in a cool, dry place, out of reach of children.
Do not use if imprinted seal under cap is broken or missing.

Supplement Facts

Serving Size 1 Tablet

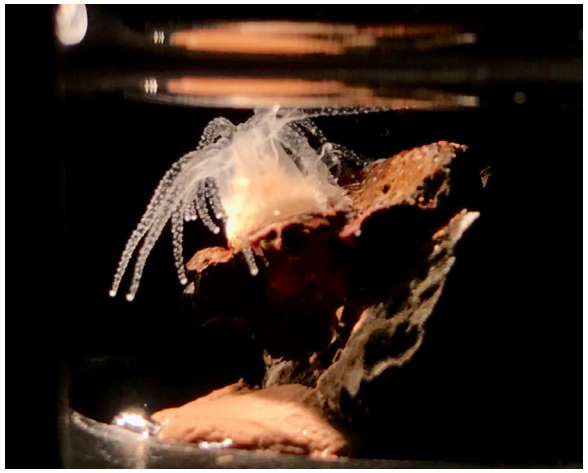
Amount Per Tablet	% Daily Value
Vitamin A 750 mcg (as Retinyl Acetate and 60% as Beta Carotene)	83%
Vitamin C (as Ascorbic Acid) 180 mg	200%
Vitamin D_3 (as Cholecalciferol) 25 mcg (1000 IU)	125%
Vitamin E (as dl-Alpha Tocopheryl Acetate) 22.5 mg	150%
Vitamin K (as Phytonadione) 80 mcg	67%
Thiamin (as Thiamine Mononitrate) 1.5 mg	125%
Riboflavin 1.7 mg	131%
Niacin (as Niacinamide) 20 mg	125%
Vitamin B_6 (as Pyridoxine Hydrochloride) 2 mg	118%
Folate 665 mcg DFE (400 mcg Folic Acid)	167%
Vitamin B_{12} (as Cyanocobalamin) 6 mcg	250%
Biotin 30 mcg	100%

Amount Per Tablet	% Daily Value
Pantothenic Acid 10 mg (as d-Calcium Pantothenate)	200%
Calcium (as Calcium Carbonate) 160 mg	12%
Iron (as Ferrous Fumarate) 18 mg	100%
Iodine (as Potassium Iodide) 150 mcg	100%
Magnesium (as Magnesium Oxide) 100 mg	24%
Zinc (as Zinc Oxide) 15 mg	136%
Selenium (as Sodium Selenate) 70 mcg	127%
Copper (as Cupric Sulfate) 2 mg	222%
Manganese (as Manganese Sulfate) 4 mg	174%
Chromium (as Chromium Chloride) 120 mcg	343%
Molybdenum (as Sodium Molybdate) 75 mcg	167%

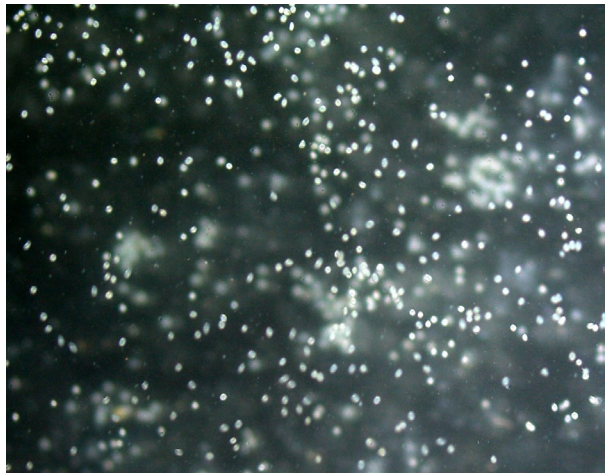
Biological seeding

THE UNIVERSITY OF CHICAGO
MARINE BIOLOGICAL LABORATORY

Coral polyp

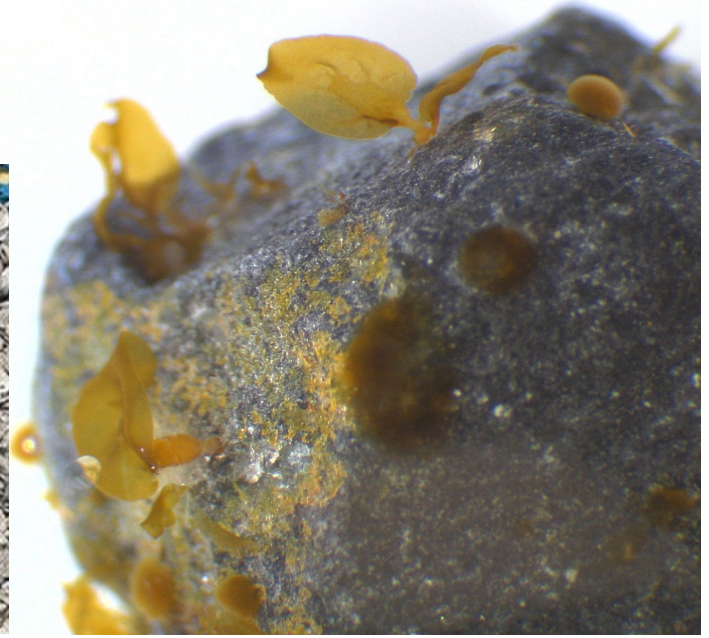


Larvae



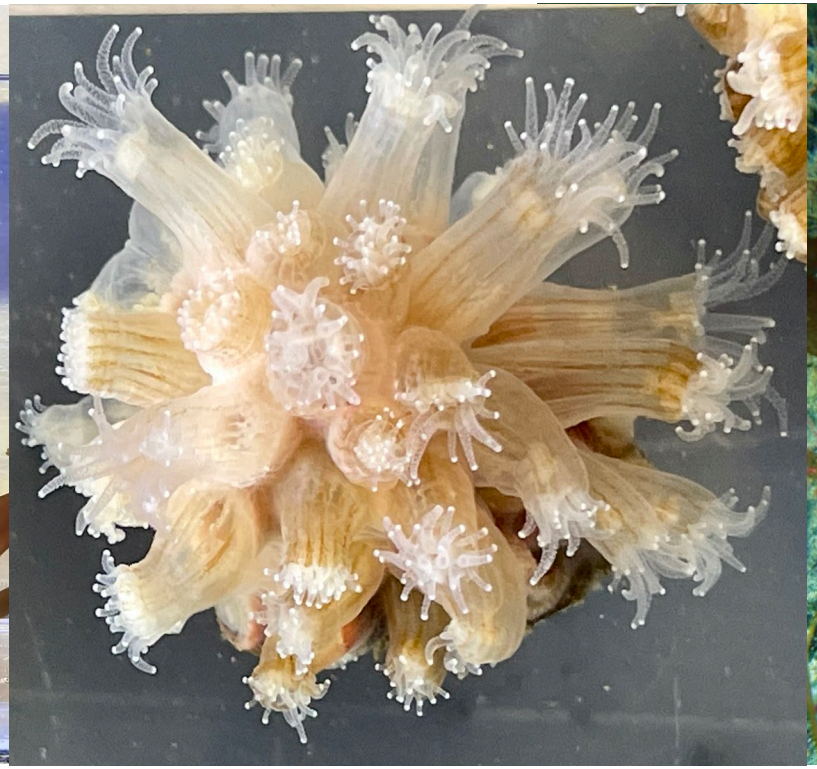
Seeded shells

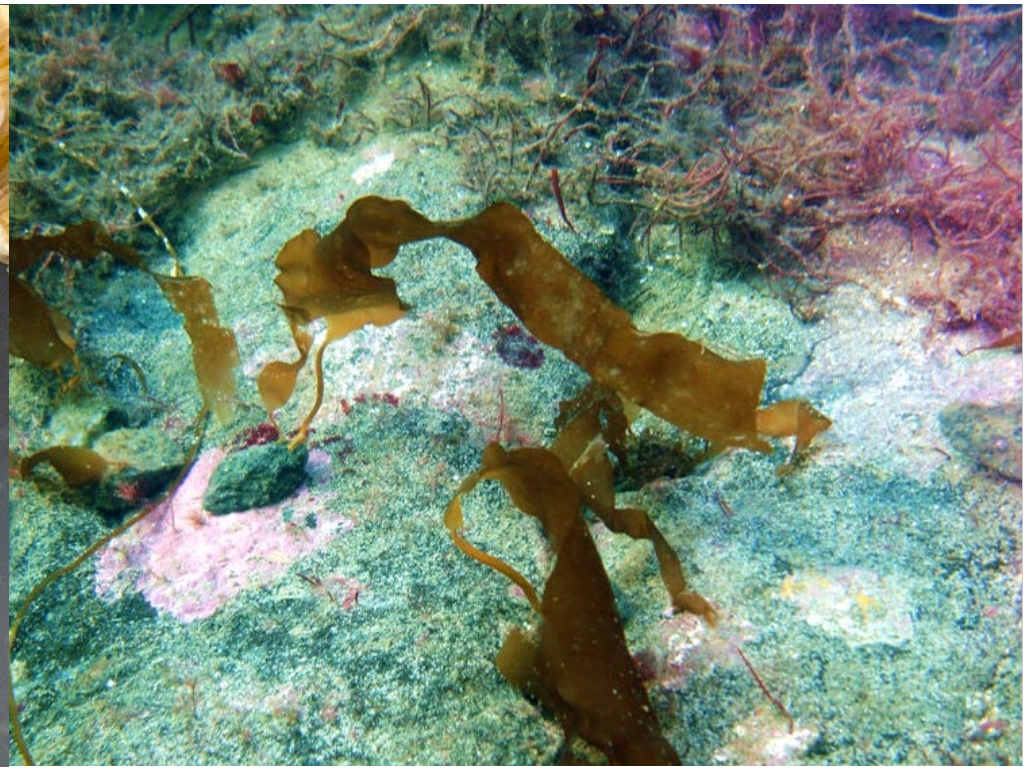
Kelp juveniles



Biological seeding

THE UNIVERSITY OF CHICAGO
MARINE BIOLOGICAL LABORATORY





Nursery pre-treatment

Field transplants

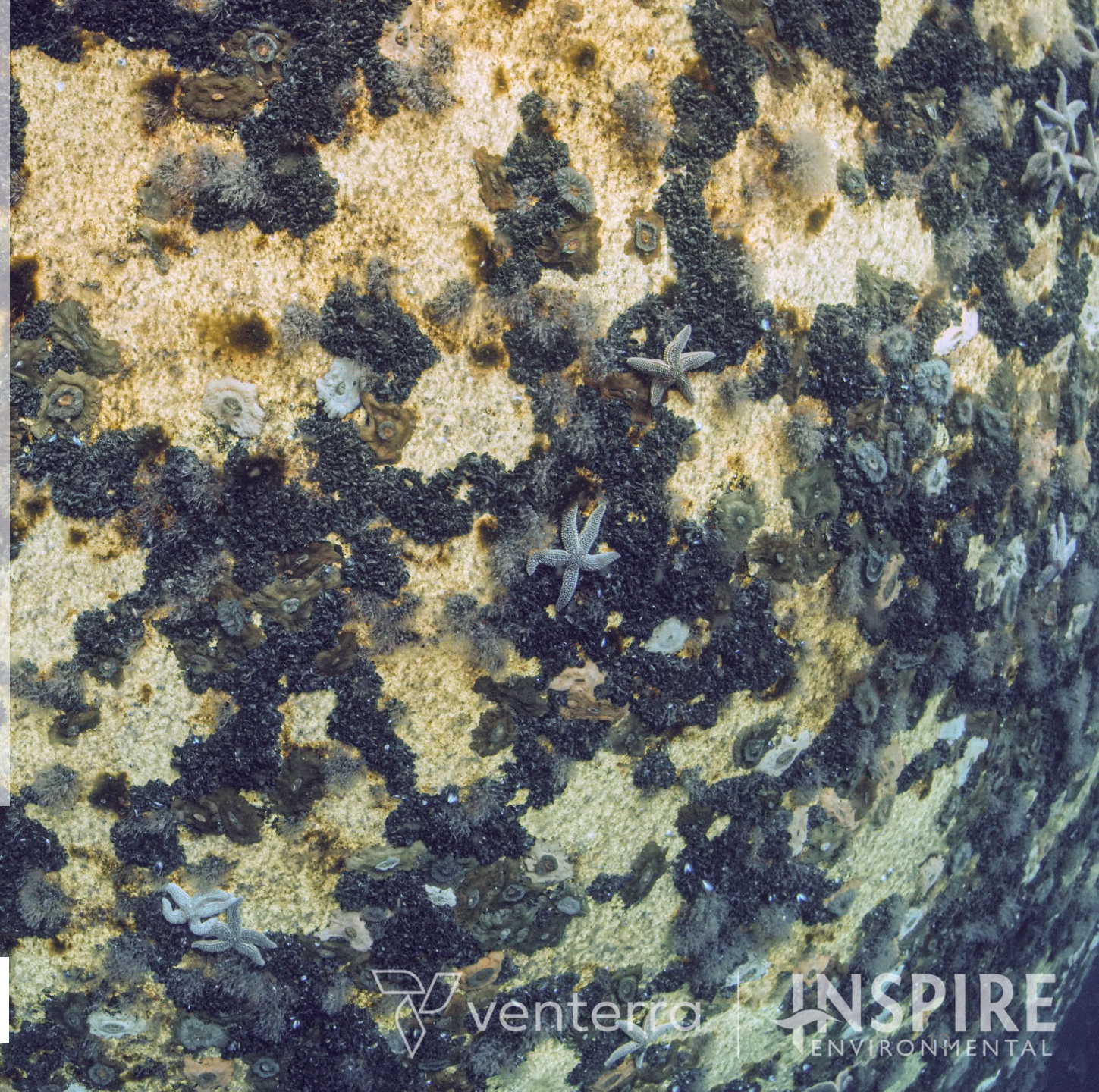
Beyond biodiversity, shifts in ecosystem function

Intentional engineering aimed at specific goals

Hypothesis-driven monitoring

Location matters

https://mocean.us/

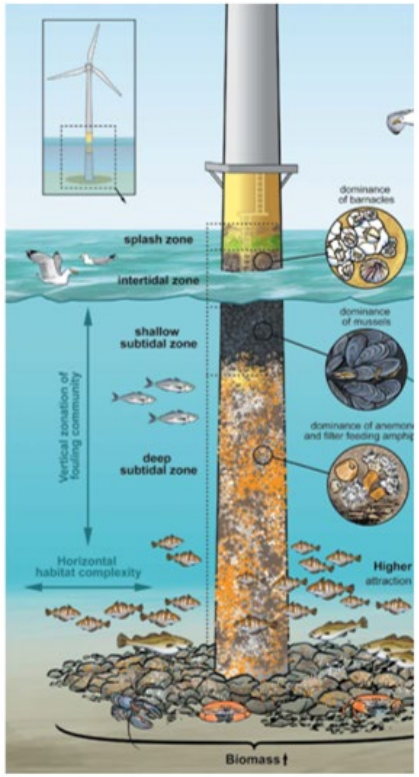


Takeaways from MOCEAN Workshop

Dan Kuchma, Tufts University
Fara Courtney, Outer Harbor Consulting

Motivation for the MOCEAN Initiative
MOCEAN's Mission
Workshop Agenda and Pictures
Restorative versus Creative Nature-Inclusive Design
NSF Regional Innovation Engine Project Goals
Assertations and Next Steps

The Netherlands – In Reviewing Offshore Wind Bids, 50% of Merit Points are for the "Effect on the Ecology"



Kavel (Site) VI , which is being developed by Ecowende (joint venture of Shell and Eneco), plan to make "positive contribution to biodiversity"….."accelerate the large-scale roll-out of offshore wind"….."Ecology will be leading because we know that renewable energy must become more sustainable"….. "ensure that the knowledge we gain from monitoring and research into the effect of the ecological measures is widely accessible"….. "Using innovative foundation techniques" ….."placing natural reef structures on the seabed to stimulate biodiversity".

Ørsted

Aims for net-positive biodiversity impact from new projects commissioned from 2030.

equinor

Implementing Equinor's Biodiversity Position: Operationalizing the Concept of Net Positive Impact in the Empire/Beacon Offshore Wind Projects

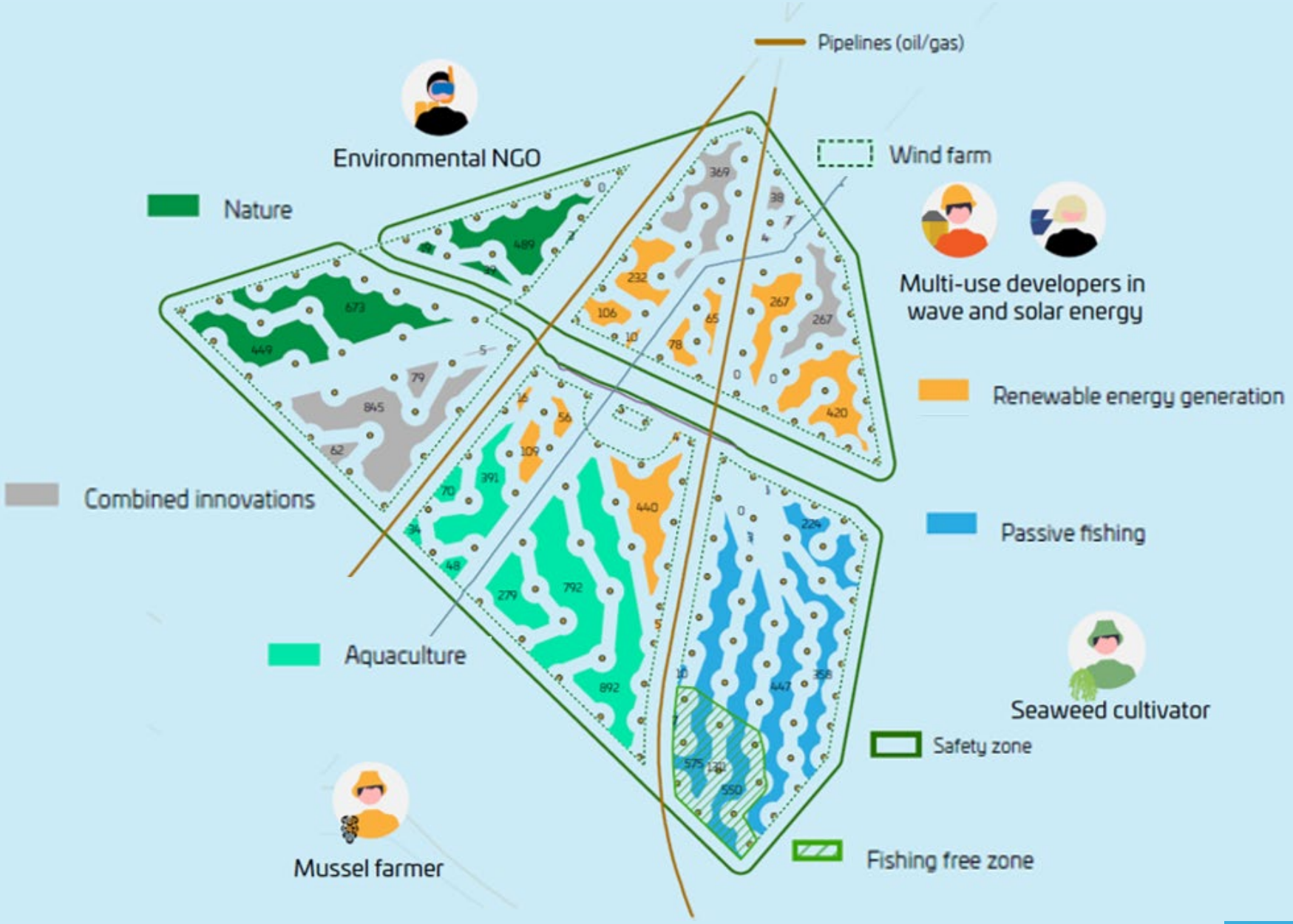
IBERDROLA

- **Scour protection** solutions for subsea infrastructure and cables that promotes marine biodiversity, seaweed planting.
- Modifications to **foundation design** to include 'space for nature', such as seal haul-out platforms, artificial reef structures, shellfish cages.
- Blue carbon capture initiatives **promoting ecosystem growth** and healthy marine habitats alongside offshore wind.
- **Sensing and monitoring** techniques and equipment that allow tracking changes in biodiversity and environment.

Netherlands Approach for Multi-Use Planning

Roadmap to Symbiosis-Inclusive Design (Road2SID):

How can we design and use offshore wind farms in such a way that they also function as food and energy plants and contribute to biodiversity restoration?



3D Printed Reefs at Anholt Wind Farm (Denmark)

mission is the

ocean

"Advance the Design and Use of Nature-Inclusive Underwater Infrastructure so that it provides Ecosystem Services that strengthen and restore Ocean Health, increase Desired Habitats, and provide significant Economic Opportunities driven by Community-Based Innovation"

MOCEAN Convening May 20-21, 2025

Joyce Cummings Center

Tufts UNIVERSITY

Day 1: Panels, Reception, Fireside Chat	
11:00 AM	Registration (and *lunch*)
12:30 PM	**Welcome and Call to Action**
1:30 PM	**Showcase of Pilot Projects**
3:00 PM	*Coffee break*
3:30 PM	**Policy Drivers Panel & Open Discussion**
5:00 PM – 7:00 PM	**Fireside Chat: Systems Thinking for a Disruptive Time** (and *reception*)

Day 2: Working Sessions & "Open Space"	
7:30 AM	*Light breakfast*
8:30 AM	**Overview of Breakout Working Sessions**
8:40 AM	**Breakout Working Sessions** re: February 2026 NSF deliverables 1. Advancing Nature -Enhancing Design & Ocean Science 2. Future Fisheries 3. Communicating the Case for Offshore Wind Energy and Nature -Enhancing Underwater Infrastructure
11:15 AM	*Lunch*
12:00 PM	**An "Open Space" Marketplace of Ideas**
3:30 PM – 4:00 PM	**Review of outcomes – final outputs to follow. Adjourn.**

Those who made it in Time for the Group Photo

Panel sessions, breakout and other discussions, and fireside chat

“Open Space” Activity

Nature-inclusive design trichotomy

Restorative NID

Measures to facilitate and speed-up nature restoration

Focus on naturally occurring ecosystem assets

“Eternal” effect envisaged

Gain of locally natural ecosystem assets

Creative NID

Optimizing infrastructure

Measures to boost biodiversity “beyond nature”

Focus on artificially created ecosystem assets

Temporary engagement

No gain nor loss of locally natural ecosystem assets*

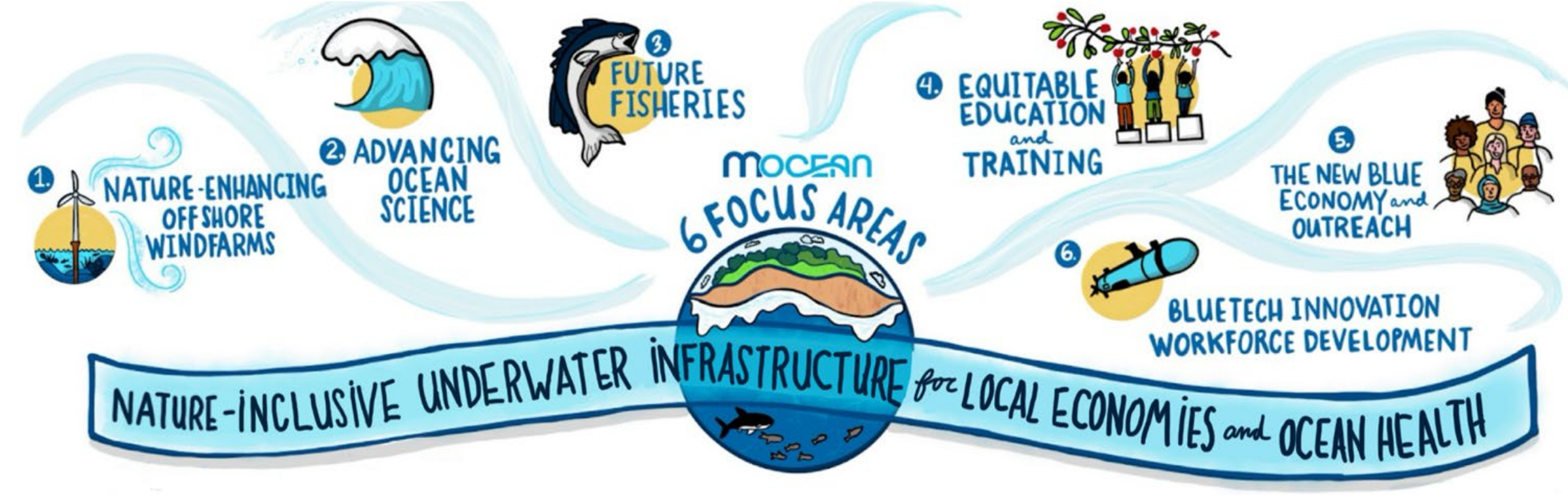
Add-on structures

Measures to boost biodiversity “beyond nature”

Focus on artificially created ecosystem assets

Temporary engagement

Loss of locally natural ecosystem assets



With support from an NSF Regional Innovation Engine Development Award, the 3 goals of MOCEAN are to: 1. Advance Policy and Regulatory Frameworks, 2. Create Innovation Ecosystems and Support Economic Development Initiatives, and 3. Create Testbed Frameworks and Initiate Pilot Projects.

Tufts

WOODS HOLE OCEANOGRAPHIC INSTITUTION 1930

RUTGERS

UMASS BOSTON

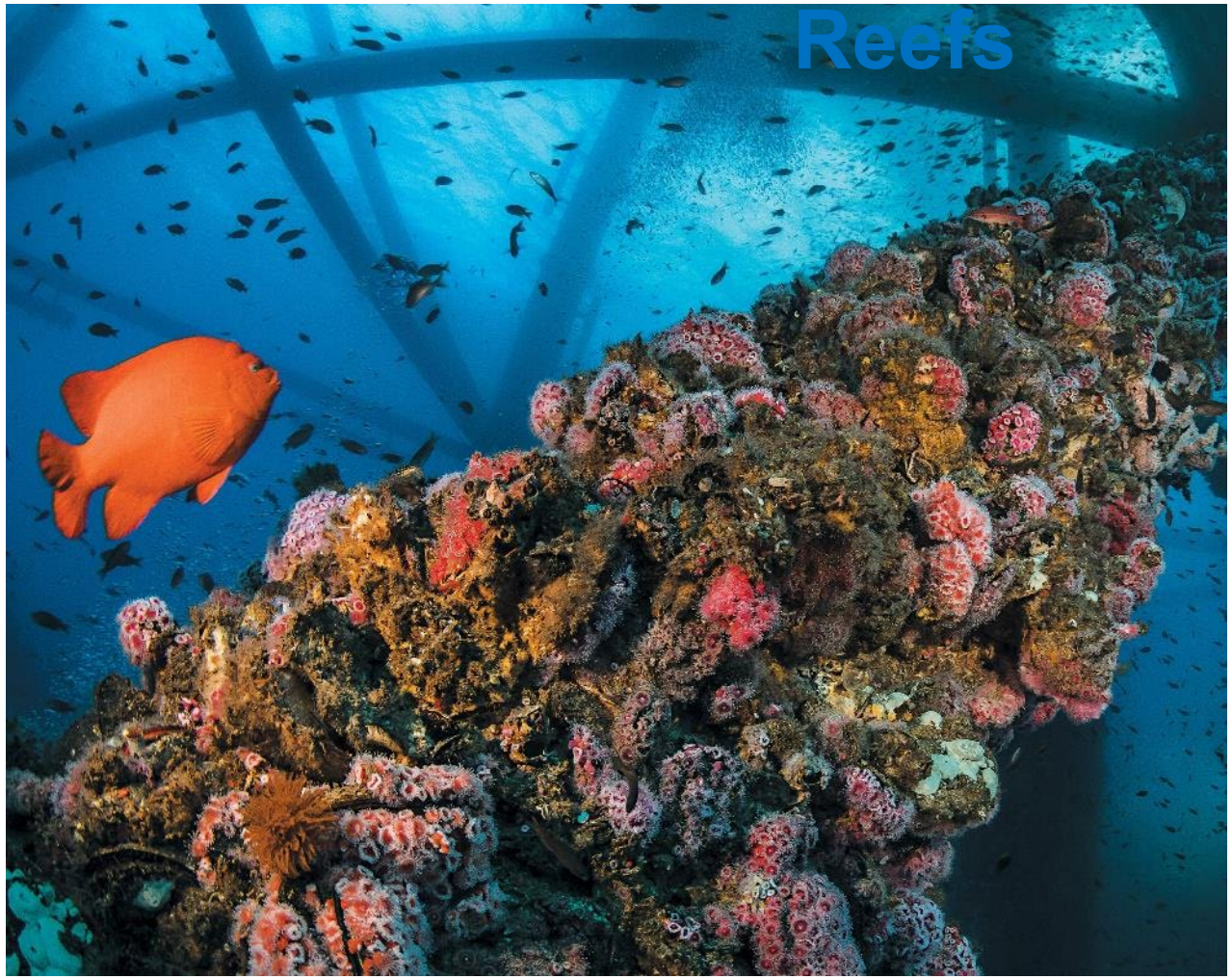
SeaAhead

New England Aquarium

Selected Assertions and Next Steps

- Underwater infrastructure can and should be designed to strengthen marine ecosystems.
- While those interested in the stewardship and use of oceans are motivated by many different considerations, they have a common interest in advancing nature-inclusive design (NID) solutions that serve the needs of all communities and the environment.
- Marine ecosystem are complex, and much learning is needed to determine how to advance NID in different environments to achieve specific objectives for nature, energy, and food.
- This learning can be achieved by adopting global best practices, and by creating a regional innovation ecosystem around NID that leverages the exceptional marine science assets, mechanisms for advancing innovation, and engaged and experience communities in our region.
- Public data that can advance scientific/engineering models and policy is key to effective NID.
- We should not wait for others to take the lead, and MOCEAN has created a community that could take on a number of key responsibilities.
- MOCEAN is looking at a number of models for its continued work after the NSF award ends in February 2026, including:

Unintended Artificial Reefs



U.S. Oil & Gas Platform

Belgium Concrete Gravity Base

ATLANTIC SURFCLAM FISHERIES

MITIGATION WORKSHOP

STOCK ENHANCEMENT AS A MITIGATION STRATEGY

November 20, 2024

Philadelphia, PA

SUMMARY REPORT

JANUARY 2025

Brought Together

- Surfclam Industry
- Federal Sector
- State Sector
- OSW Developers
- Research Sector

Workshop Goals

- Review Research and evidence for seeding viability
- Review standards & key elements
- Build a shared understanding of roles, authorities, and jurisdiction
- Explore stock enhancement mitigation and regional scaling
- Determine immediate, short term and long term actions

ROSA Responsible Offshore Science Alliance

ATLANTIC SHORES offshore wind

CBI CATALYZING COLLABORATION

MOCEAN

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

NEW YORK STATE

SUPPORTED BY NYSERDA New York State Energy Research and Development Authority

Special Initiative on Offshore Wind

Surfside Foods SEAFOOD PRODUCTS

Nature-Inclusive Design

Nature-based design (NBD):

- Focuses on using nature to solve problems or improve outcomes.
- Addresses human needs, such as flood control, water purification, or reducing urban heat islands.
- Broader category.

Nature-inclusive design (NID):

- Aims to create spaces/structures that are beneficial for both people and wildlife, often by integrating features that enhance biodiversity, improve habitat connectivity, and promote ecological function.
- NID can be seen as a subset of NBD that **specifically emphasizes the needs of non-human stakeholders.**

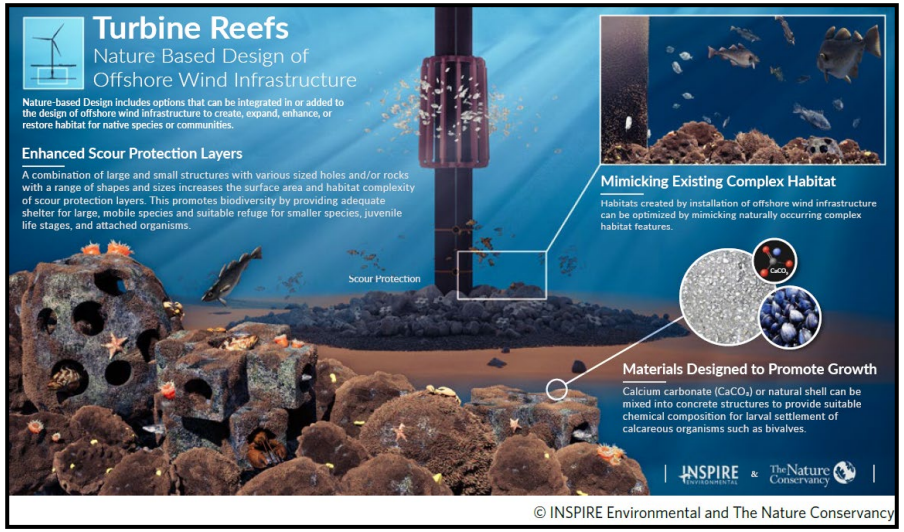
Mangrove planting on the coast of Ambon Island, Indonesia. Image by U.S. Department of State via Flickr (Public domain).

https://www.oneearth.org/six-projects-restoring-vital-mangrove-forests-around-the-world/

Hermans, A., O.G. Bos, and I. Prusina. 2020. (Technical Report). Nature-Inclusive Design: A Catalogue for Offshore Wind Infrastructure. Witteveen+Bos. Den Haag.

What is Nature-Inclusive Design in OSW Development?

- Changes to <u>hard structures</u> to increase habitat
- Includes: monopiles, converter stations, scour protection, cable protection
    - Structural enhancements to smooth surfaces
    - Engineered substrates to provide more habitat



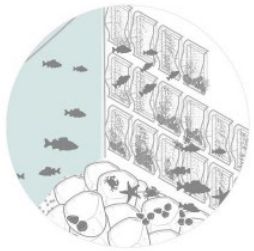
Nature-Inclusive Design in OSW Development in Belgium

Elia Energy Island

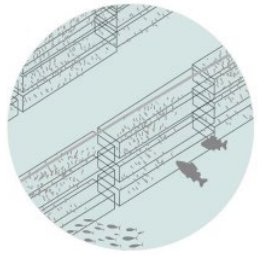
- Habitat for birds, oysters, other inverts, fish
- Also functions as scour protection

https://www.elia.be/en/press/2023/11/20231113_elia-takes-seven-measures-to-enhance-biodiversity-around-the-princess-elisabeth-island

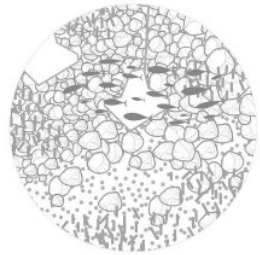
1. Storm wall with ledges for cliff-nesting birds



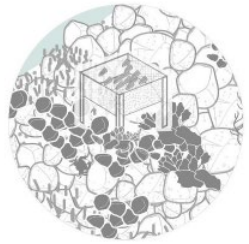
2. Relief panels



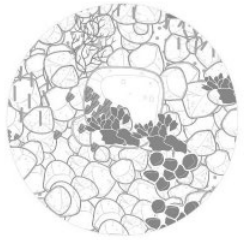
3. Longlines for European oysters



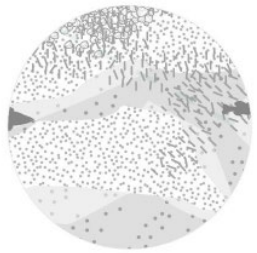
4. Chaotic scour protection with complex edges



5. Tables for European flat oysters



6. Boulders

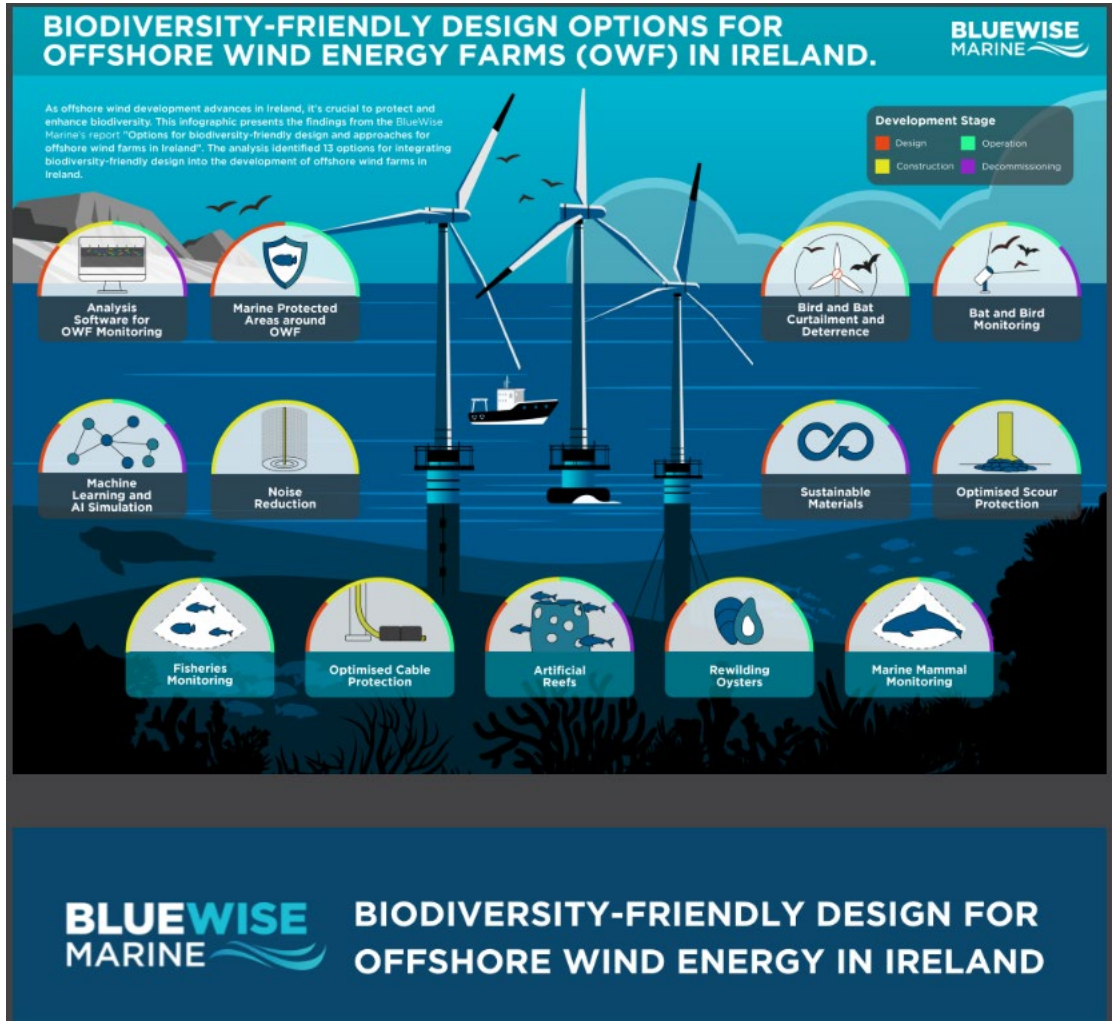


7. Gravel beds

Biodiversity-friendly Design in OSW Development in Ireland

"Biodiversity-friendly Design"

- Monitoring
- Deterrence
- Noise reduction
- Artificial reefs
- Oyster reefs
- "Optimized" scour protection



https://bluewisemarine.ie/making-offshore-wind-work-for-nature-and-climate-in-ireland/

Nature-Inclusive Design in OSW Development in US

A study conducted by Wageningen University & Research has revealed that artificial reefs installed within offshore wind farms are highly attractive to Atlantic cod, with the fish spending significant time around them. Published in the scientific journal *Royal Society Open Science*, the study offers key insights into whether marine species can benefit from the reintroduction of hard substrates, such as artificial reefs, in the North Sea's wind farms.

In 2020, four artificial reefs were installed within the Borssele 1&2 offshore wind farm. These structures, made up of 45 concrete tubes of varying sizes, were part of a long-term experiment. More than 60 cod were captured and fitted with acoustic transmitters near the reefs. In addition, 16 receivers were positioned around the reefs

Metal and concrete treatments
Cod tubes – Orsted in Europe
Beneficial colonization

The study results indicated that most of the tagged cod remained close to the reefs for extended periods. The fish also spent significant time hiding inside and around the concrete tubes, suggesting that these structures play a crucial role as both feeding grounds and shelters for the species.

ARTIFICIAL REEFS OUTPERFORM CONVENTIONAL EROSION PROTECTION

The research presents valuable insights into eco-friendly construction within offshore wind farms, specifically regarding habitat creation for North Sea species. The artificial reefs proved more attractive to cod than the conventional stone-based erosion protection surrounding the wind turbines. The larger openings of the concrete tubes offer better shelter for the fish. Interestingly, two of the artificial reefs were installed on a layer of stones, while the other two were placed directly on the sandy seabed, with both designs attracting cod equally.

REEFS: A PATH TO MARINE BIODIVERSITY RESTORATION?

Offshore wind farms can negatively affect marine ecosystems during construction and operation, due to factors like underwater noise and habitat degradation. However, **Benoit Bergès,** lead researcher and marine biologist at Wageningen Marine Research, sees potential for positive contributions through habitat creation. "I'm looking forward to further exploring the availability of food and energy consumption of fish around artificial reefs and determining if these structures actually enhance fish reproduction and contribute to larger population growth," Bergès noted.

After the completion of Borssele 1&2 in 2020, Ørsted and Wageningen University & Research launched a monitoring program in 2021 and 2022 to observe how Atlantic cod interacted with the artificial reefs. The study focused on assessing the use of these reef structures by cod and how they impacted the species' behavior in the wind farm environment.

Table 3. Summary of Nature-Based Design Options Identified from U.S. Suppliers

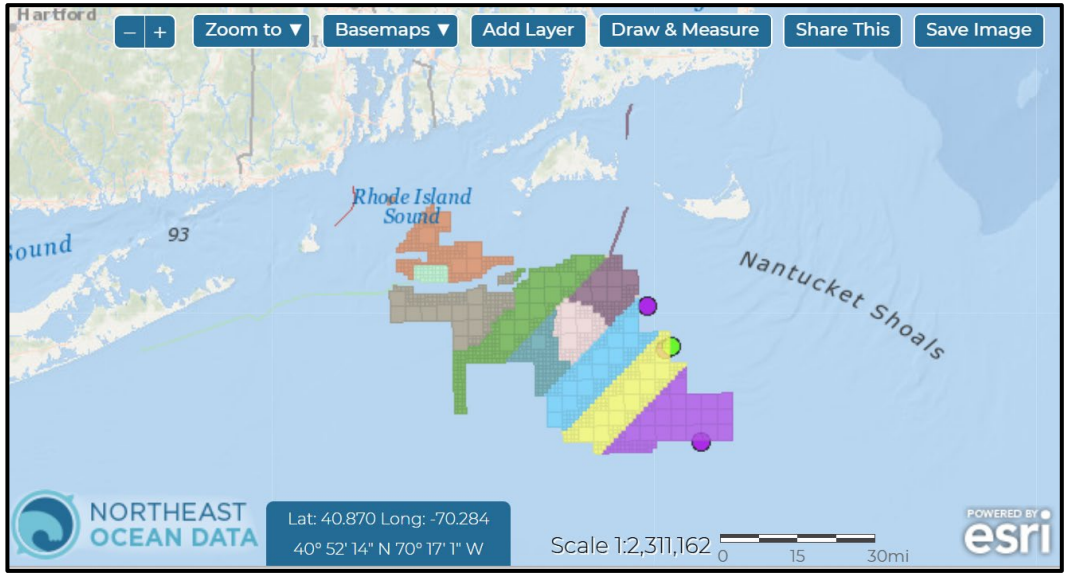
NBD Product	Product Use	Supplier	Location
Wind Turbine Scour Protection Unit	Scour material	ECOncrete® USA	NY
Recycled Concrete	Scour material	Janus Materials	SC
Reef Cells	Scour enhancement	Reef Cells	FL
Reef Balls®	Scour enhancement	Reef Innovations, Roman Stone Construction Co.	FL
Layer Cakes®	Scour enhancement	Reef Innovations	FL
Cube Reefs	Scour enhancement	Reef Innovations	FL
ECO Mats®	Cable protection layer	ECOncrete® USA	NY
Fleximats®	Cable protection layer	Roman Stone Construction Co.	NY

Turbine Reefs: Nature-Based Designs for Augmenting Offshore Wind Structures in the United States. Technical Report 2021. TNC /Inspire.

New England Shelf Hydrogeology Project - Expedition 501

ECORD Science Operator

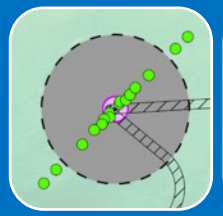
- European Consortium for Ocean Research Drilling (ECORD)
- Began on May 19th via Lift Boat *Robert*
- Currently at MV03 (green dot – in SouthCoast)
- Have drilled to 393 m below seafloor
- Many cores removed
- Water chemistry, sedimentology, microbiology. micropaleontology
- Have had some challenges with glauconite
- 2-month study



South Fork Wind Benthic Story Map

Annie Murphy and Lianne Allen-Jacobson
INSPIRE Environmental
annie@inspireenvironmental.com
lianne@inspireenvironmental.com

Key Takeaways



South Fork Wind (SFW) has invested in a comprehensive benthic (seafloor) monitoring program that includes targeted studies that span pre-construction, construction, and post-construction time periods.

These SFW benthic surveys have not detected demonstrable changes in the biological communities or benthic functions associated with a) soft sediments surrounding offshore wind structures, b) soft sediments along the export cable, or c) boulders relocated during seafloor preparation.

Wind farms add new structure to the marine environment, which can act as artificial reefs and provide habitat for valuable marine resources. These SFW benthic surveys document the marine life living on and near this infrastructure, which conforms to expectations based on other studies on new structures (e.g., offshore energy projects, artificial reefs).

Comprehensive monitoring requirements aim to protect the valuable marine resources found in offshore habitats. Preliminary results provide promising support for the hypothesis that these projects will have minimal environmental impact, based on the first surveys at SFW

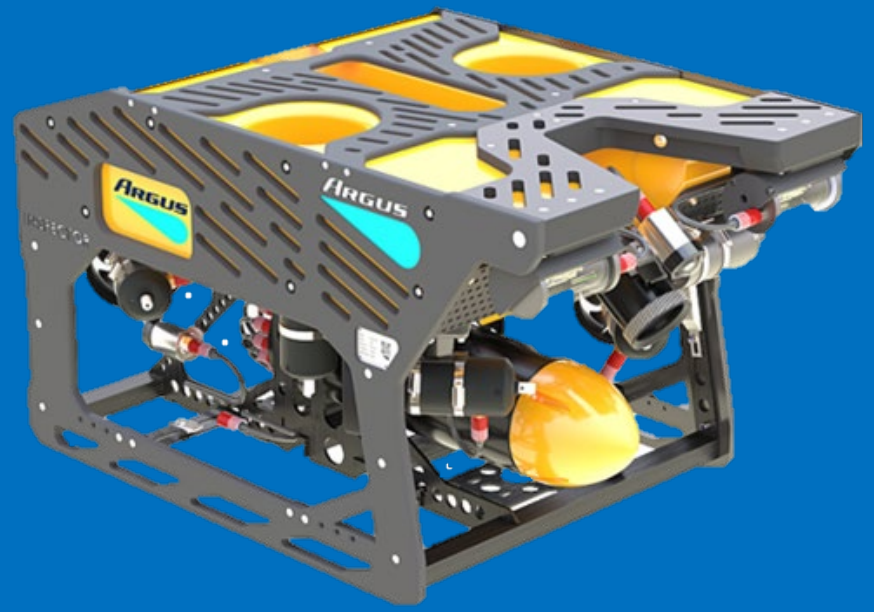
Hypotheses

H1	Epifauna will grow on introduced structures
H2	Structure-associated taxa will enrich the surrounding habitat, which will result in accumulation of finer sediments and organic matter.
H3	Any disruption to the function of infaunal communities by cable installation will be temporary.
H4	Boulder relocation will result in limited effects on the organisms that live on rocks and boulders.

Benthic Monitoring Methodology

Sediment Profile and Plan View Imagery

ROV-based video and still imagery



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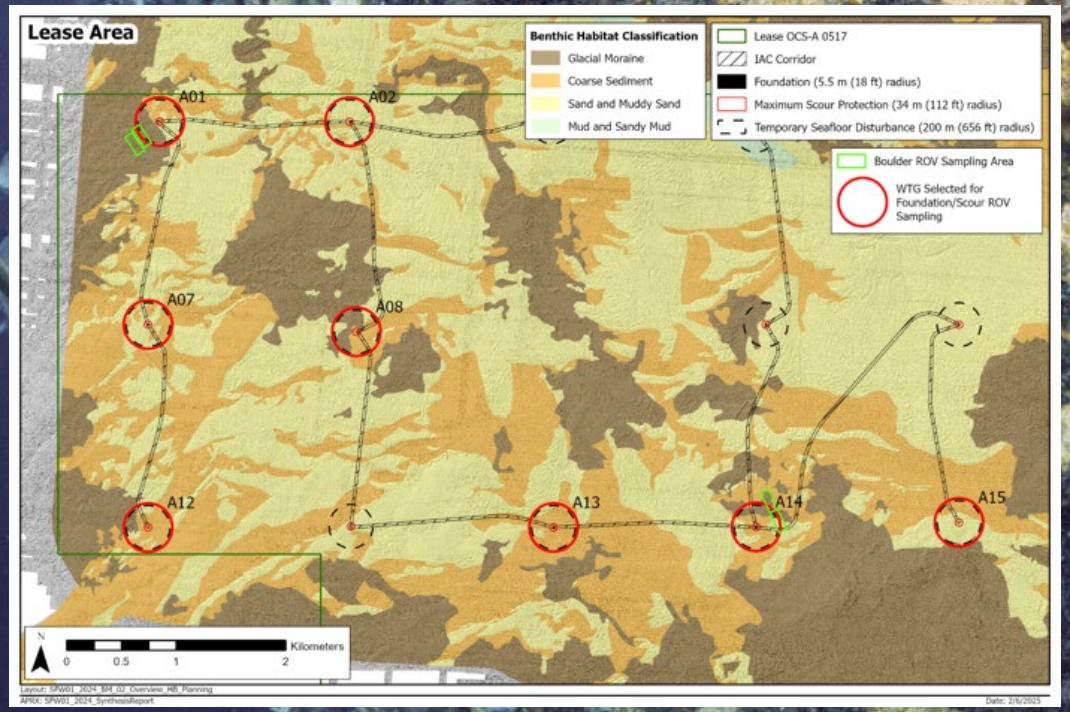
Novel Hard Habitat

ROV surveys (2023, 2024) have documented community succession of epifauna growing on monopile surfaces; increased diversity and abundance of attached organisms over time with water depth important in structuring the communities

HI



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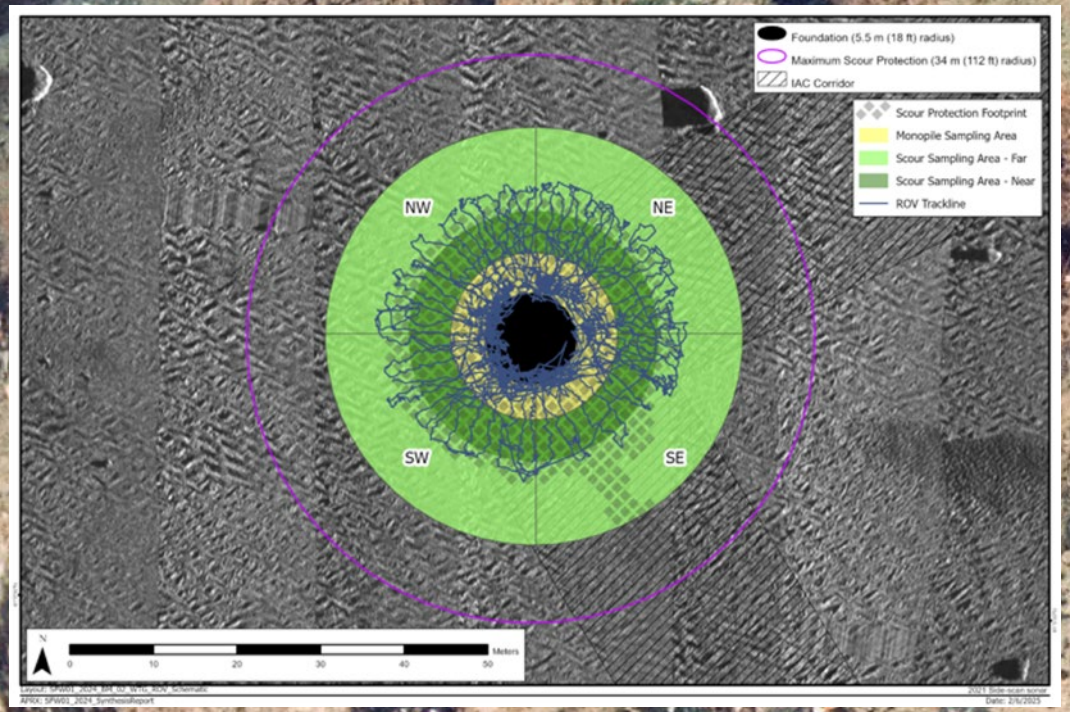

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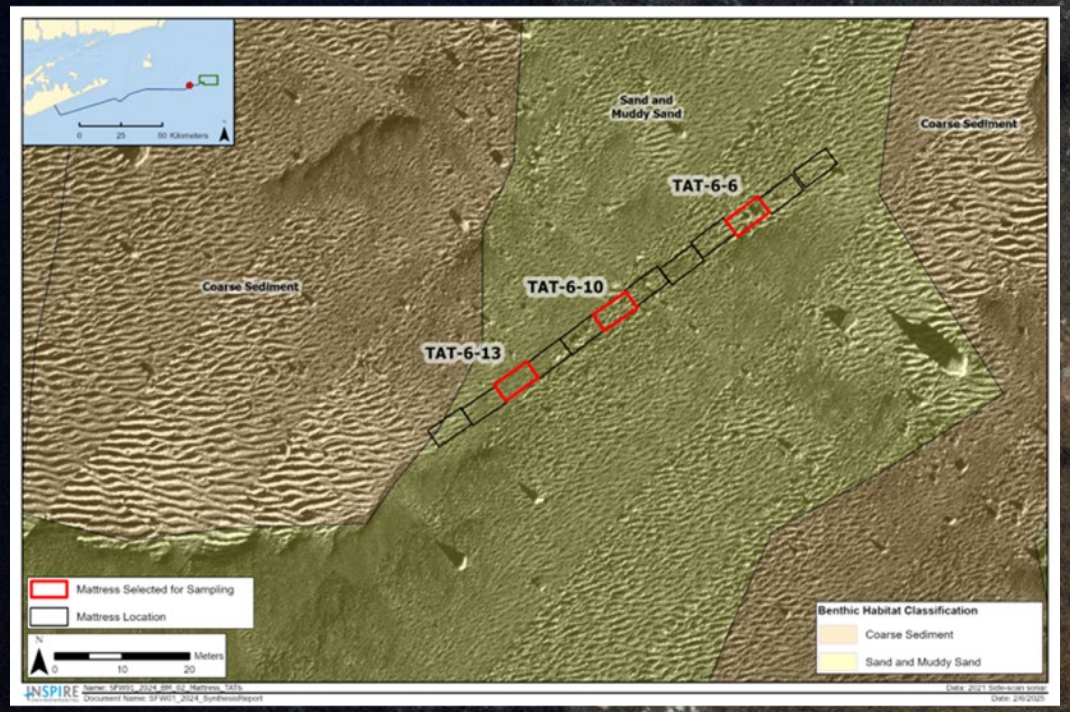
Novel Hard Habitat

ROV surveys (2023, 2024) have documented community succession of epifauna growing on cable mattresses; increased diversity and abundance of attached organisms over time, with species patterns dependent on location



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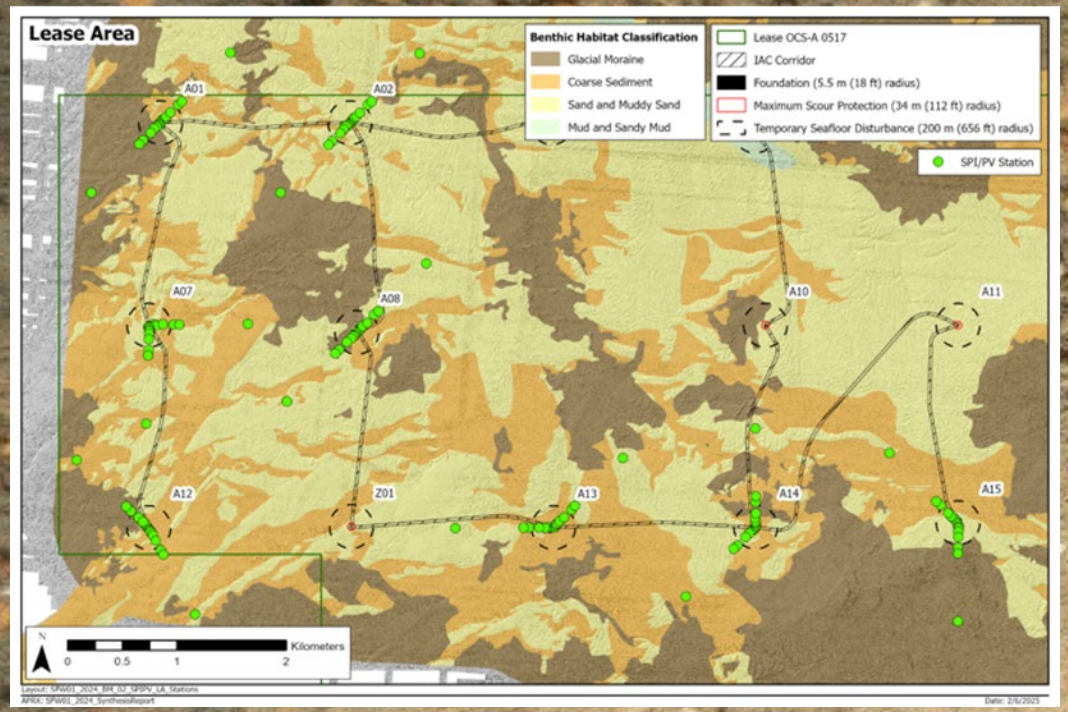
Adjacent Benthic Habitats

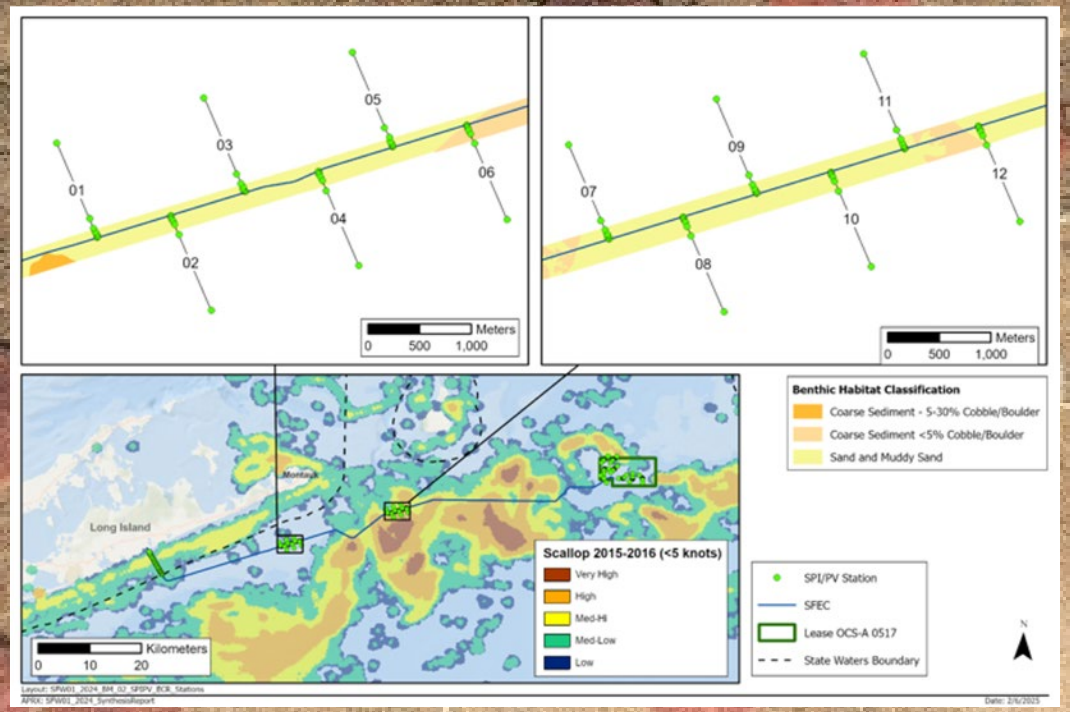
SPI/PV surveys (2022, 2024) have found no demonstrable changes to the benthic function of the seafloor adjacent to the foundations

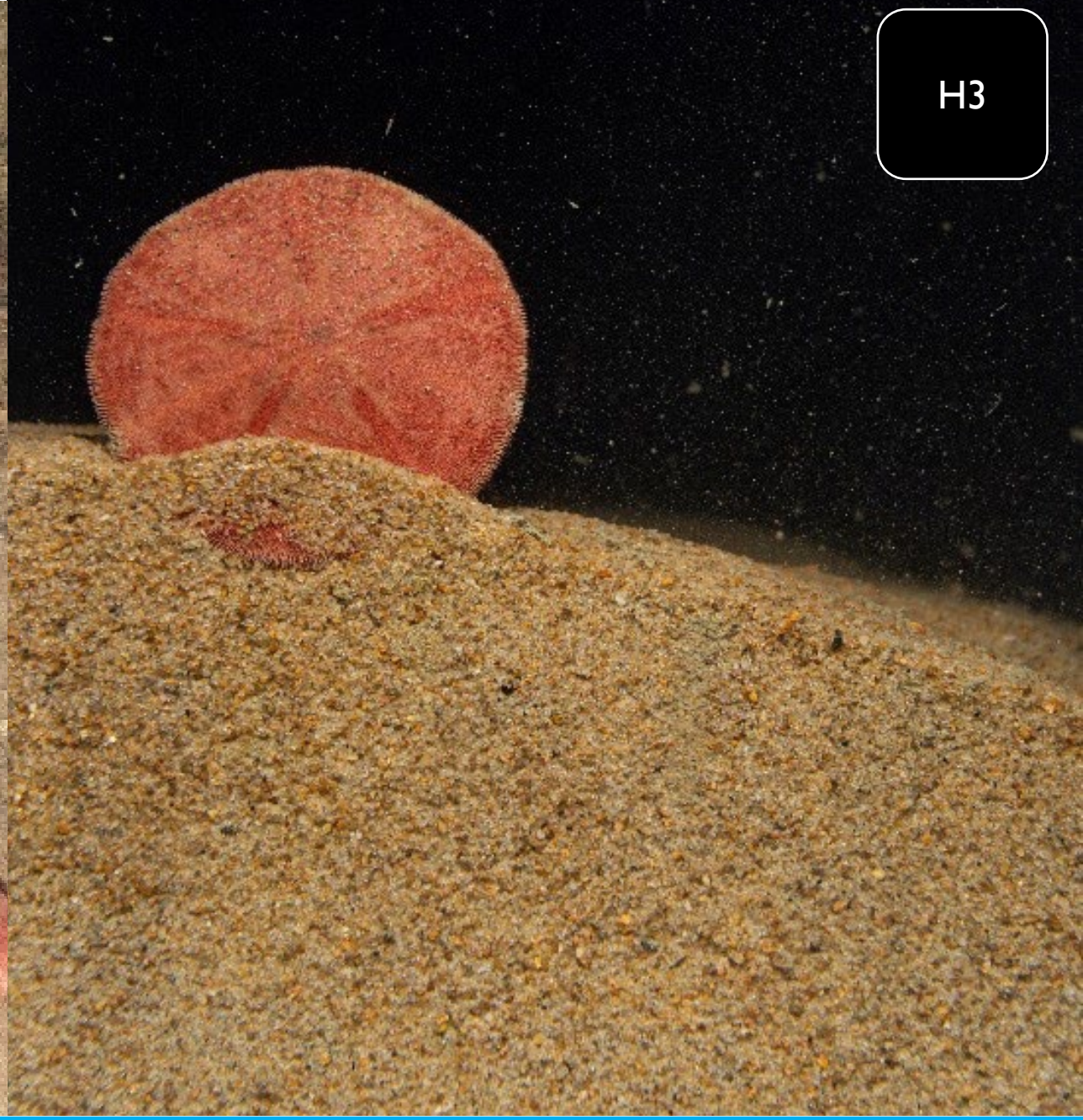


H2

Adjacent Benthic Habitats

SPI/PV surveys (2017, 2024) have found no demonstrable changes to the benthic function of the seafloor adjacent to the export cable





H3

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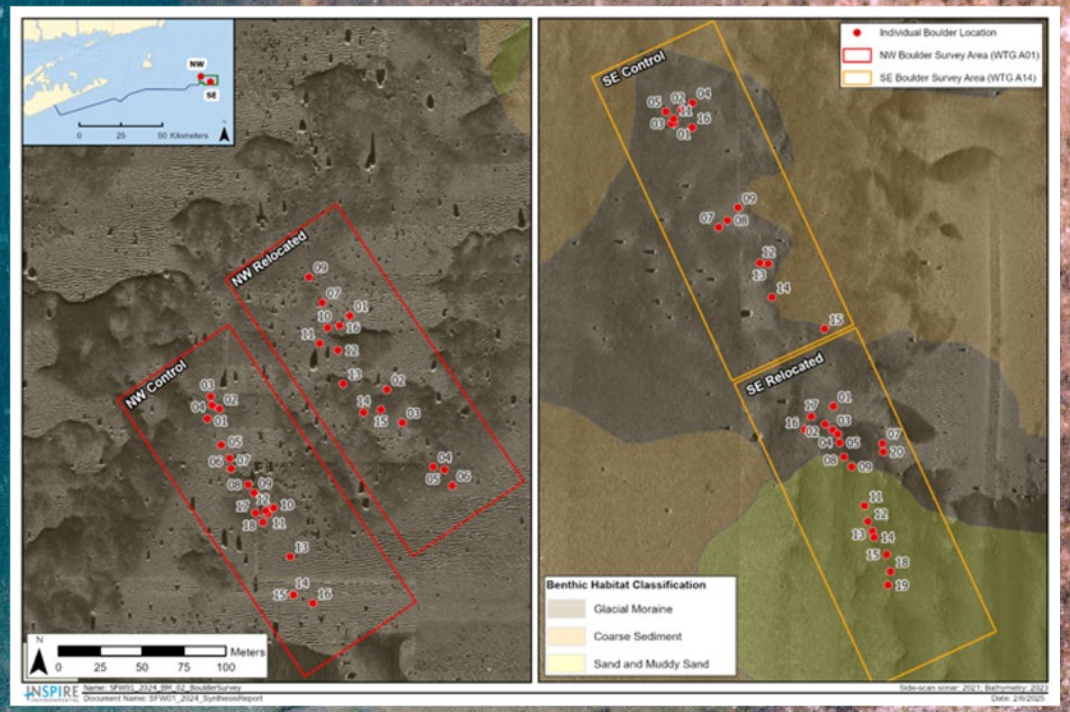
Native Hard Habitat boulders

ROV surveys (2023, 2024) have found no demonstrable changes to the biological communities associated with the relocated boulders over time and compared with nearby non-relocated boulders

H4



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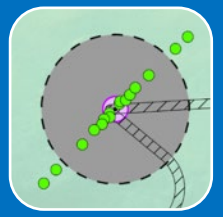
South Fork Wind Storymap



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RWSC
Regional Wildlife Science Collaborative

RWSC Update

Massachusetts Habitat Working Group
June 18, 2025

Emily Shumchenia, PhD
RWSC Director

Tools to coordinate research & track data

https://rwsc.org/research-data

- Science Plan
- Research Database
- Research Planning Map
- Data policies, contract language, recommended repositories, recommended data management practices

- RWSC also supports funders by contributing to RFP development and proposal review/selection

Funding to be or being allocated 2025-2026:

- POWERON
- Projects selected by MassCEC
- New Jersey RMI
- Empire Wind 1 and Sunrise Wind regional monitoring (ROSA & RWSC)
- Maine Offshore Wind Research Consortium
- Research funded voluntarily by companies

Still talking about >$20M across all of these

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Regional Wildlife Science Collaborative

2025-2026 Key Areas of Focus

Steering Committee

Competitively select, oversee, and report to funders and the public on regional research projects that:

- Update analysis of seabird to displacement and collision and start power analysis to inform regional scale displacement studies (Empire Wind 1)
- Determine/characterize potential effects of offshore structures on oceanographic/hydrodynamic processes and marine ecology (Empire Wind 1)
- Determine/characterize any changes in baleen whale distributions and/or acoustic behavior across the Atlantic OCS and whether this change was due to offshore wind development (POWERON)

Sector Caucuses

- Assist with identifying funds and developing funding plans for research and data collection activities recommended in the Science Plan, with a specific focus on:
  - Bird and bat tracking
  - Acoustic telemetry
  - Glider deployments
- Ensure that efforts funded by each Caucus entity are represented in RWSC Research Database

Subcommittees

- Track Science Plan progress, ongoing research/data collection, including RWSC-funded projects - provide feedback on project plans as needed
- Finalize an assessment of data repositories and recommendations for enhancing wildlife/environment data workflows

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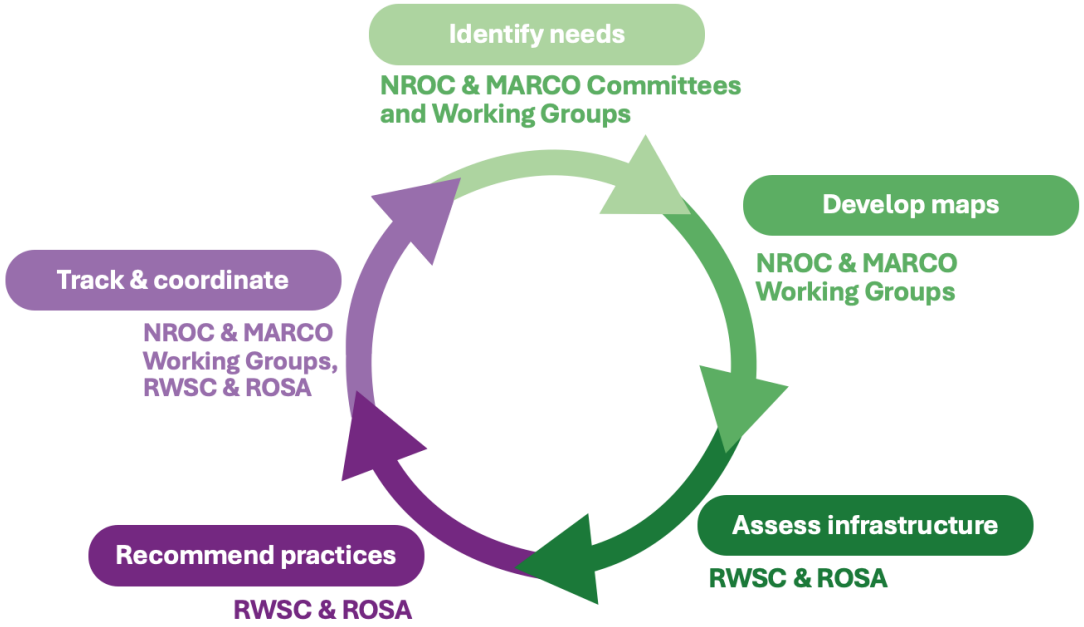
Data reliability for business, government, and research decisions - *Another example of collaborative funding*



- NROC and MARCO convene policy working groups that are discussing many applications of ocean data in planning and decision making (maritime, energy, minerals, cables)
- ROSA & RWSC Data Governance – we each participate in each other's groups
- NROC, MARCO, RWSC, ROSA working together
  - Understand, find, catalog existing data
  - Support streamlined data management and access
  - Support development of Data Catalog
  - Identify locations where more data collection is needed
  - Identify vulnerabilities in data management systems and where additional funding/capacity are needed

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U.S Environmental Data Sharing Strategy Workshop

— *hosted by Oceantic & NREL, June 11-12, 2025 in Washington DC*

- RWSC participated in workshop planning; provided foundational presentation “Current state of environmental data sharing”; led breakout group discussions
- ~50 in-person and ~35 virtual participants from offshore wind companies, agencies, consultants
- Goal to inform “Data Sharing Action Plan” that NREL will deliver to BOEM
  - Environmental data collected offshore
  - Standardize workflows for making data available to the public at the appropriate time and in the needed formats
  - Anticipated draft in September 2025
  - Will seek extensive partner review

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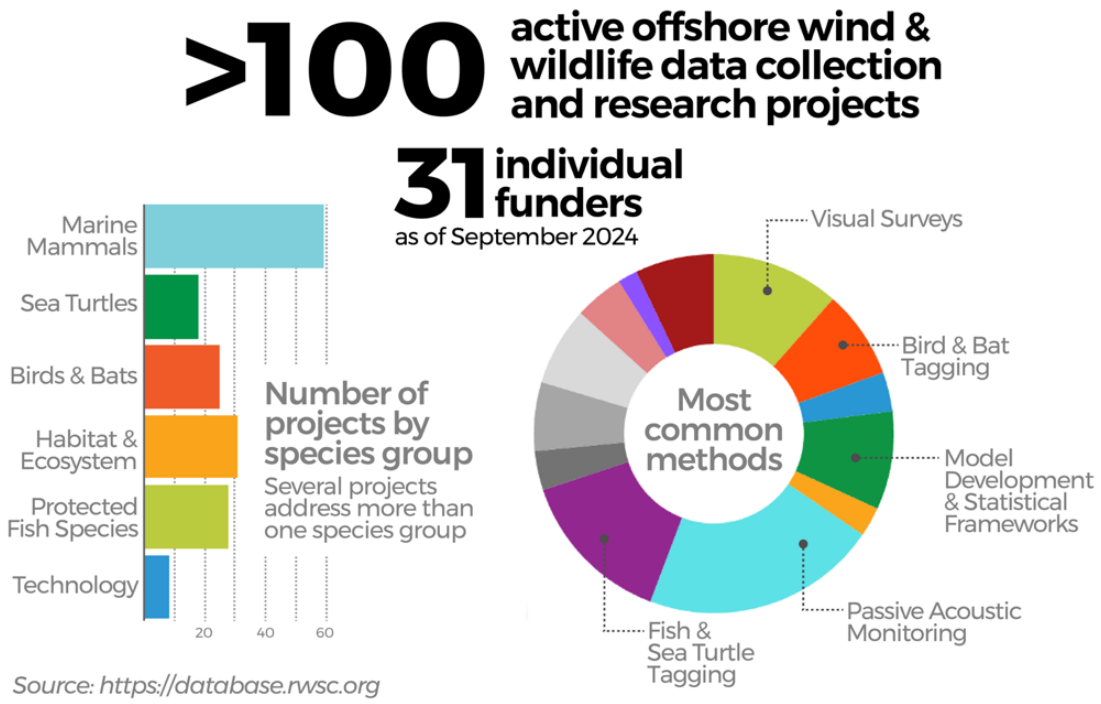
RWSC Sector Caucuses' Annual Research Funding Strategy Meeting - September 2025



- RWSC synthesis of ongoing and planned data collection and research (including RWSC-funded efforts)
- Funding coordination lessons learned in 2025
- Upcoming RFPs – funders invited to share
- Research funding coordination priorities in 2026
  - Bird and bat tracking
  - Acoustic telemetry
  - Glider deployments

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How to receive updates

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All RWSC Subcommittee meetings are open to the public: visit https://rwsc.org/events

Monthly e-newsletter: meeting invites and other news

Contact information

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Avalon Bristow, MARCO Executive Director
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Nick Napoli, NROC Executive Director, MARCO Senior Advisor
nnapoli@northeastoceancouncil.org

USGS
science for a changing world

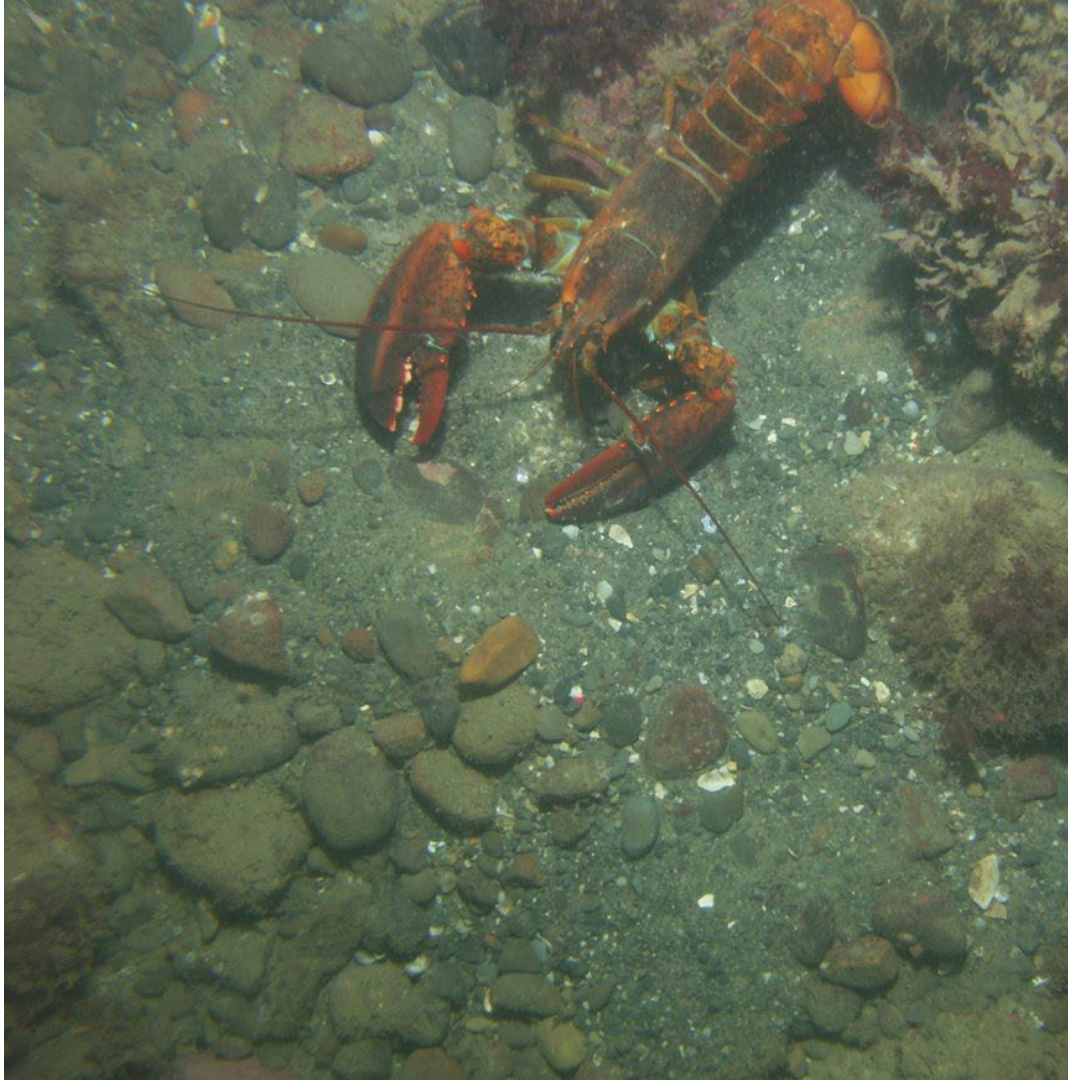
What's shake'n in the Gulf of Maine: Capabilities in development and imminent products from the USGS

Laura Brothers

BOEM
BUREAU OF OCEAN ENERGY MANAGEMENT

BSEE

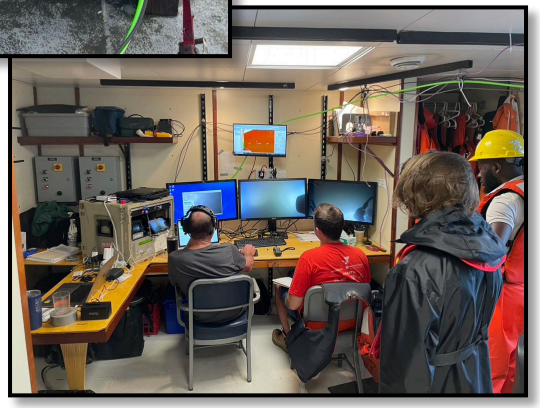
U.S. Department of the Interior
U.S. Geological Survey



I. Developing Capabilities —Deep(er) Water Sampling

SEABOSS

Rugged Unit that collects seafloor imagery and coincident grab samples



Good to 60 meters water depth

USGS

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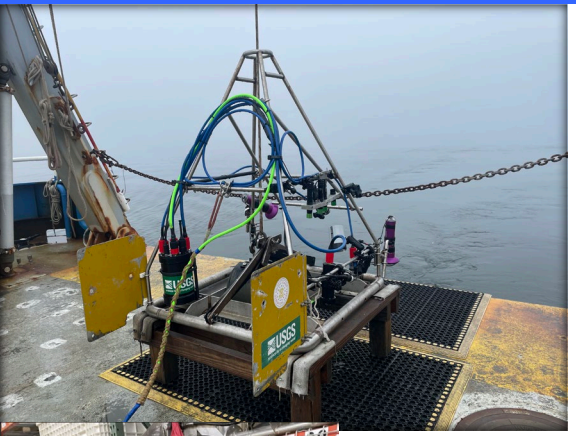

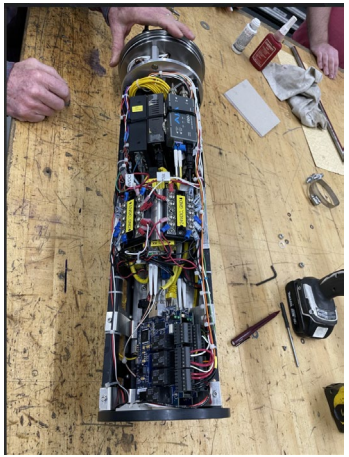

Super SEABOSS

Rugged Unit that collects seafloor imagery and coincident grab samples

Good to *500* meters water depth

Will be able to sample Gulf of Maine basins and deeper shelf/shelf-edge environments

USGS

Bench Testing Now, Field Test 2026; ETA 2026

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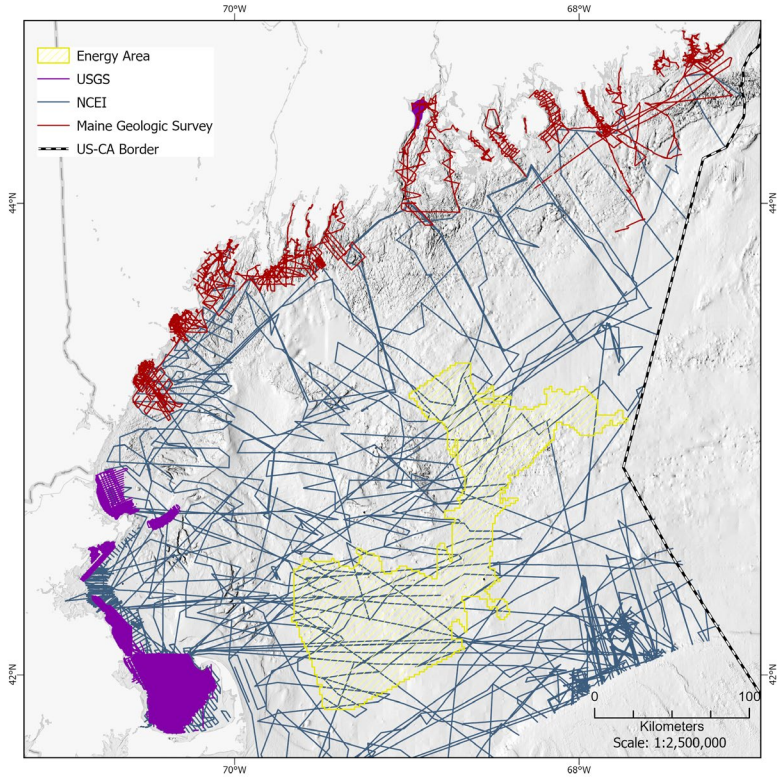
II. Imminent Products—GoME Data Inventory Report

Reviews the geologic framework of the Gulf of Maine and available hydrographic, geophysical and sampling data within the Gulf

Identifies data gaps—there are many!

Uses these data to characterize habitat

A great place to start for a desktop study/future data collection efforts!



USGS

ETA Summer 2025

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II. Imminent Products—Seabed Hazard GeoPackage

Seafloor Hazards for Offshore Infrastructure:
Some Examples →Boulders, Mobile Seabed, Gas, Glauconite, UXO, and many others

Reviewed studies conducted along the US Atlantic and Pacific continental shelves

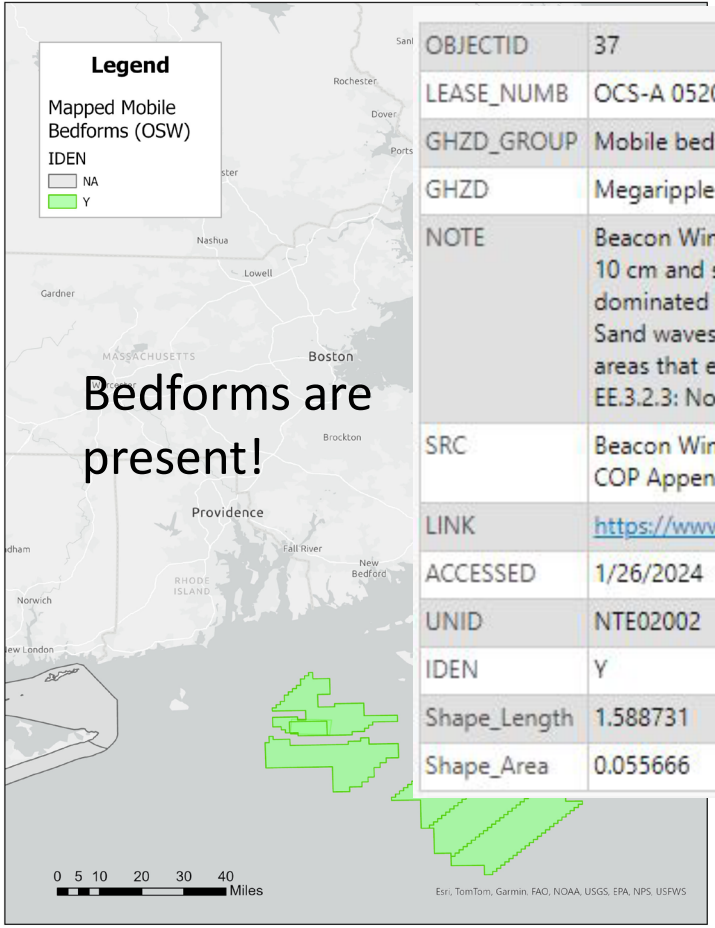
- Developer Studies--Non-proprietary portions of the documents submitted by OSW developers submitted as part of the regulatory process
- Trusted Datasets – 170+ publicly available studies from US gov, universities, States, etc.

USGS

ETA Geopackage July 2025,
Associated Report Fall 2025

BSEE

III. Results: Presence/Absence/Not Available of Mobile Seabed



OBJECTID	37
LEASE_NUMB	OCS-A 0520
GHZD_GROUP	Mobile bedforms
GHZD	Megaripples
NOTE	Beacon Wind COP Appendix EE.2.2.1: Defines dunes and sand waves as bedforms with wave heights of greater than 10 cm and spacings of more than 1 m. The composition of bedforms within the Atlantic OCS bedforms is dominated by fluvial-contributed sediments, with few outcroppings of bedrock limited to the northern Atlantic OCS. Sand waves and other bedform features are frequently formed along the OCS seafloor, especially in straits and areas that experience high-velocity currents (both sustained and tidally-reversing). Beacon Wind COP Appendix EE.3.2.3: No discrete bedform features with a height greater than 0.9 m were identified within the Lease Area.
SRC	Beacon Wind COP Appendix EE - Potential Scour Analysis Section EE.2.2.1: Sand Waves in the OCS, Beacon Wind COP Appendix EE - Potential Scour Analysis Section EE.3.2.3: Localized Bedform Feature Assessment
LINK	https://www.boem.gov/renewable-energy/state-activities/beacon-wind-appendix-ee-scour-analysis
ACCESSED	1/26/2024
UNID	NTE02002
IDEN	Y
Shape_Length	1.588731
Shape_Area	0.055666

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