Learning from the Experts Webinar Series

Benthic Habitat Research for Offshore Wind

Dr. Annie Murphy
Principal Scientist
INSPIRE Environmental

July 30, 2025

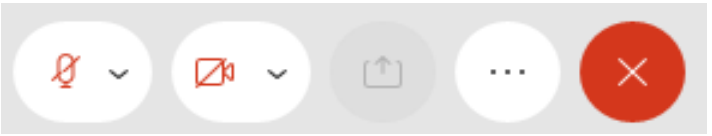
Meeting Procedures

Webinar recordings and presentations will be available at:

www.nyserda.ny.gov/osw-webinar-series

Participation for Members of the Public:

> Members of the public will be muted upon entry.



You'll see  **when your microphone is muted**

> Questions and comments may be submitted through the Slido Q&A feature at any time during the webinar.

> If technical problems arise, please contact Ayla.Morwin@nyserda.ny.gov

Learning from the Experts

This webinar series is hosted by NYSERDA's offshore wind team and features experts in offshore wind technologies, development practices, and related research.

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The views and opinions expressed in this presentation are those of the presenter and do not represent the views or opinions of NYSERDA or New York State.

NEW YORK STATE | NYSERDA

Benthic Research and Offshore Wind

NYSERDA Webinar

July 30, 2025

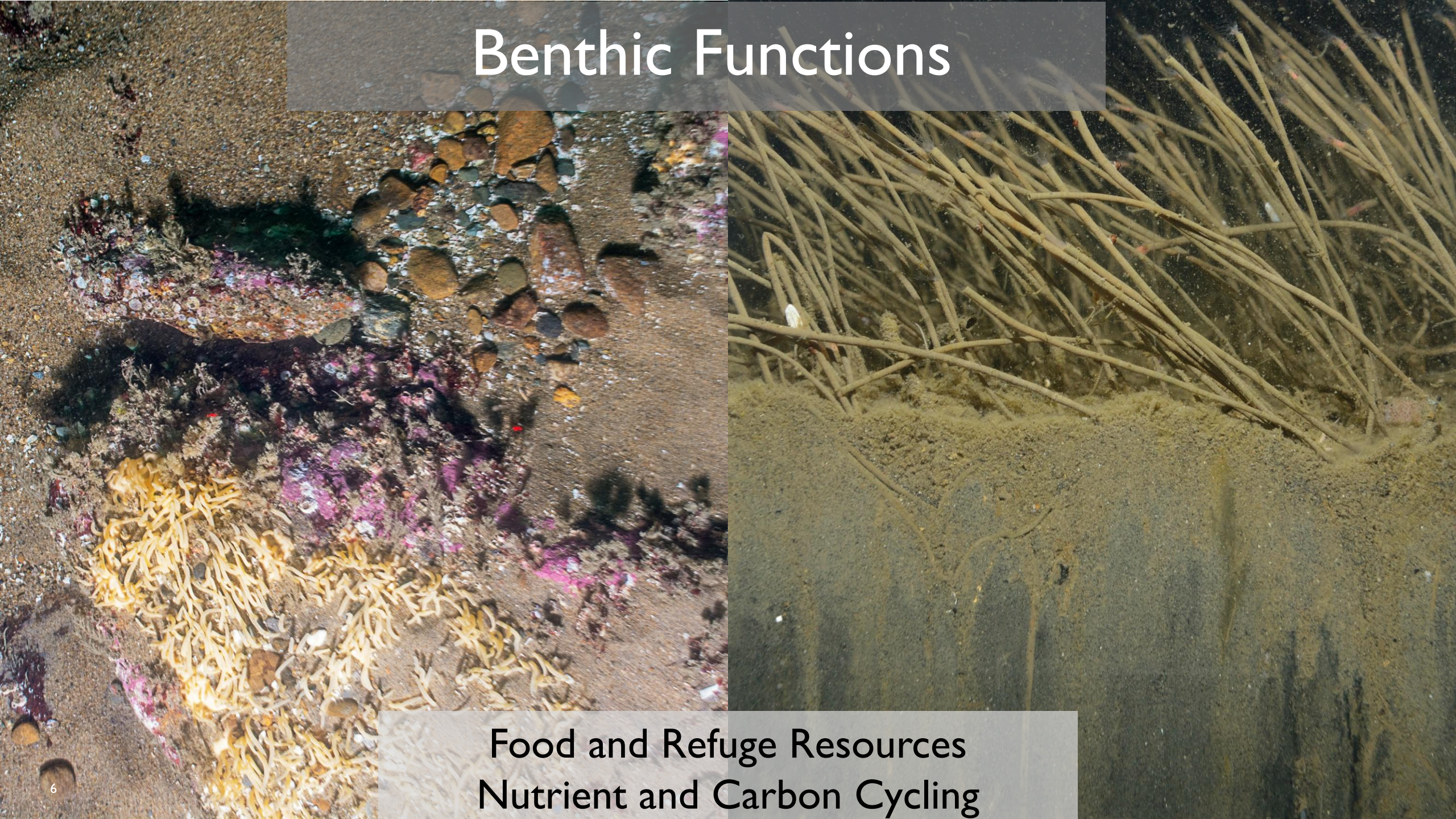
Annie Murphy

Annie.murphy@venterra-group.com

Overview

- Benthic Habitats and Functions off the coast of US northeast
- Overview of environmental permitting and siting for US OSW
- Benthic Habitat Mapping to inform decisions
- Ecological Monitoring Case Studies
  - Block Island Wind Farm
  - Coastal Virginia Offshore Wind
  - South Fork Wind Farm
- Intentional Engineering to Promote Valuable Functions

Benthic Functions



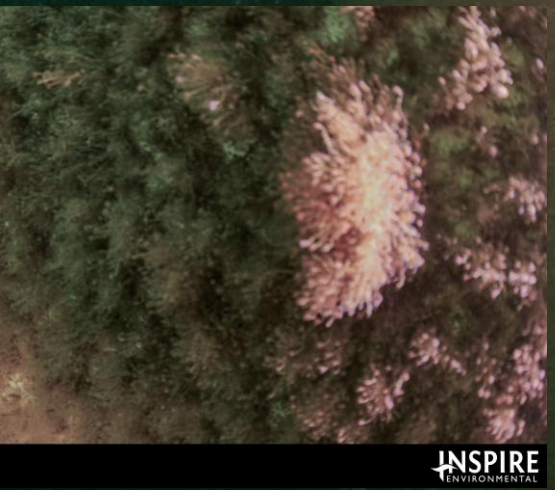
Food and Refuge Resources
Nutrient and Carbon Cycling

Complexity Increases Habitat "Value"

INSPIRE ENVIRONMENTAL

NW Atlantic Continental Shelf is Mostly Soft Sediments

Human Activity Alters Benthic Functions



Habitat Conversion

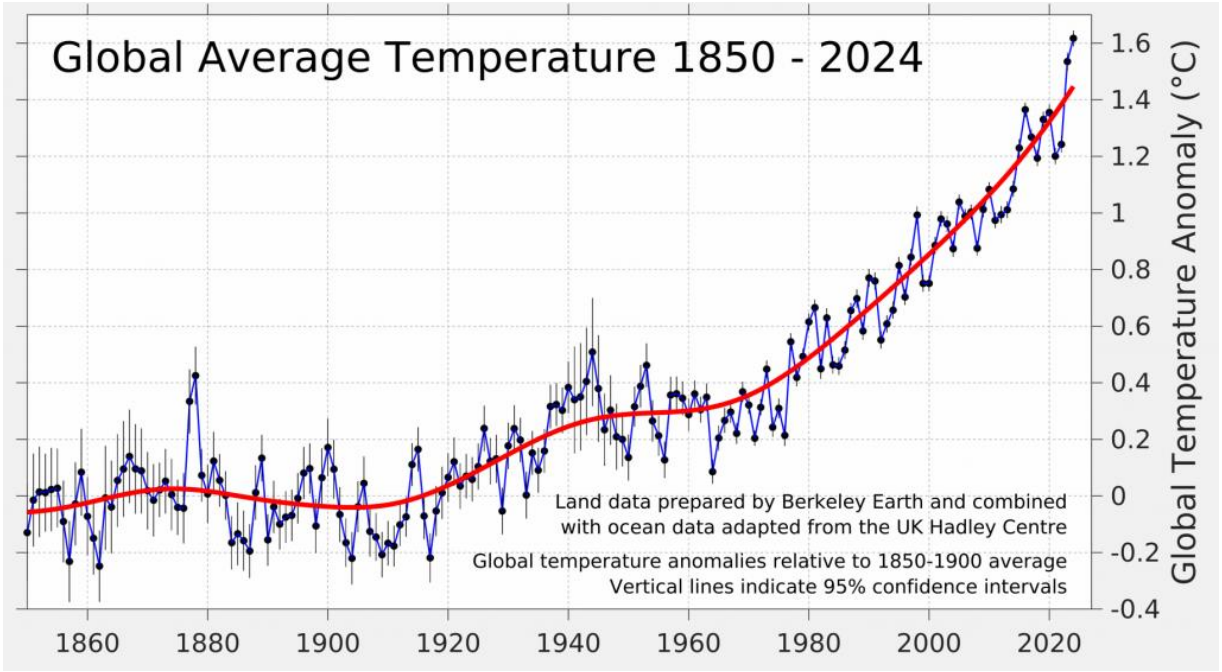
Organic Enrichment

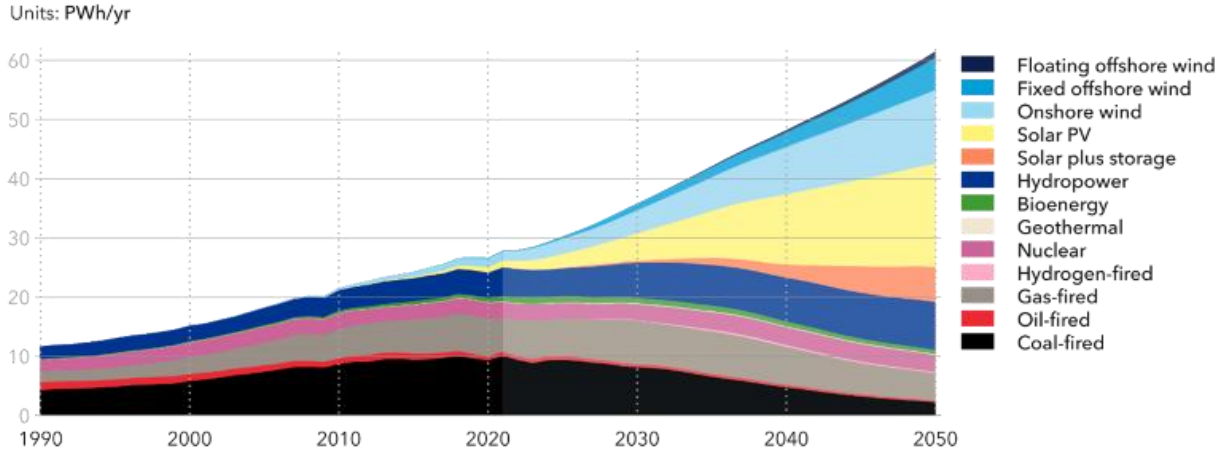
Burial (resuspension/deposition)

Why Offshore Wind?

- Our planet is warming due to increased greenhouse gas emissions from fossil fuel consumption

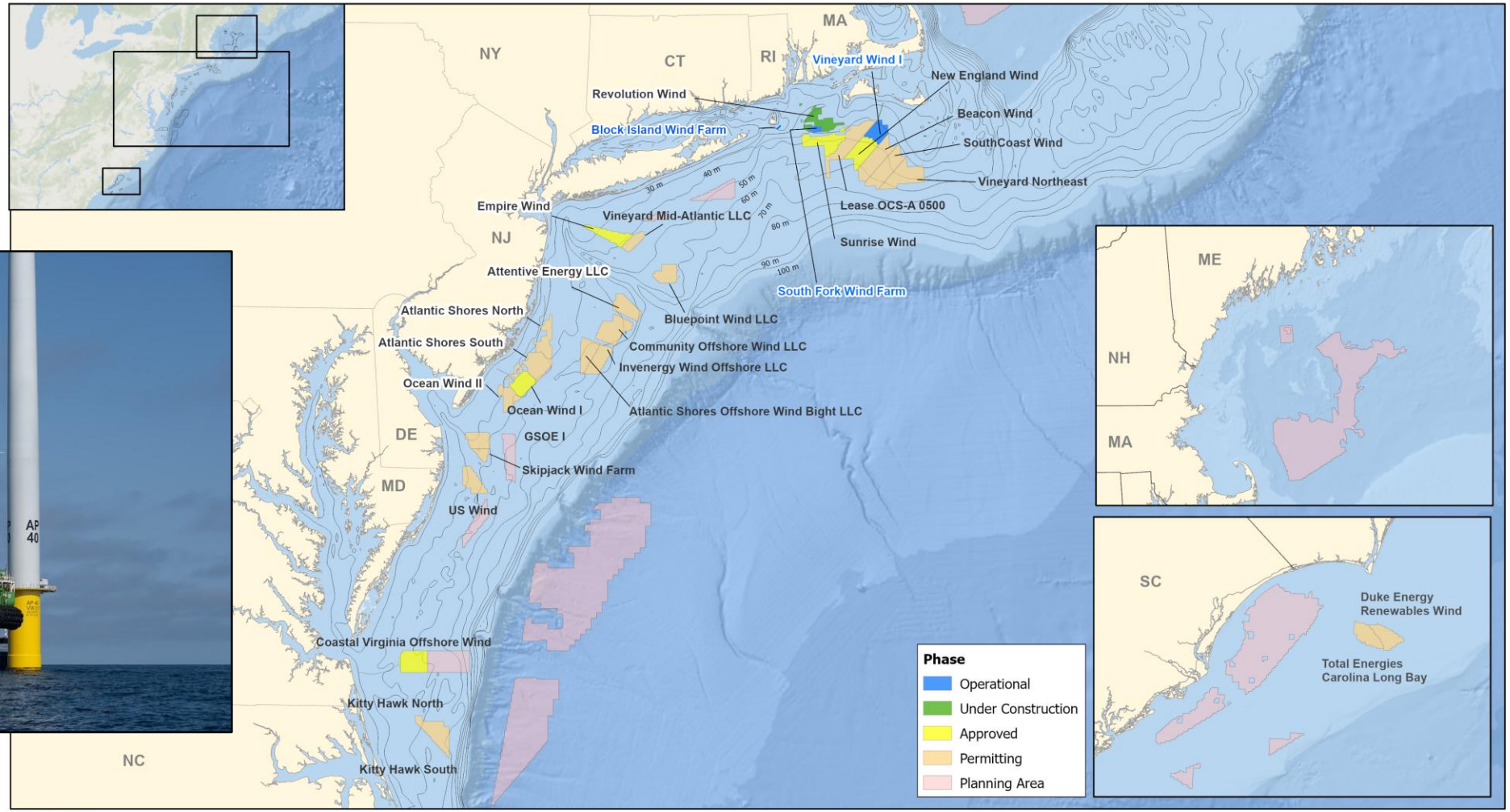
- Offshore wind provides reliable renewable energy efficiently to coastal states





Offshore Wind as Part of the Solution

Ongoing US east coast development



U.S. Offshore Wind Project Timeline

PLANNING, ANALYSIS, & INFRASTRUCTURE DEVELOPMENT — ~2 YEARS

- Identify Call Area, WEAs, lease areas
- Stakeholder engagement
- Spatial planning

LEASING — 1-2 YEARS

- Environmental Assessment
- Leasing notices
- Strategic analyses
- Conduct auction
- Issue Lease

PRE-COP SITE ASSESSMENT & PERMITTING — UP TO 5 YEARS

- Site investigation
- Benthic characterization
- Geophysical, geotechnical studies

COP

- Construction & Operations Plan

EIS & ROD — UP TO 2 YEARS

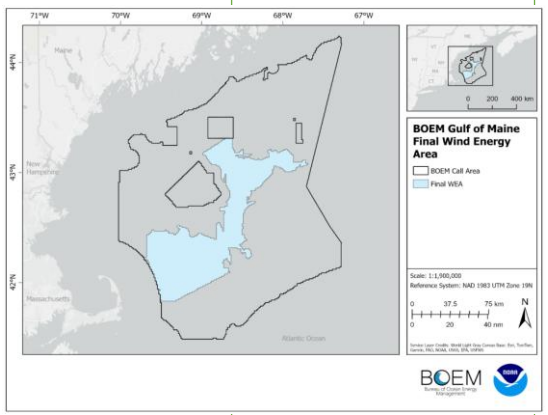
- NEPA process by BOEM
- EFH Consultation

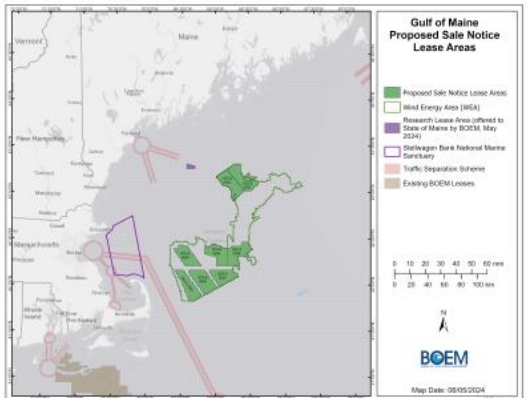
PRE-CONSTRUCTION

CONSTRUCTION — 2 YEARS

OPERATION — +25 YEARS

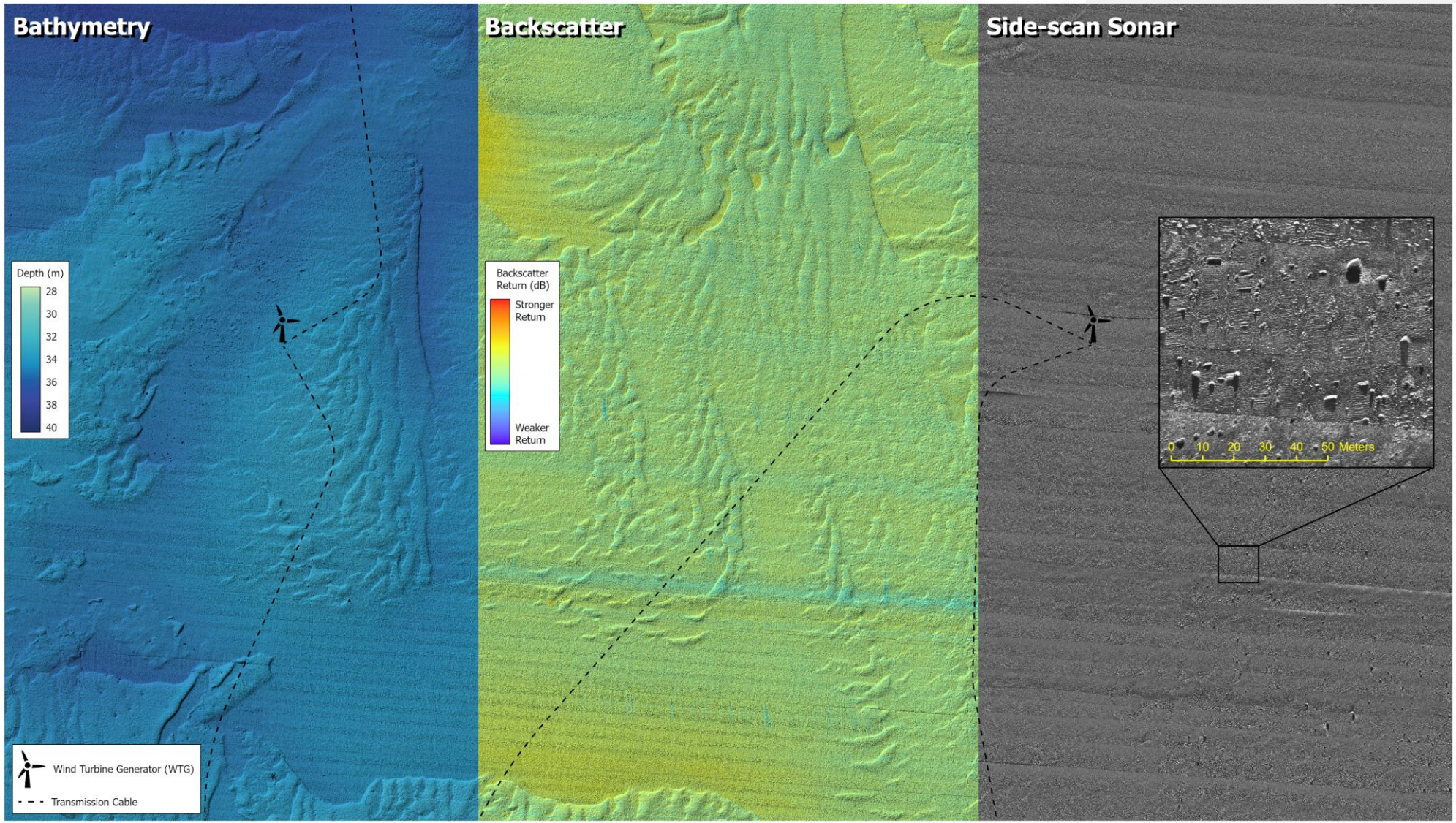
DECOMMISSION



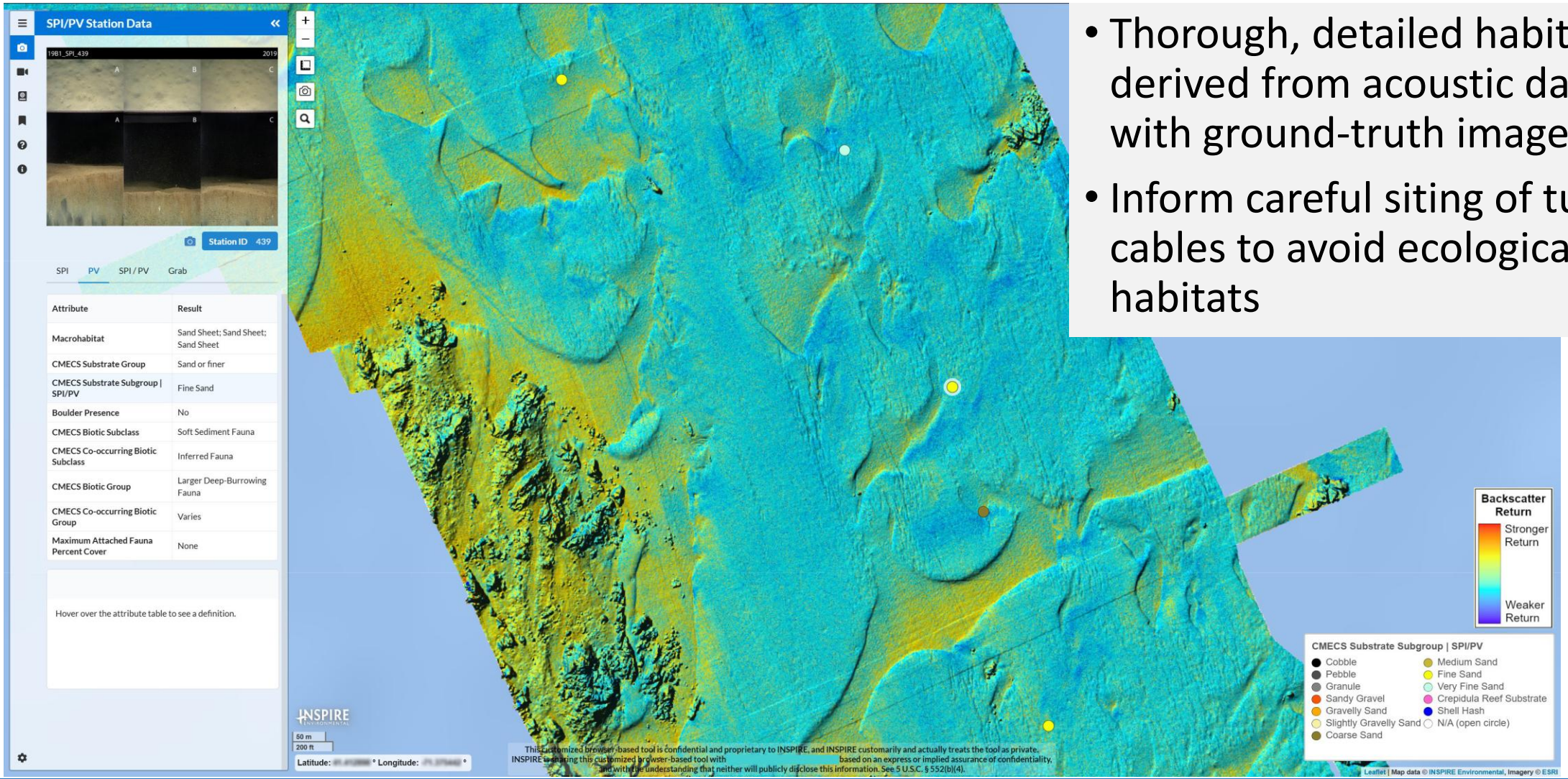


Benthic Habitat Mapping

High resolution geophysical data provides details on the seafloor composition

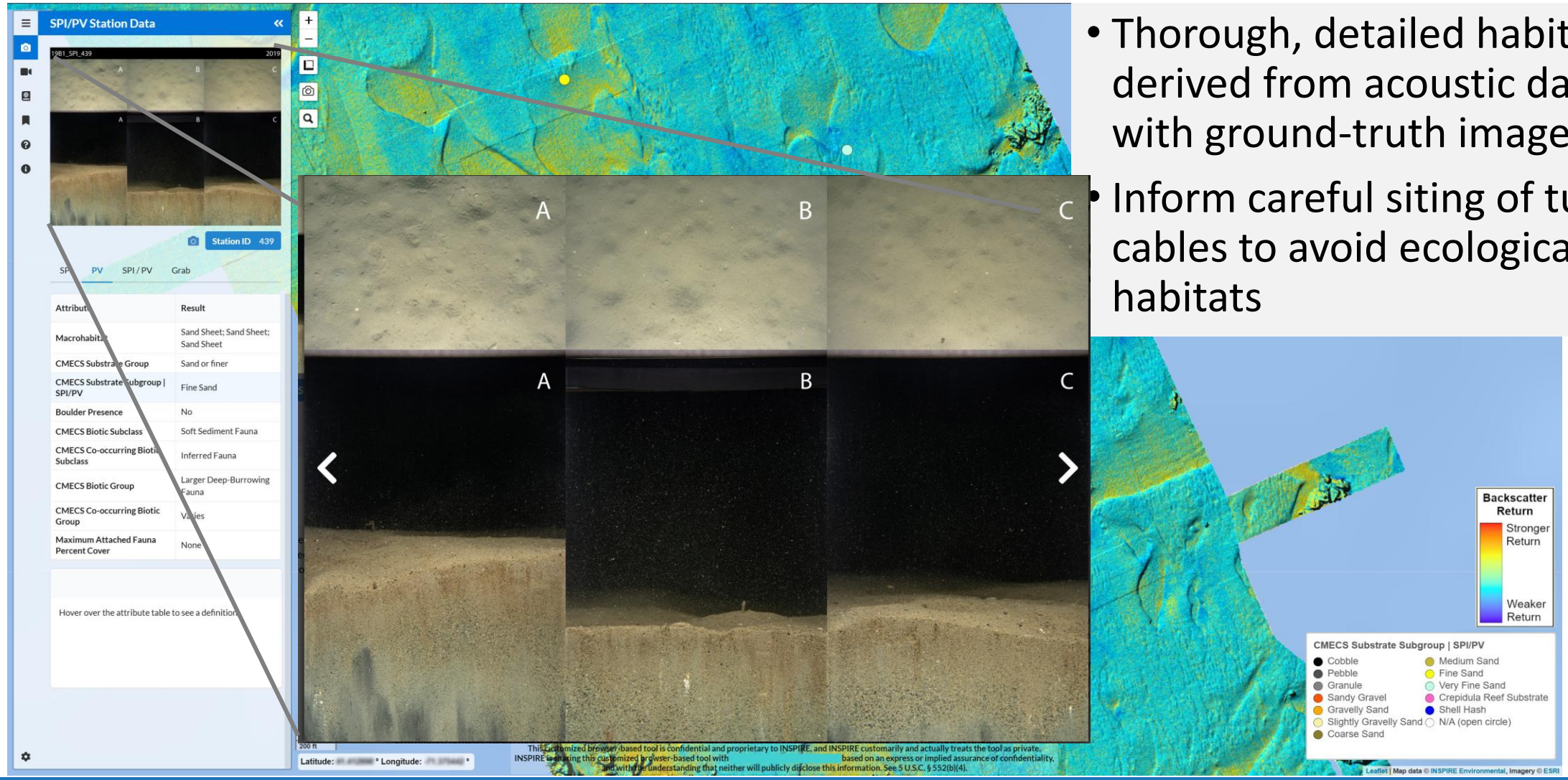


Benthic Habitat Mapping



- Thorough, detailed habitat maps derived from acoustic data coupled with ground-truth imagery
- Inform careful siting of turbines and cables to avoid ecologically sensitive habitats

Benthic Habitat Mapping



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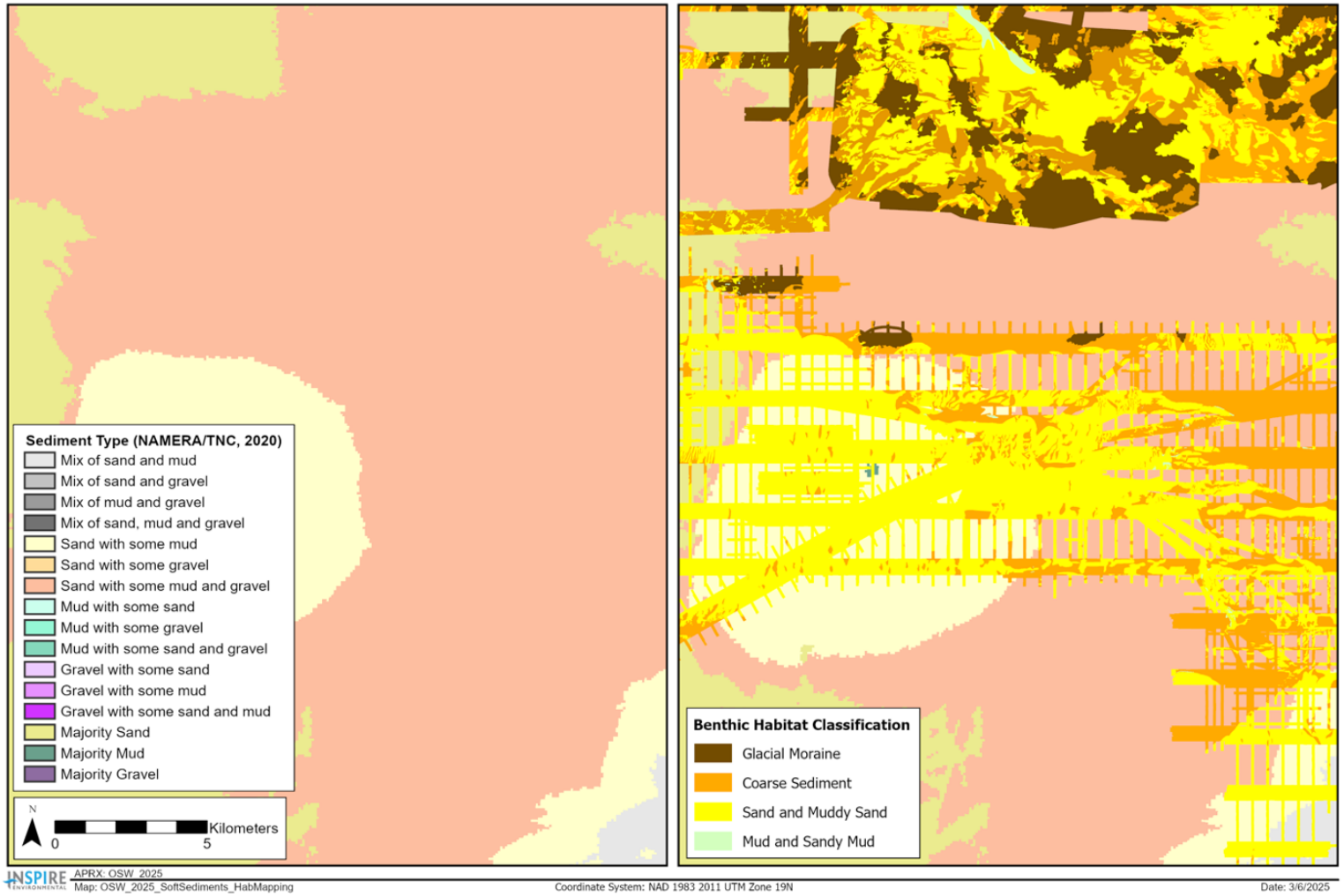
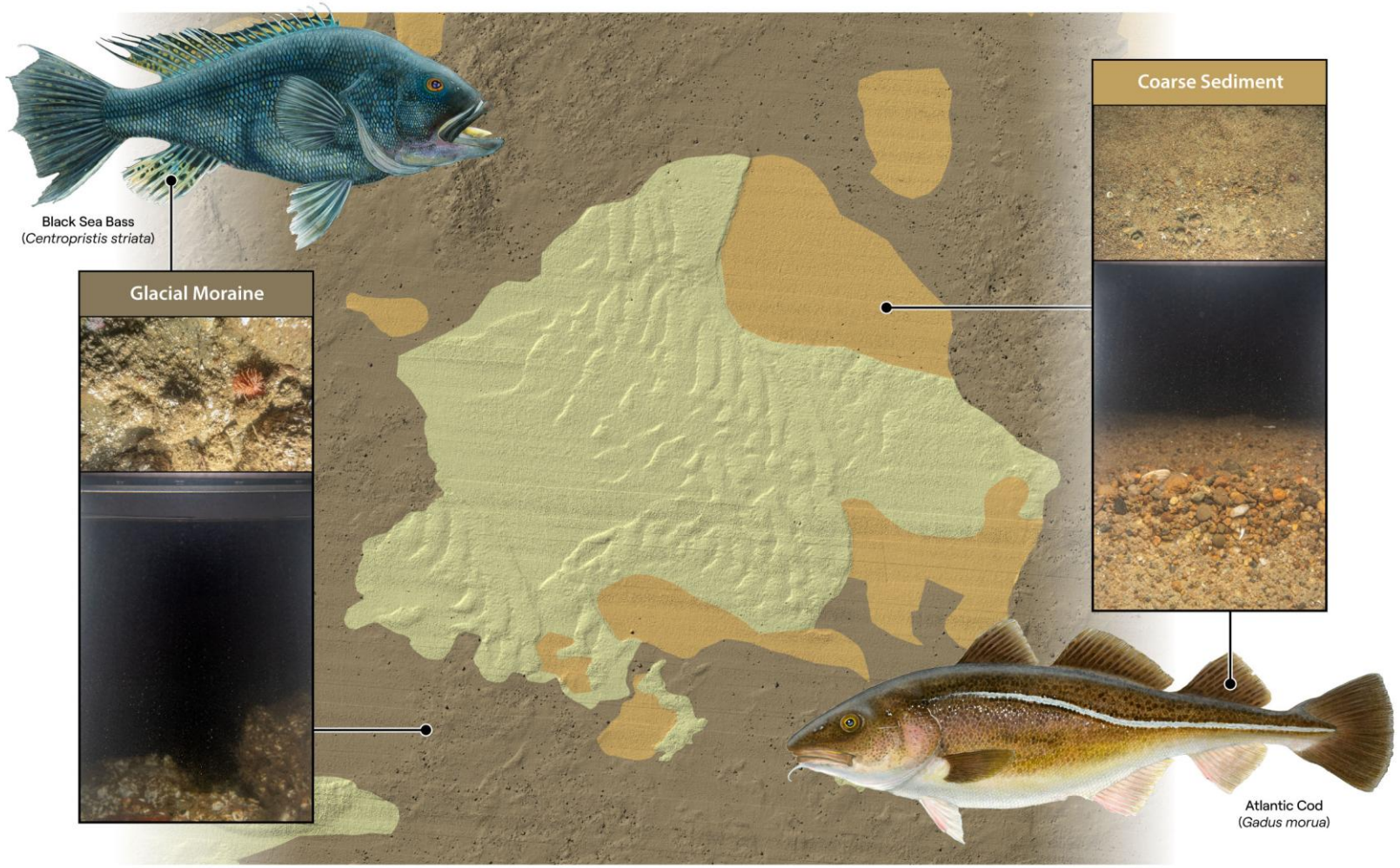


- Project-specific data provide more detailed habitat maps
- Beyond desktop data
- Informs project design and impact assessments

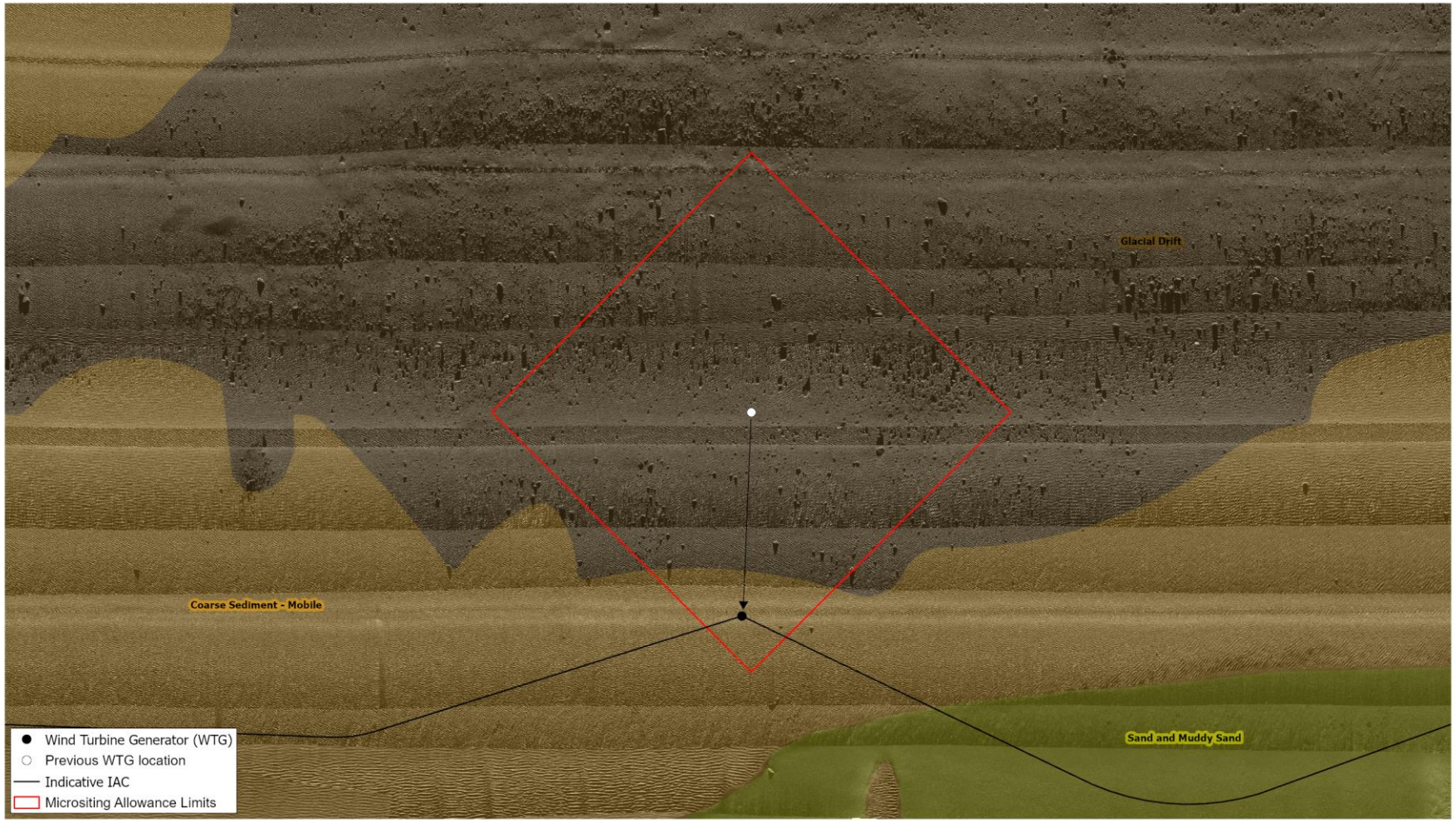
Benthic Habitat Mapping

Essential Fish Habitat Assessments



Benthic Habitat Mapping

Project Micrositing



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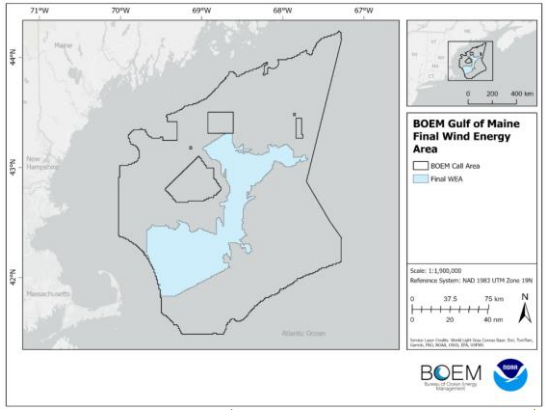

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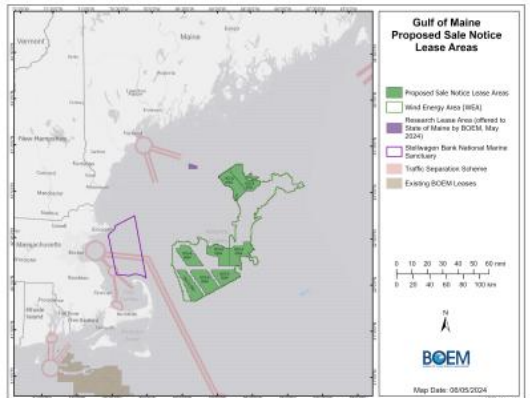

PRE-COP SITE ASSESSMENT & PERMITTING — UP TO 5 YEARS

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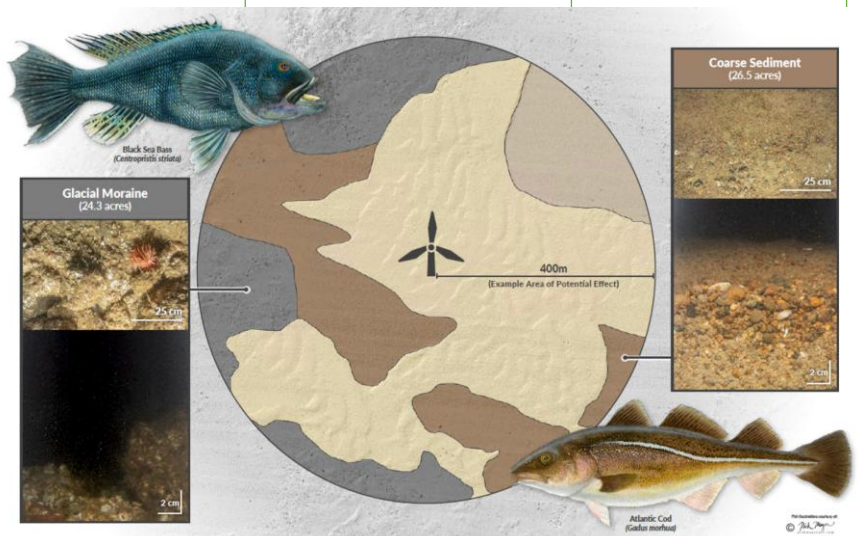
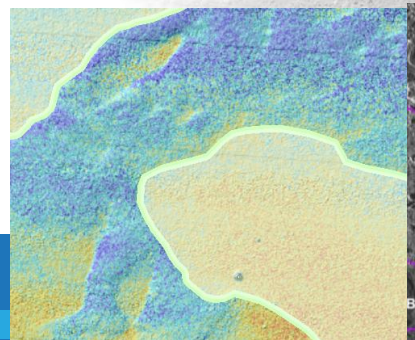
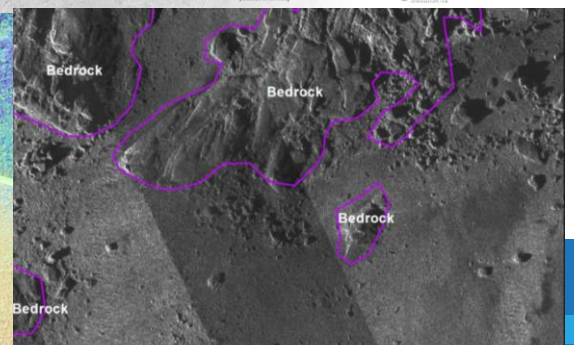






COP

- Construction & Operations Plan

EIS & ROD — UP TO 2 YEARS

- NEPA process by BOEM
- EFH Consultation

PRE-CONSTRUCTION

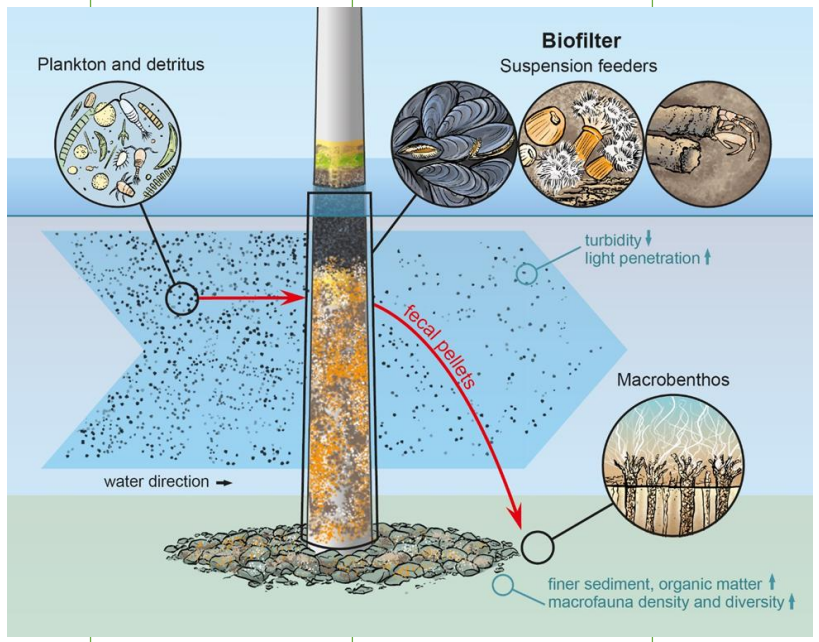
- Baseline Monitoring
- Compliance Plans

CONSTRUCTION — 2 YEARS

- Installation
- Monitoring

OPERATION — +25 YEARS

- Environmental and technical reviews
- Ecological Monitoring



DECOMMISSION

- Environmental Review
- Permitting for Decomm.

INSPIRE ENVIRONMENTAL

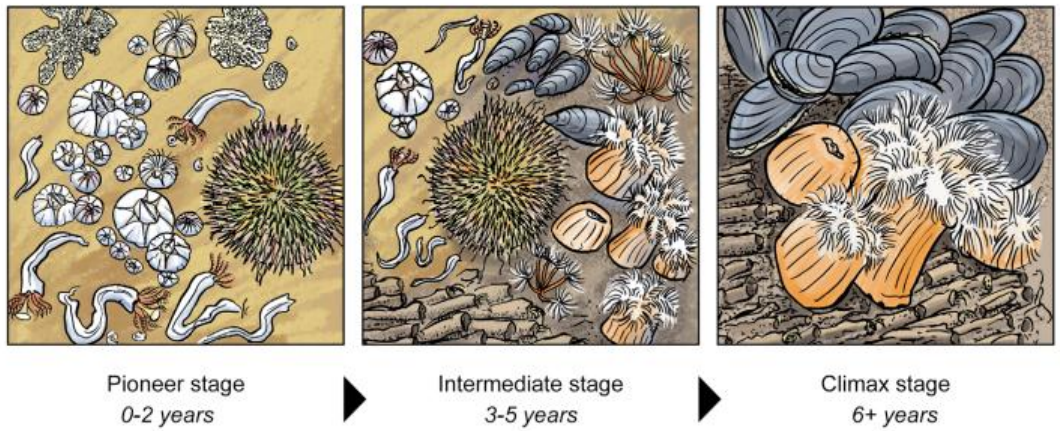
Artificial Reef Effect

Novel structures
lead to ecological shifts (connectivity) at multiple scales

Species Distributions

Benthic species colonize structures
Changes in community structure + diversity
Facilitate poleward expansion of species
Opportunistic non-indigenous colonization

Energy [Carbon] Distributions



Artificial Reef Effect

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Species Distributions

Benthic species colonize structures
Changes in community structure + diversity
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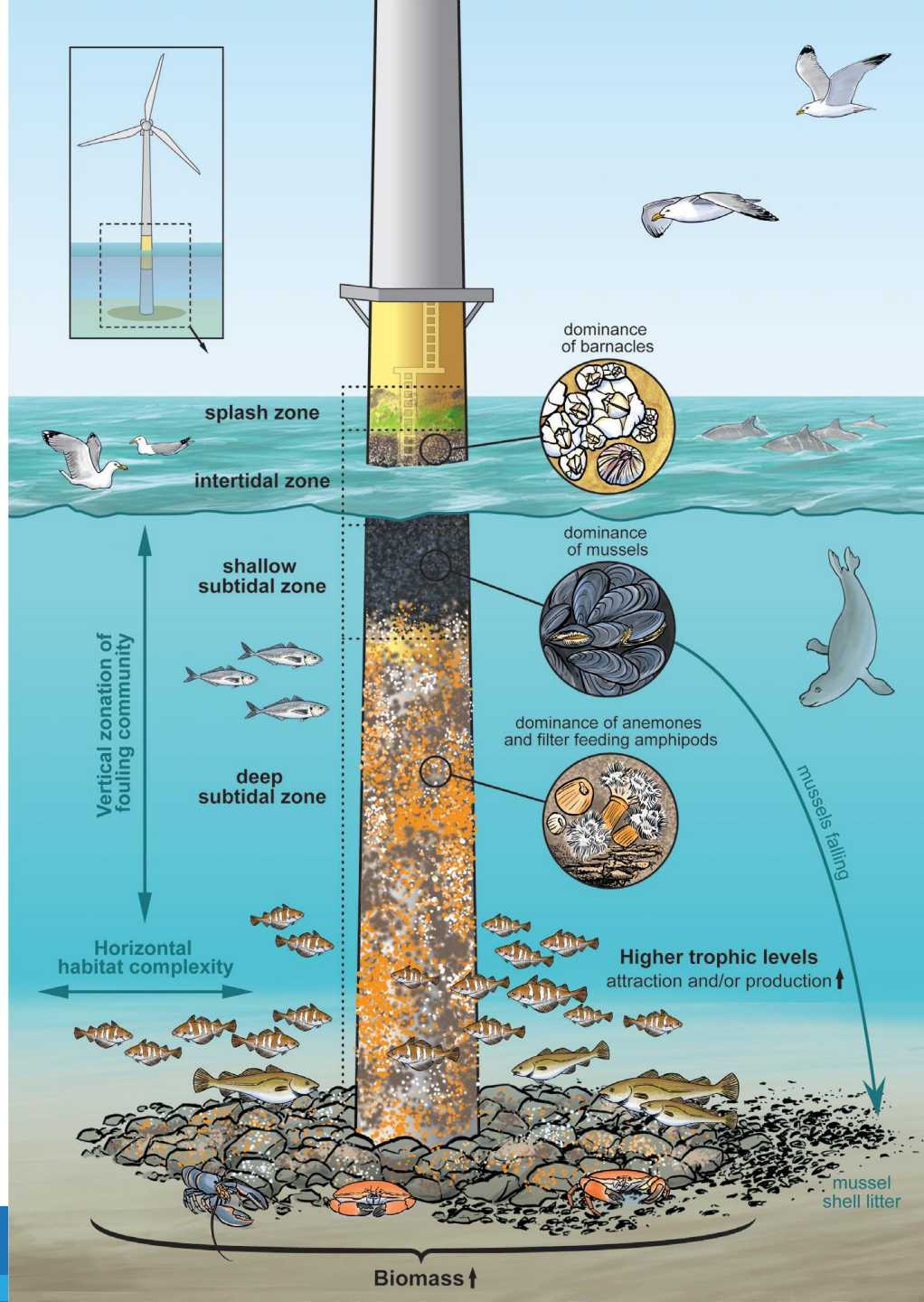
Energy Distributions

Redistribution of Carbon
Seafloor Enrichment
Foraging for Higher Trophic Levels

Ecosystem Function



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Interactions of Offshore Wind with the Marine Ecosystem

Vol. 727: 123–142, 2024 | MARINE ECOLOGY PROGRESS SERIES Mar Ecol Prog Ser | Published January 25

American lobster *Homarus americanus* responses to construction and operation of an offshore wind farm in southern New England

Dara H. Wilber[1,*], Lorraine J. Brown[1,2], Matthew Griffin[1,3], Drew A. Carey[1]

[1]INSPIRE Environmental, Newport, RI 02840, USA
[2]Exa Data and Mapping Services, Poulsbo, WA 98370, USA
[3]Saltbox Sea Farm, North Kingstown, RI 02852, USA

ABSTRACT: Construction and operation of the Block Island Wind Farm (BIWF) has occurred against a background of declining American lobster *Homarus americanus* abundance and harvests in southern New England (SNE), USA. Potential effects of BIWF on a portion of the SNE stock were assessed with a ventless trap survey conducted at 2 blocks near BIWF and 2 blocks at a reference

Journal of Sea Research 201 (2024) 102522

Journal of Sea Research 199 (2024) 102502

Contents lists available at ScienceDirect

Journal of Sea Research

journal homepage: www.elsevier.com/locate/seares

Guardians of the seabed: Nature-inclusive design of scour pro offshore wind farms enhances benthic diversity

Enzo M. Kingma[a,*], Remment ter [illegible][b,c], Corvin Kardinaal[d], Rebecca Bak
Oliver Bittner[a], Babeth van der We[illegible] Joop[illegible] Co[illegible]

[a] Wageningen Marine Research, Ankerpark 27, 1781 AG Den [illegible]
[b] Delft University of Technology, Civil Engineering and Geosc[illegible]
[c] Van Oord Dredging and Marine Contractors, Engineering &
[d] Waardenburg Ecology, Varkensmarkt 9, 4101 CK Culemborg, The Netherlands

ARTICLE INFO

Keywords:
Benthos
Marine growth

ABSTRACT

In the past, a large part of the seabed of the southern North Sea w beds, coarse peat banks, and glaciai erratics. Human activities, disappearance of most of these hard substrates, resulting in the l

Wind Energ. Sci., 7, 801–814, 2022
https://doi.org/10.5194/wes-7-801-2022

Artificial hard-substrate colonisation in the offshore Hywind Scotland Pilot Park

Rikard Karlsson[1,★], Malin Tivefälth[1,★], Iris Duranović[1,★], Svante Martinsson[1], Ane [illegible]hamar[2] and
[illegible]
[1]Envi[illegible]artment, [illegible]MT S[illegible]den [illegible]Gothenburg, [illegible]426, Sweden
[illegible]
[illegible]These authors contributed equally to this work.
Correspondence: Rikard Karlsson (rikard.karlsson@mmt.se) and Iris Duranović (iris.duranovic@mmt.se)

Received: 26 October 2021 – Discussion started: 10 November 2021
Revised: 16 February 2022 – Accepted: 27 February 2022 – Published: 4 April 2022

Abstract. Artificial substrates associated with renewable offshore energy infrastructure, such as floating off

Marine Pollution Bulletin 206 (2024) 116802

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Do offshore wind farms promote the expansion and proliferation of non-indigenous invertebrate species?

Jean-Claude Dauvin[*]

Université de Caen Normandie, UNICAEN, UMR CNRS M2C 6143, 24 rue de Tilleuls, F-14000 Caen, France

Contents lists available at ScienceDirect

Journal of Sea Research

journal homepage: www.elsevier.com/locate/seares

Life on every stone: Characterizing benthic communities from scour protection layers of offshore wind farms in the southern North Sea

Mirta Zupan[a,b,*], Joop Coolen[c], Ninon Mavraki[c], Steven Degraer[a], Tom Moens[b], Francis Kerckhof[a], Lucia Lopez Lopez[d], Jan Vanaverbeke[a,b]

[a] Royal Belgian Institute of Natural Sciences (RBINS), Marine Ecology and Management (MARECO), Vautierstraat 29, 1000 Brussels, Belgium
[b] Ghent University, Department of Biology, Marine Biology Research Group, Krijgslaan 281/S8, 9000 Ghent, Belgium
[c] Wageningen Marine Research, P.O. Box 57, 1780 AB Den Helder, the Netherlands
[d] Flanders Research Institute for Agriculture, Fisheries and Food (ILVO), Marine Research, Jacobsenstraat 1, B-8400 Ostend, Belgium

Journal of Coastal Research	00	00	000–000	Charlotte, North Carolina	Month 2024

Effects of the Block Island Wind Farm on Benthic and Epifaunal Communities

Mark Fonseca*, Adrianna McMahon, Robert Erickson, Christopher Kelly, John Tiggelaar, II, and Bruce Graham

CSA Ocean Sciences, Inc.
Stuart, FL 34997, U.S.A.

www.cerf-jcr.org

www.JCRonline.org

ABSTRACT

Fonseca, M.; McMahon, A.; Erickson, R.; Kelly, C.; Tiggelaar, J., II, and Graham, B., 0000. Effects of the Block Island Wind Farm on benthic and epifaunal communities. *Journal of Coastal Research*, 00(00), 000–000. Charlotte (North Carolina), ISSN 0749-0208.

This study reports on monitoring surveys conducted at three of the five commercially operating turbines in U.S. waters off Block Island, Rhode Island, U.S.A., with an emphasis on the final, fourth year of a Bureau of Ocean Energy Management sampling program. The monitoring focused on changes to sediments and infaunal and epi- fauna species abundance, richness, and diversity

ICES Journal of Marine Science, 2022, **0**, 1–15
DOI: 10.1093/icesjms/fsac051
Original Article

Demersal fish and invertebrate catches relative to construction and operation of North America's first offshore wind farm

Dara H. Wilber[1,*], Lorraine Brown[1,2], Matthew Griffin[1,3], Gregory R. DeCelles[4] and Drew A. Carey[1]

[1]INSPIRE Environmental, Newport, RI, USA
[2]Exa Data and Mapping, Poulsbo, WA, USA
[3]Saltbox Sea Farm, North Kingstown, RI, USA
[4]Orsted Offshore North America, Providence, RI, USA

Science of the Total Environment 878 (2023) 162902

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Ecological effects of offshore wind farms on Atlantic cod (*Gadus morhua*) i the southern North Sea

A. Gimpel[a,b,*], K.M. Werner[a], F.-D. Bockelmann[c], H. Haslob[a], M. Kloppmann[a], M. Schaber[a], V

Version of Record: https://www.sciencedirect.com/science/article/pii/S0029801823001828
Manuscript_482c085b215477e33fd855e7d918c36c

Ocean Engineering 272 (2023) 113798

Contents lists available at ScienceDirect

Ocean Engineering

journal homepage: www.elsevier.com/locate/oceaneng

Hydrodynamic effects of biofouling-induced surface roughness – Review and research gaps for shallow water offshore wind energy structures

Maduka Maduka[a,b,***], Franck Schoefs[a,*], Krish Thiagarajan[b,**], Alison Bates[c]

[a] GeM (Institute for Research in Civil and Mechanical Engineering)/IUML (Sea and Littoral Research Institute), CNRS UMR 6183/FR 3473, Nantes Université, Ecole Centrale de Nantes, F44322, Nantes, France
[b] Department of Mechanical and Industrial Engineering, University of Massachusetts, Amherst, USA
[c] Department of Environmental Studies, Colby College, Waterville, ME, USA

Vol. 683: 123–138, 2022 | MARINE ECOLOGY PROGRESS SERIES Mar Ecol Prog Ser | Published February 3

Offshore wind farm effects on flounder and gadid dietary habits and condition on the northeastern US coast

Dara H. Wilber[1,*], Lorraine Brown[1,2], Matthew Griffin[1,3], Gregory R. DeCelles[4], Drew A. Carey[1]

[illegible]ironmental, Newport, RI 02840, USA

ICES Journal of Marine Science, 2023, **0**, 1–13
DOI: 10.1093/icesjms/fsad179
Original Article

Hydrobiologia (2021) 848:1639–1657
https://doi.org/10.1007/s10750-021-04553-6

PRIMARY RESEARCH PAPER

Offshore wind farms and the attraction–production hypothesis: insights from a combination of stomach content and stable isotope analyses

Ninon Mavraki · Steven Degraer · Jan Vanaverbeke

Marine Environmental Research 178 (2022) 105664

Contents lists available at ScienceDirect

Marine Environmental Research

journal homepage: www.elsevier.com/locate/marenvrev

Small suspension-feeding amphipods play a pivotal role in carbon dynamics around offshore man-made structures

Ninon Mavraki[a,*], Joop W.P. Coolen[a], Danae-Athena Kapasakali[b], Steven Degraer[b,c], Jan Vanaverbeke[b,c], Jan Beermann[d,e]

[a] Wageningen Marine Research, P.O. Box 57, Ankerpark 27, 1781, AG Den Helder, the Netherlands
[b] Royal Belgian Institute of Natural Sciences, Operational Directorate Natural Environment, Marine Ecology and Management, Vautierstraat 29, Brussels, 1000, Belgium
[c] Marine Biology Research Group, Department of Biology, Ghent University, Krijgslaan 281/S8, Ghent, 9000, Belgium
[d] Department of Functional Ecology, Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Am Handelshafen 12, 27570, Bremerhaven, Germany
[e] Helmholtz Institute for Functional Marine Biodiversity at the University of Oldenburg, Oldenburg, Germany

European plaice movements show evidence of high residency, site fidelity, and feeding around hard substrates within an offshore wind farm

Jolien Buyse[1,*], Jan Reubens[2], Kris Hostens[1], Steven Degraer[3,4], Jolien Goossens[4], and Annelies De Backer[1]

[1]Flanders Research Institute for Agriculture, Fisheries and Food (ILVO), Marine Research, Jacobsenstraat 1, 8400 Ostend, Belgium
[2]Flanders Marine Institute (VLIZ), Jacobsenstraat 1, 8400 Ostend, Belgium
[3]Institute of Natural Sciences, Operational Directorate Natural Environment, Marine Ecology and Management, Vautierstraat 29, 1000 Brussels, Belgium
[4] Marine Biology Research Group, Department of Biology, Krijgslaan 281–S8, 9000 Ghent, Belgium
** Corresponding author: tel:+32 59 56 98 36; e-mail:jolien.buyse@ilvo.vlaanderen.be.*

Received: 30 June 2023 | Revised: 24 May 2024 | Accepted: 29 May 2024
DOI: 10.1002/edn3.575

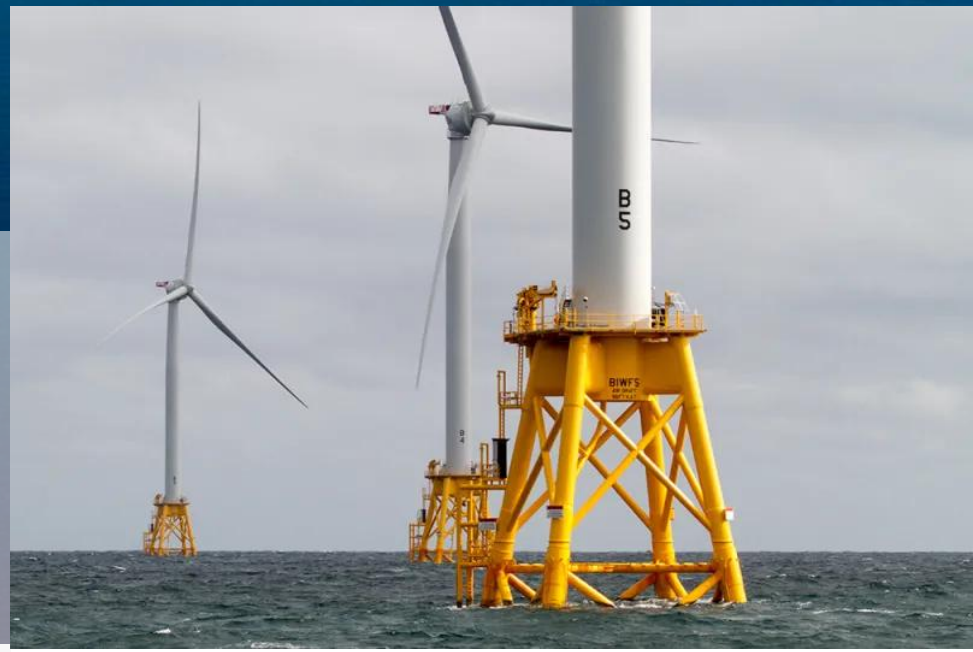
ORIGINAL ARTICLE

Environmental DNA for monitoring the impact of offshore wind farms on fish and invertebrate community structures

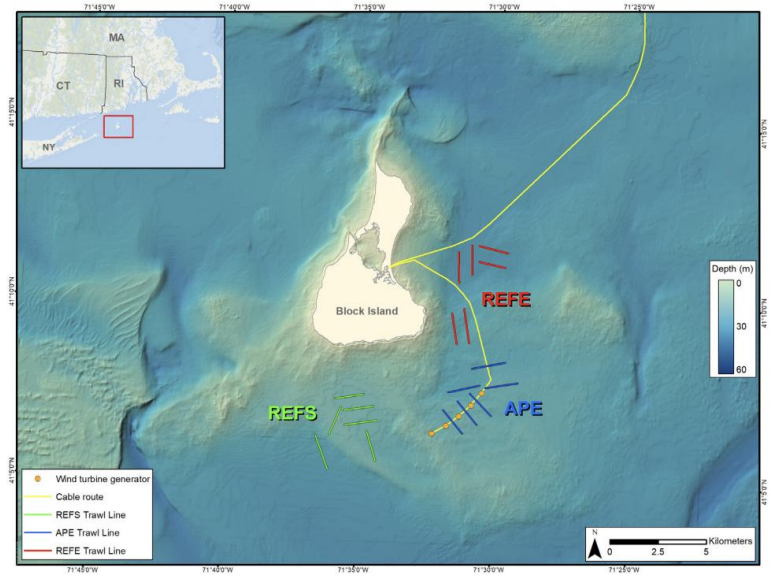
Isolde Cornelis[1] | Annelies De Backer[1] | Sara Maes[1] | Joran Vanhollebeke[1] | Rein Brys[2] | Tom Ruttink[3] | Kris Hostens[1] | Sofie Derycke[1,4]

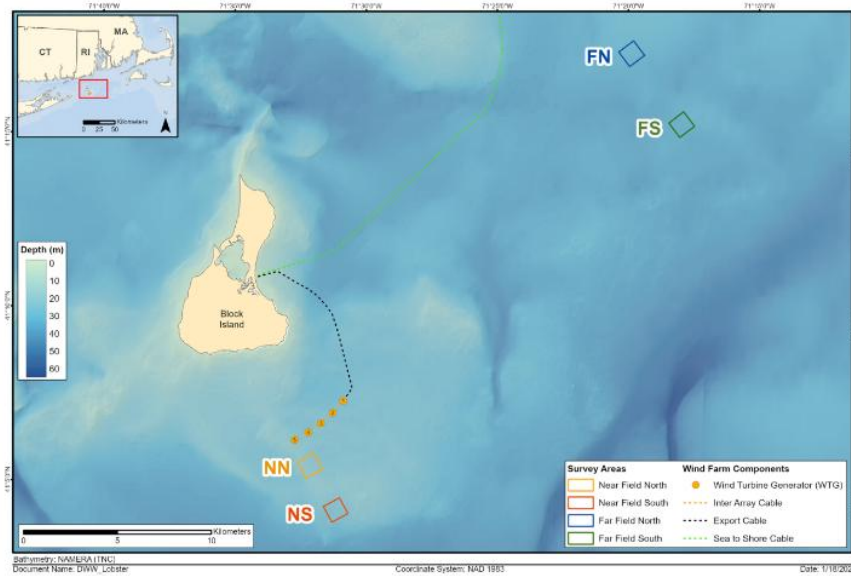
Block Island Wind Farm

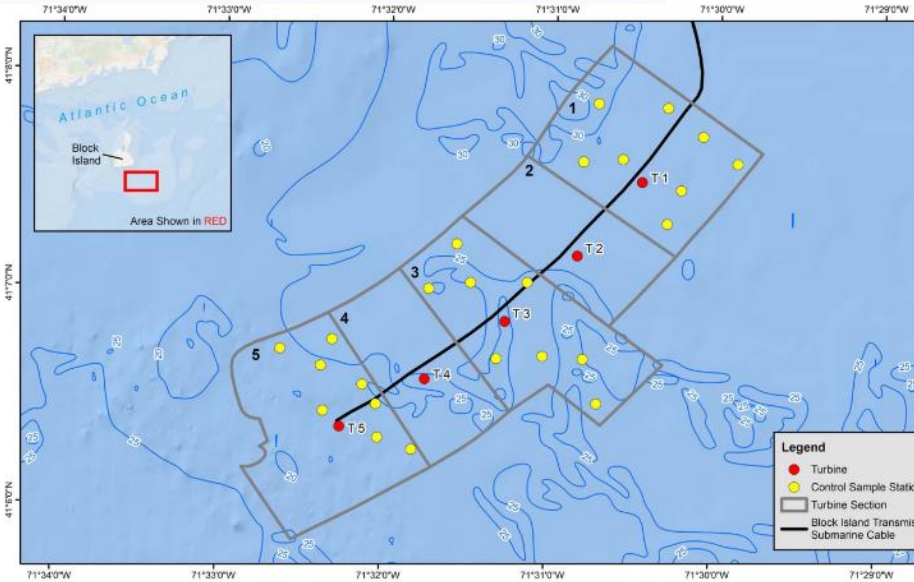
Wilber et al. 2022a
Wilber et al. 2022b
Gervelis et al. 2023
Wilber et al. 2024
Fonseca et al. 2024
Wilber et al. 2018
Hutchison et al. 2020
Guarinello and Carey 2020
Carey et al. 2020
Jech et al. 2022

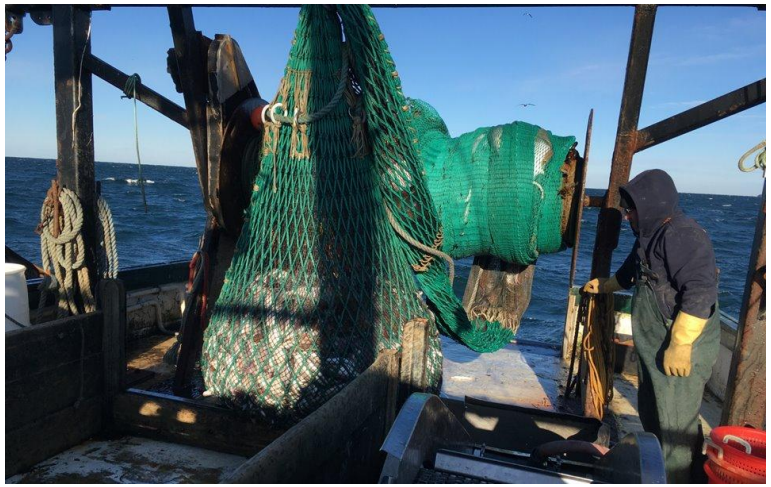


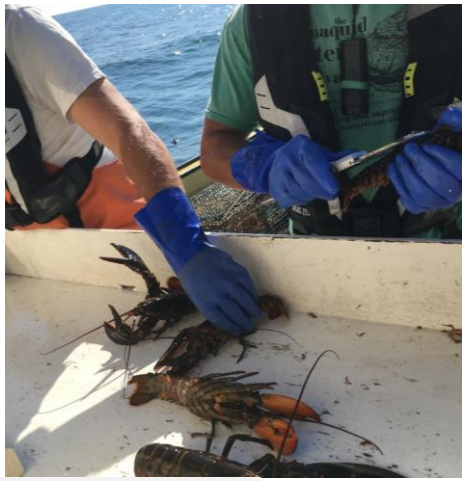
Block Island Wind Farm

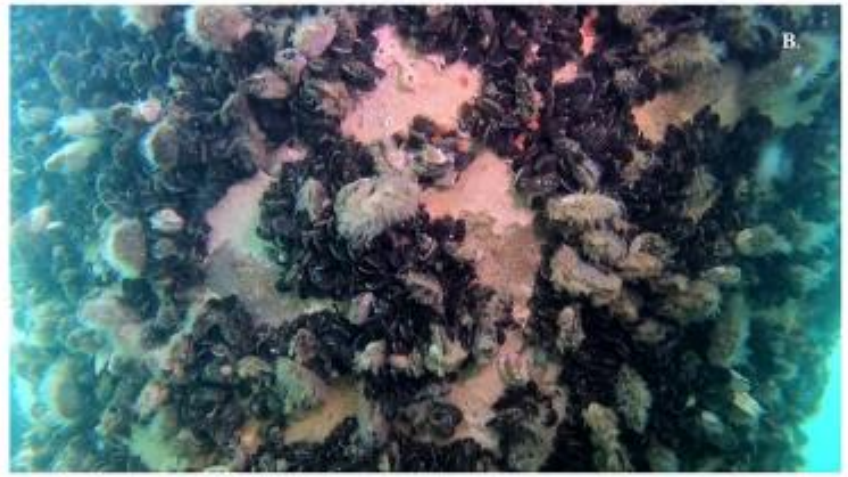












Wilber et al. 2022

Wilber et al. 2024

Fonseca et al. 2024

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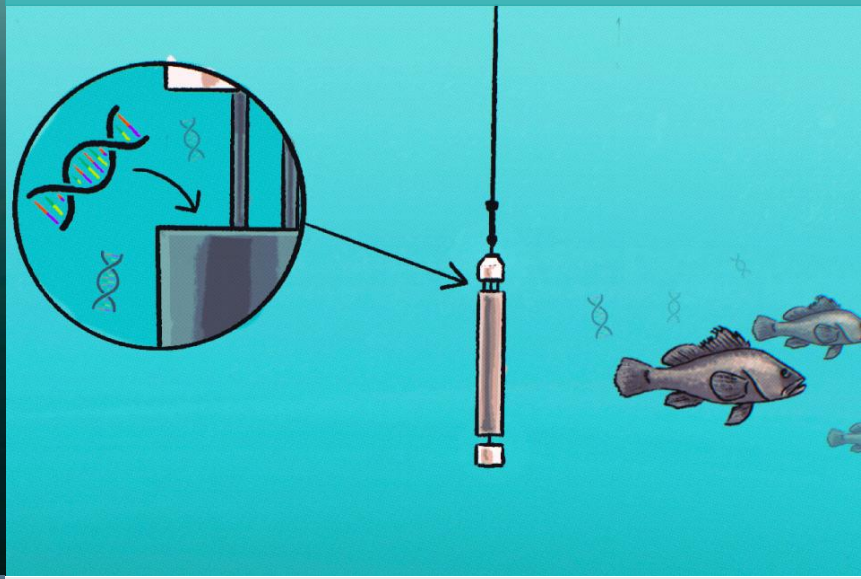
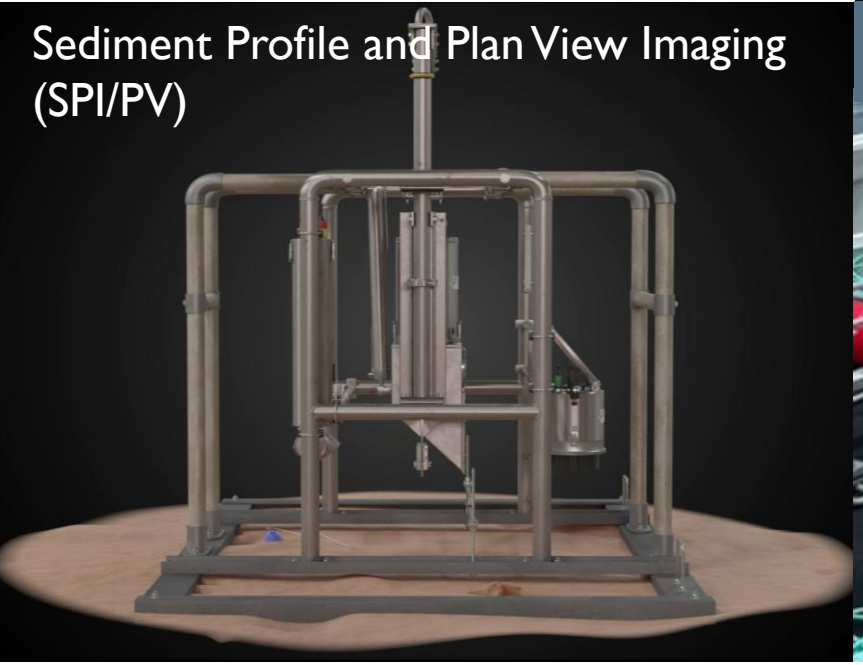
Video from Remotely Operated Vehicles (ROV-video)

Small Underwater Drones

Environmental DNA (eDNA)

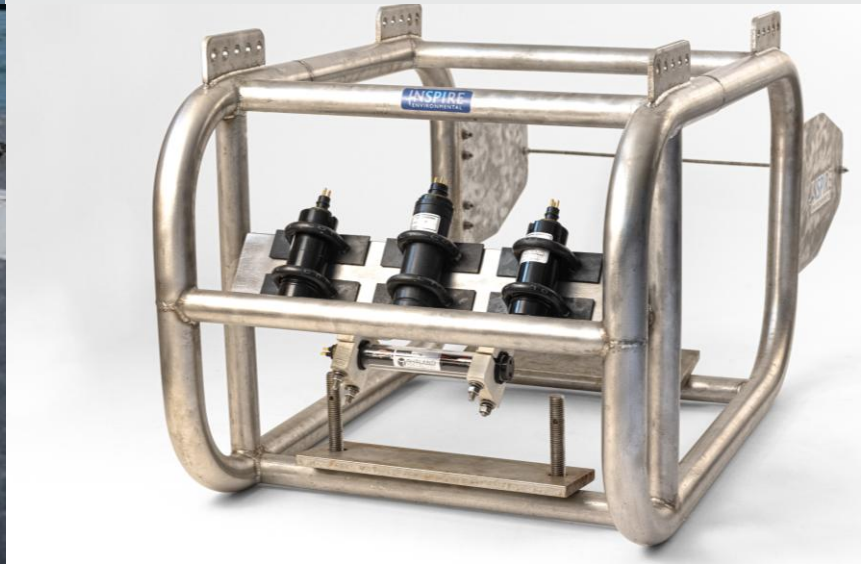


Sediment Profile and Plan View Imaging (SPI/PV)



Baited Remote Underwater Video (BRUV)

Towed Video Sled



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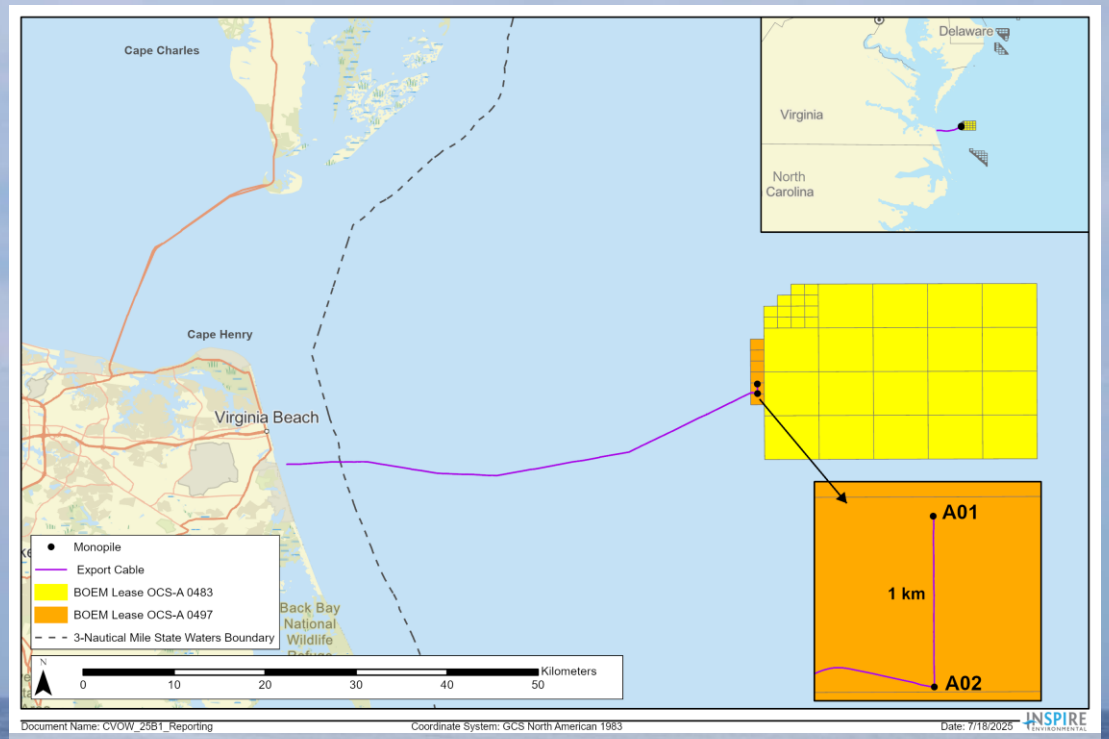
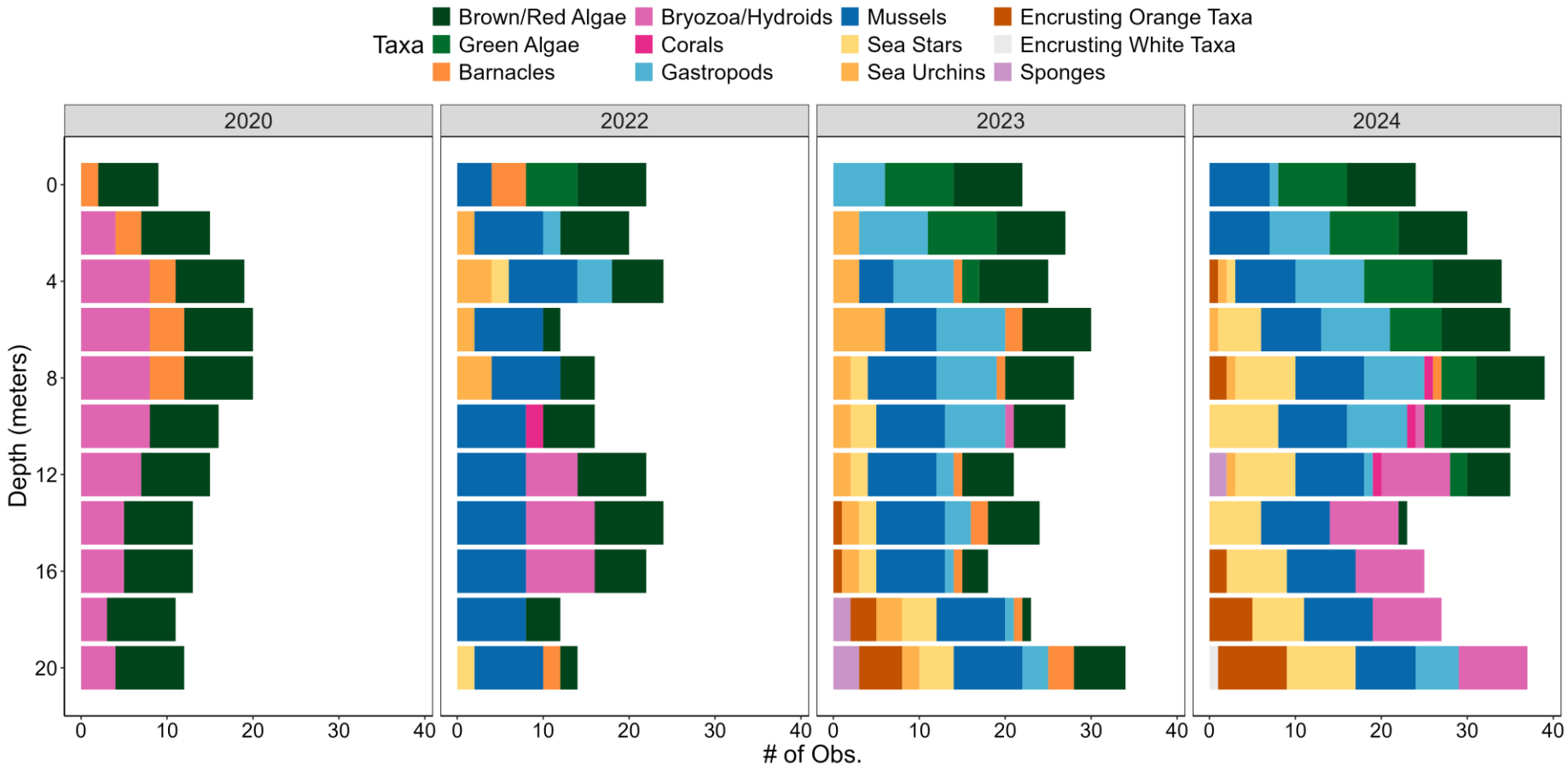
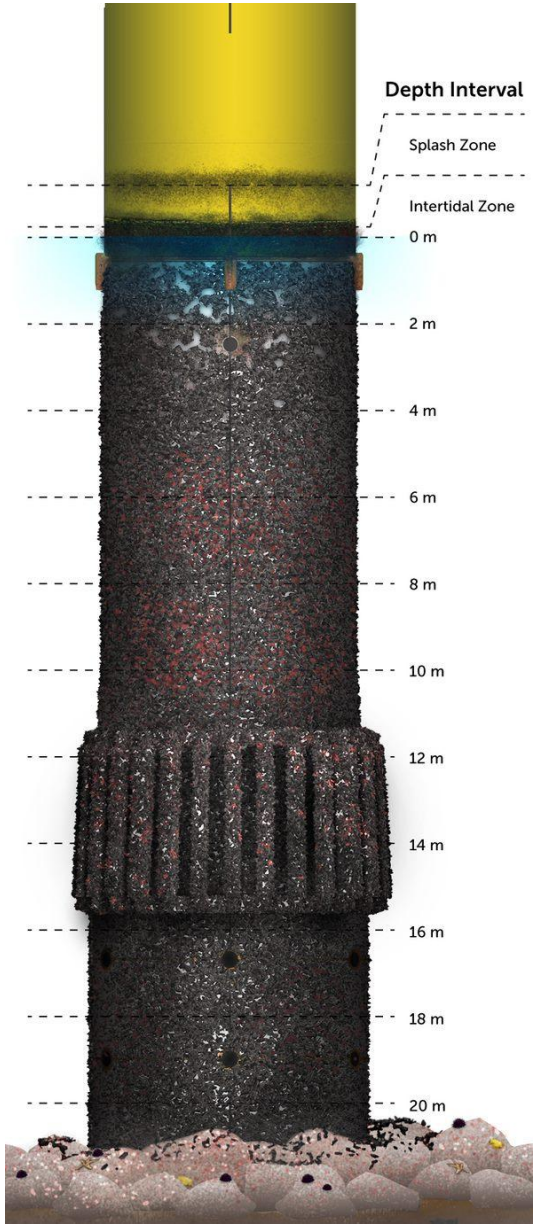
Coastal Virginia Offshore Wind – Research Array



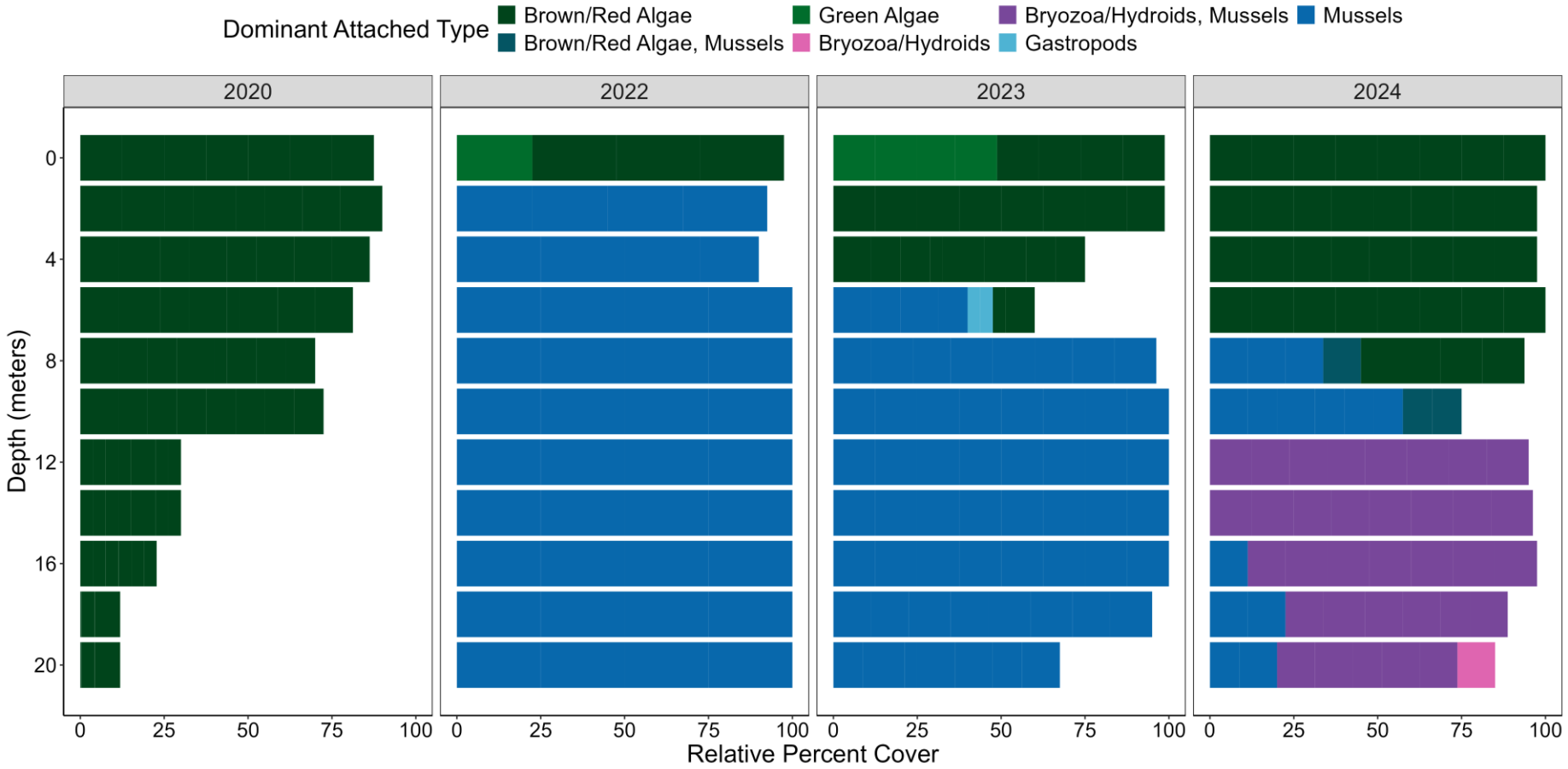
Annual Underwater Visual Surveys documenting community composition, percent cover, fish communities

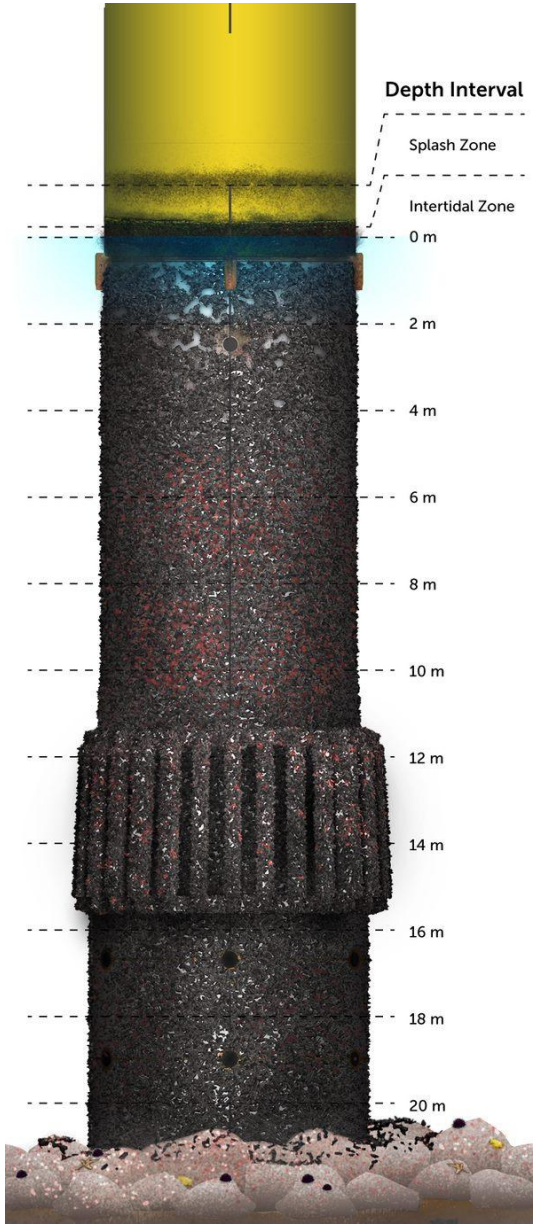
The number of taxa increases, and then stabilizes





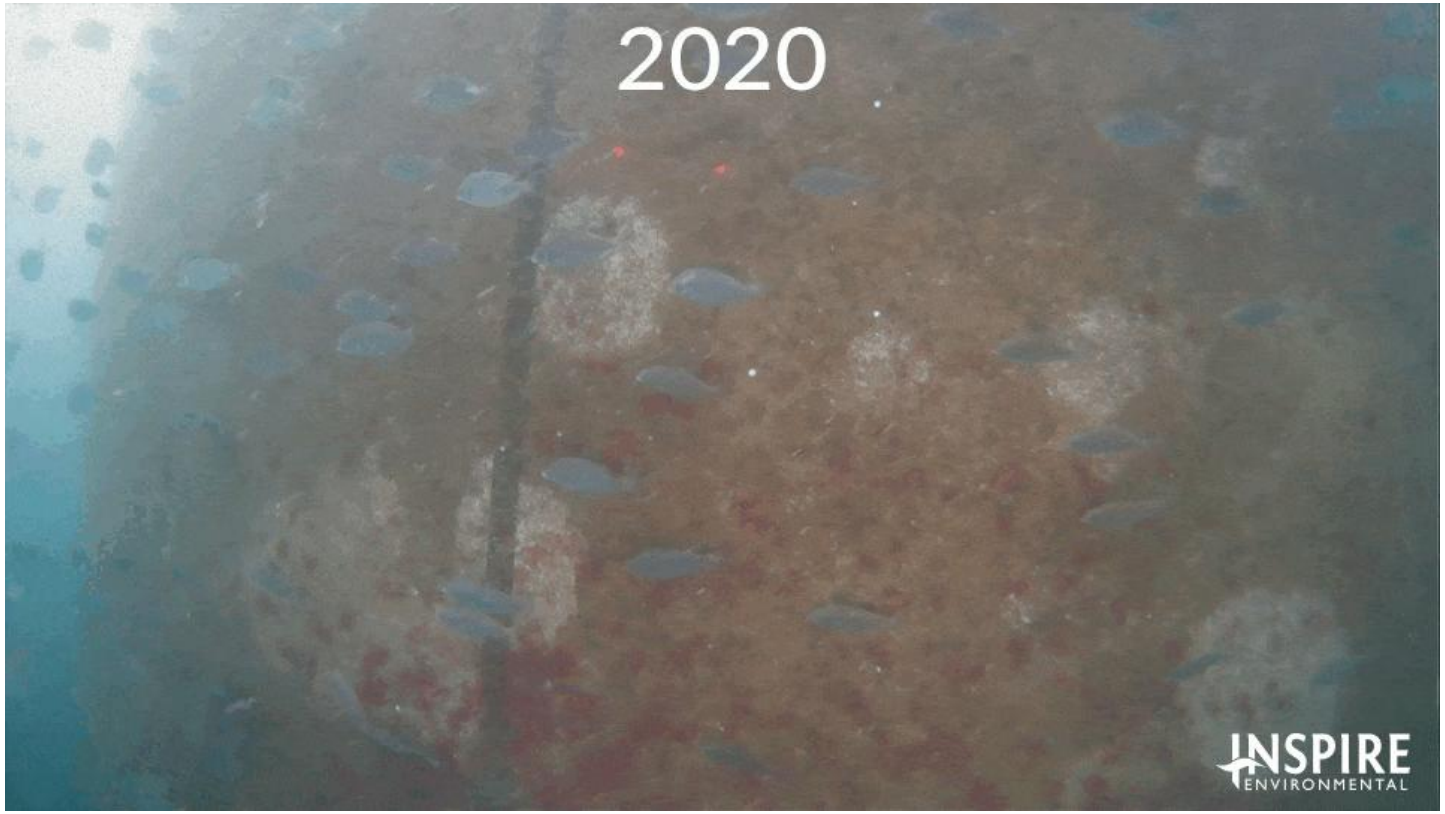
Shift from algae to mussels to mussels + hydrozoans





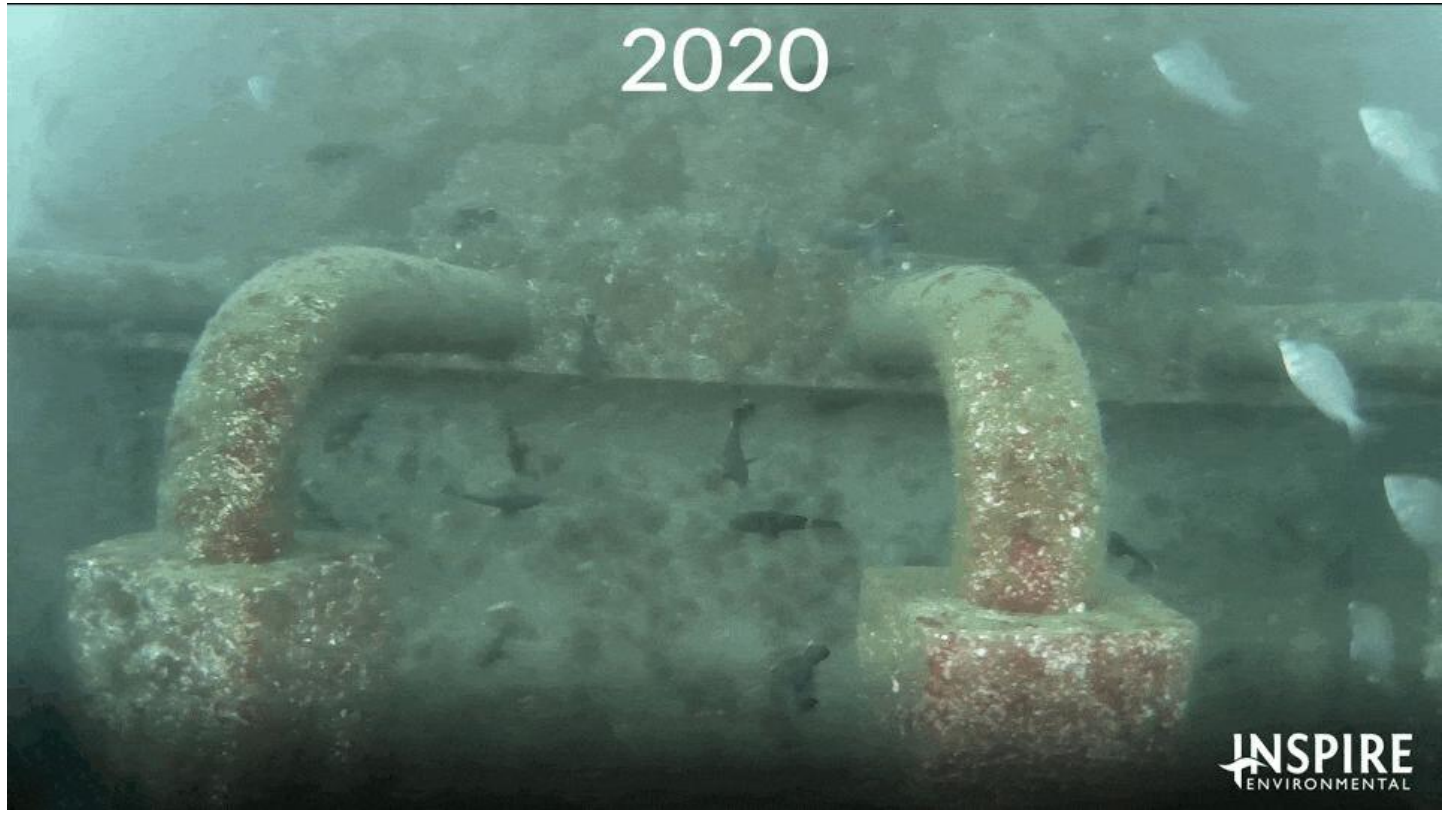
Successional change: shallower on monopile

- **Y0** • Algae
- **Y2** • Thick layer of mussels
- **Y3** • Gaps in mussels
- **Y4** • Return of algae

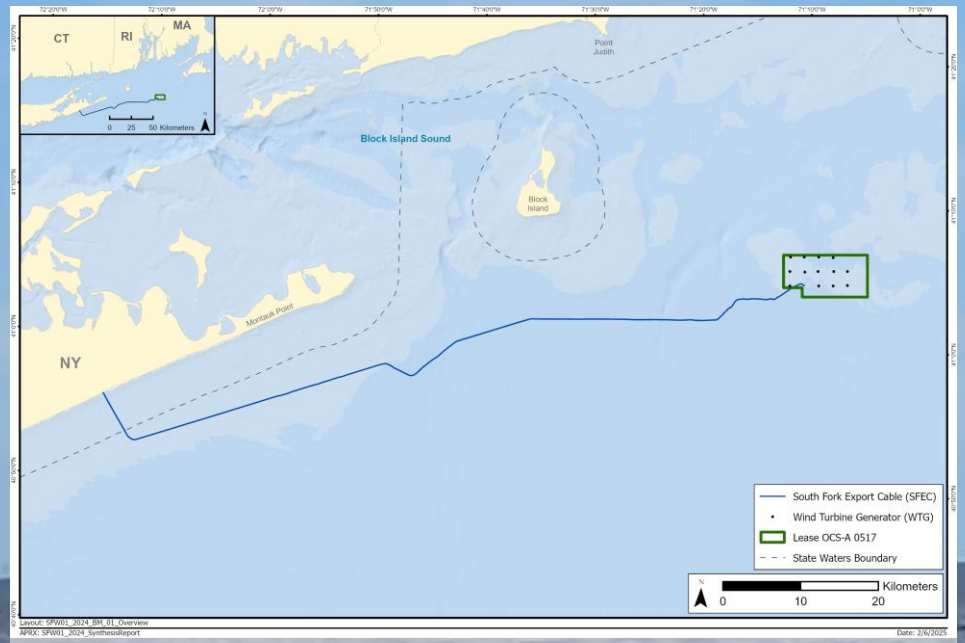


Successional change: deeper on monopile

- **Y0** • Mostly bare
- **Y2** • Thick layer of mussels
- **Y3** • Gaps in mussels
- **Y4** • Mussels with hydroids

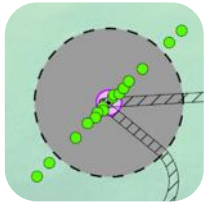


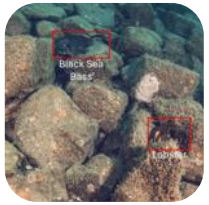
South Fork Wind Farm

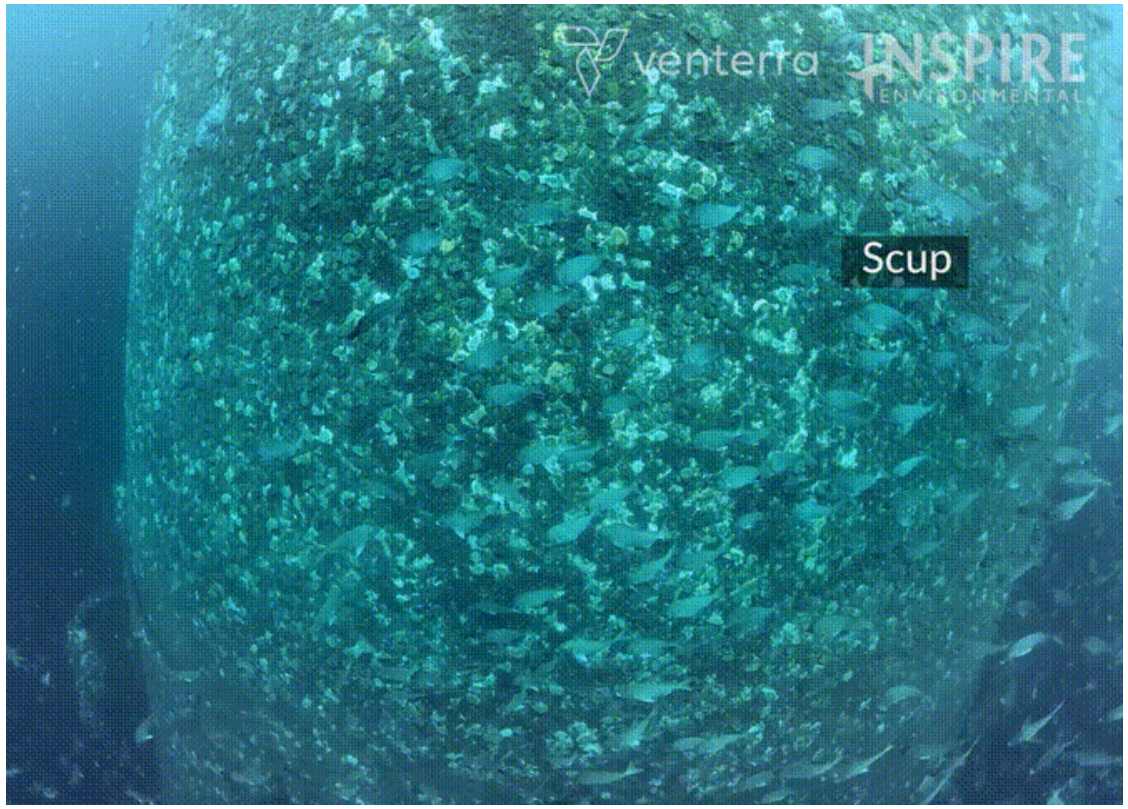


Comprehensive Fisheries and Benthic Monitoring Program - new structures and surrounding habitats

South Fork Wind Storymap







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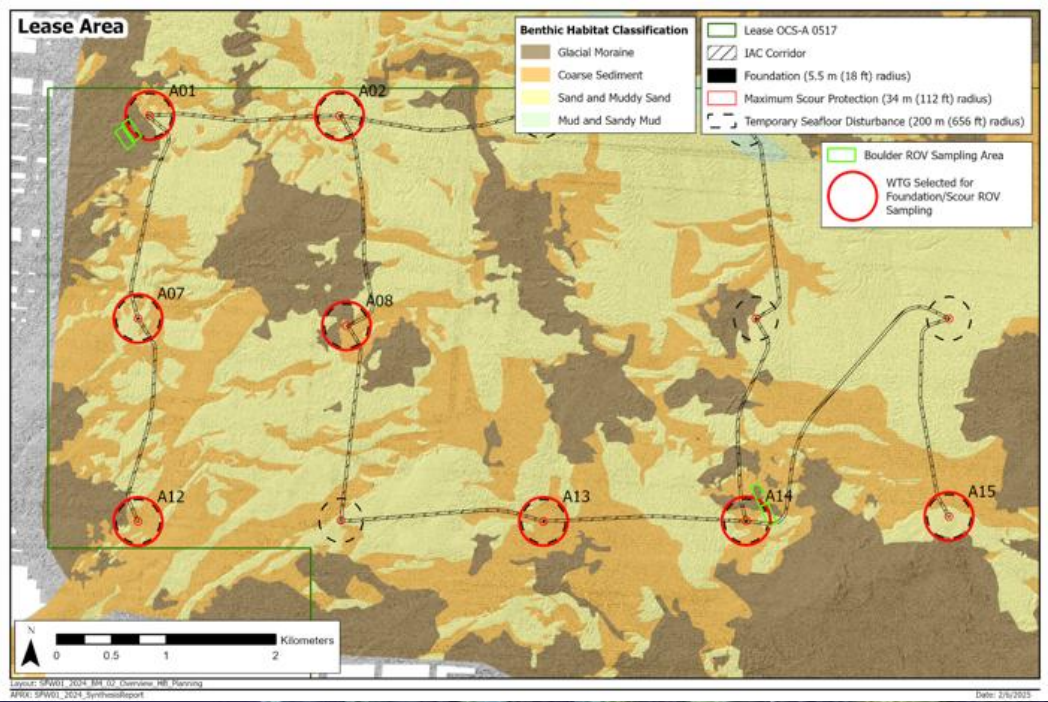
Novel Hard Habitat

Foundations, Scour Protection, Cable Mattresses

ROV surveys (2023, 2024) have documented community succession of epifauna growing on new surfaces; increased diversity and abundance of attached organisms over time



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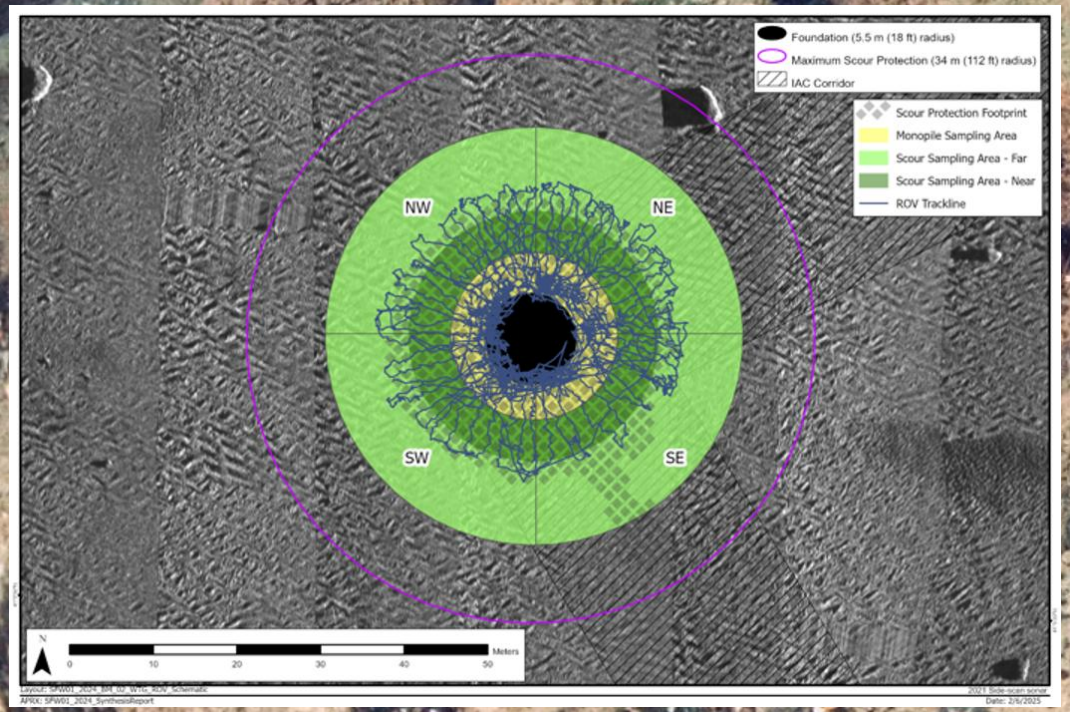

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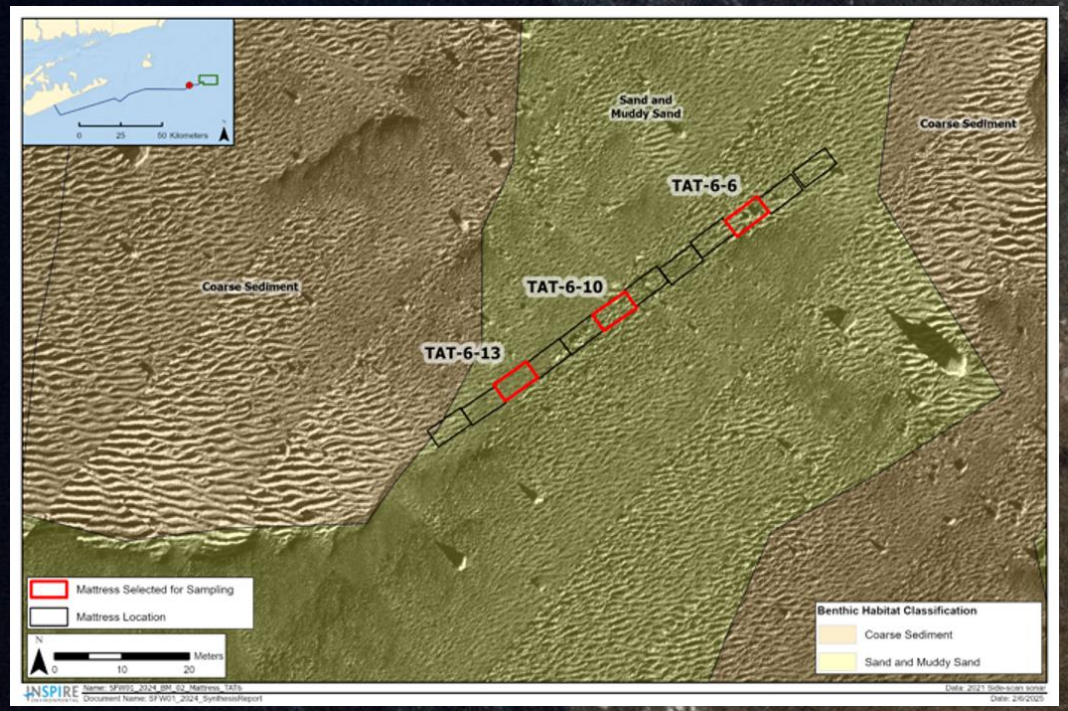
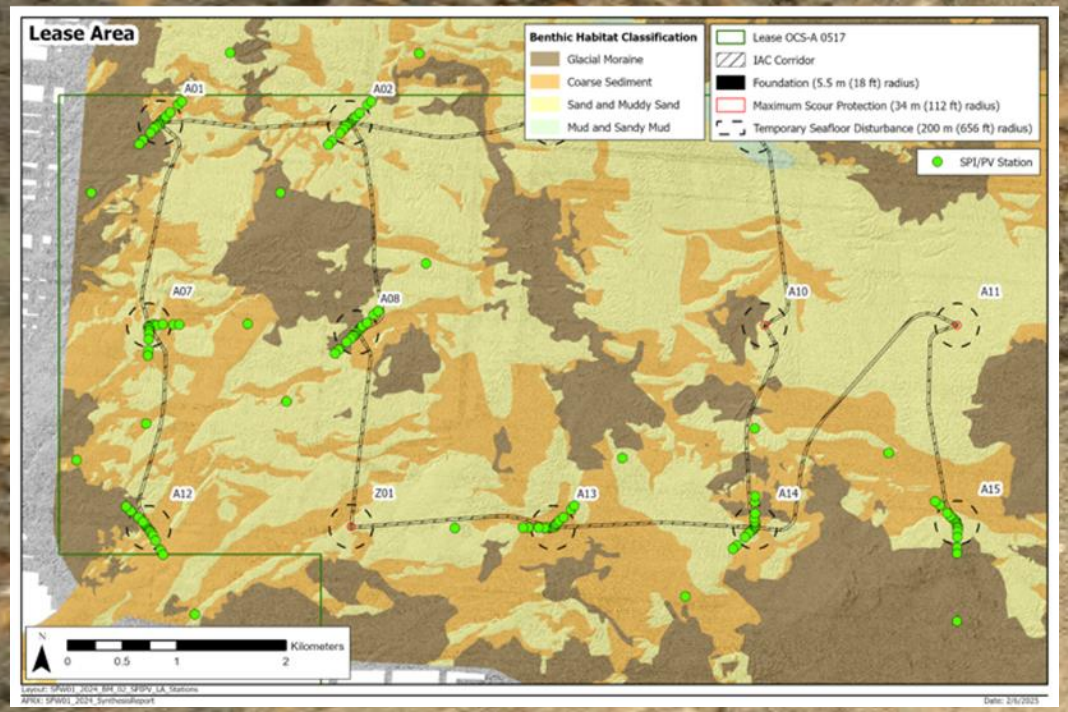


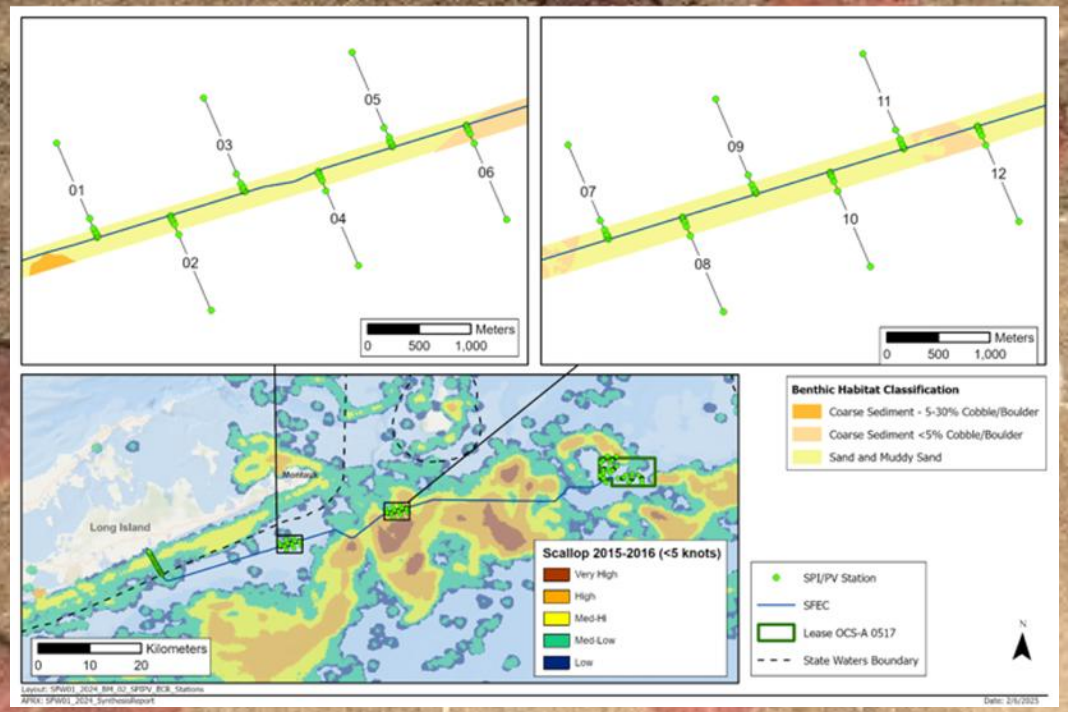
Adjacent Benthic Habitats

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



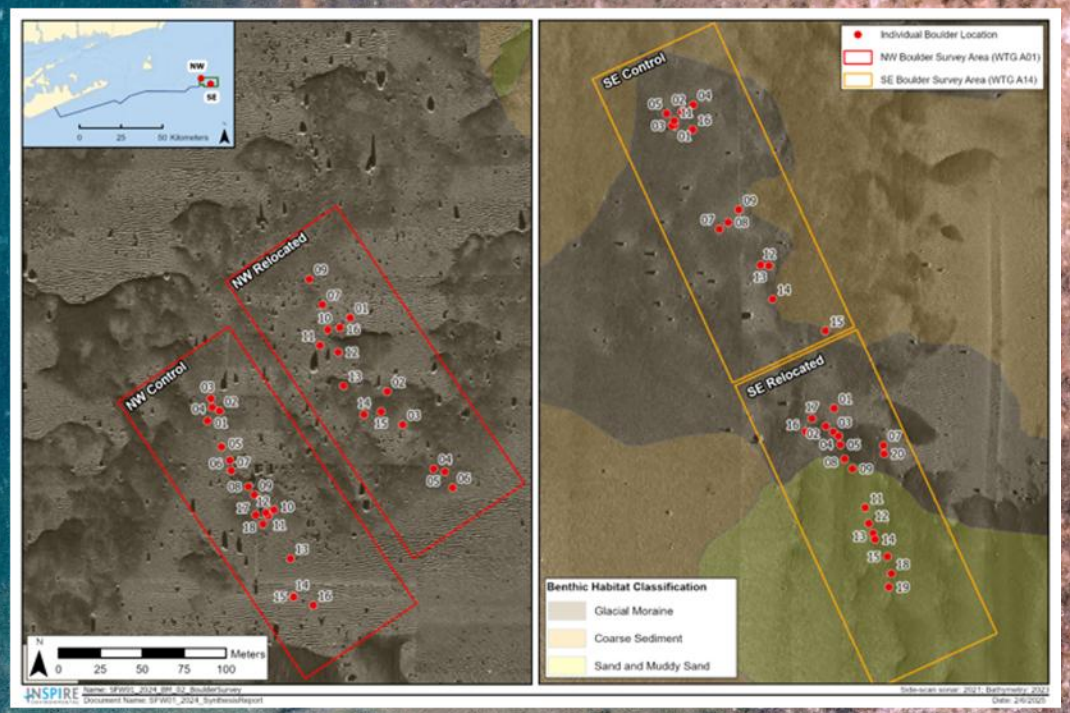
Adjacent Benthic Habitats

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



Adjacent Benthic Habitats

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




Black Sea Bass


Triggerfish


Mahi mahi

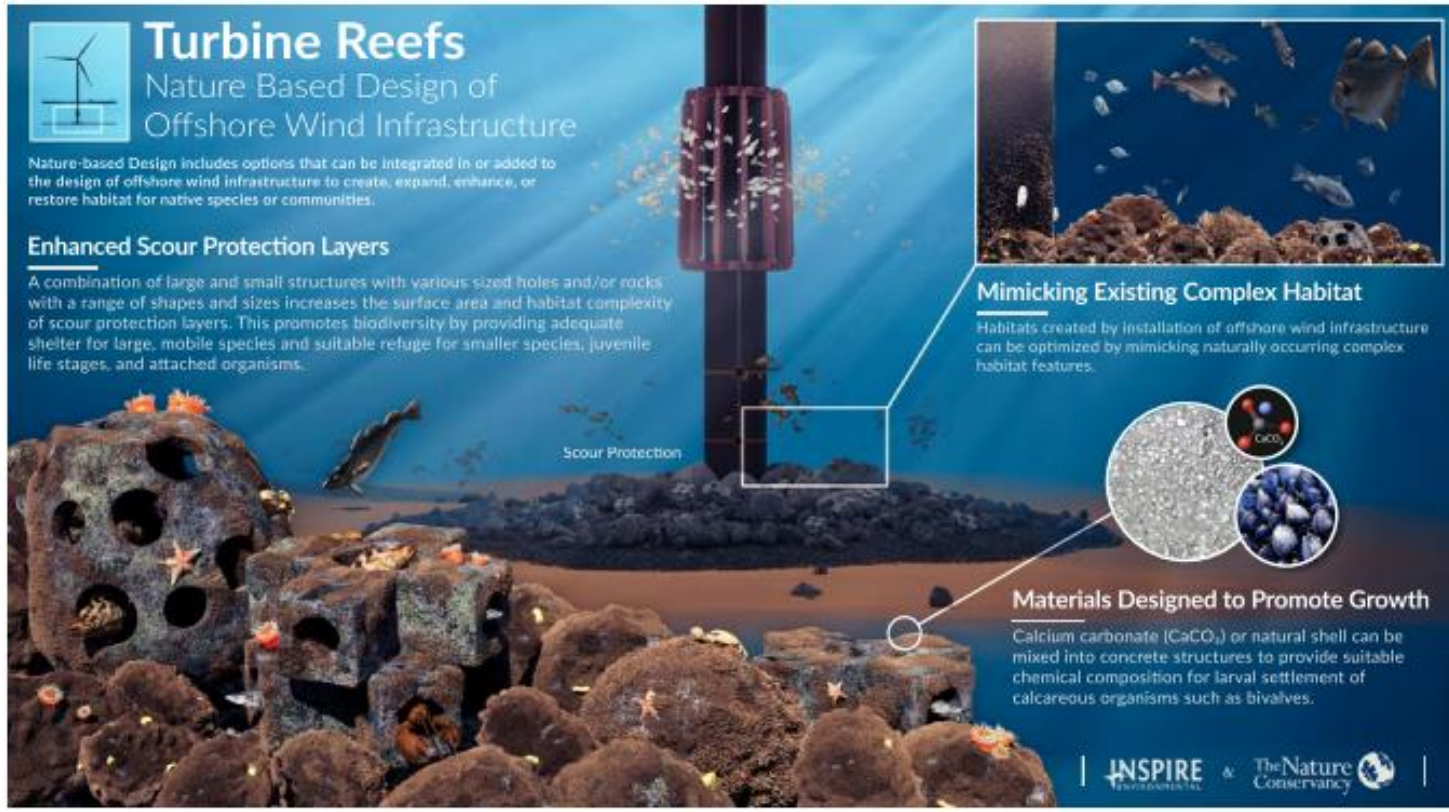

Winter Flounder


Atlantic cod


Sculpin

Engineering with Nature

- Can higher "performance" be achieved?
- Well, it depends on what the target/goal is…
- Indicator species, invasive species, sentinel species, bioengineering species, productivity
- "Performance" will depend on environment –
  - Surrounding benthic habitat
  - Hydrodynamics
  - Proximity to natural reefs/boulders
  - Fishing activity (mobile gear)



If (when) we build it …

Beyond Biodiversity, Shifts in Ecosystem Function

Intentional Engineering Aimed at Specific Goals

Hypothesis-driven Monitoring

Location matters

Spatial and temporal scales

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Questions?

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