State of Maine Offshore Wind Research Array

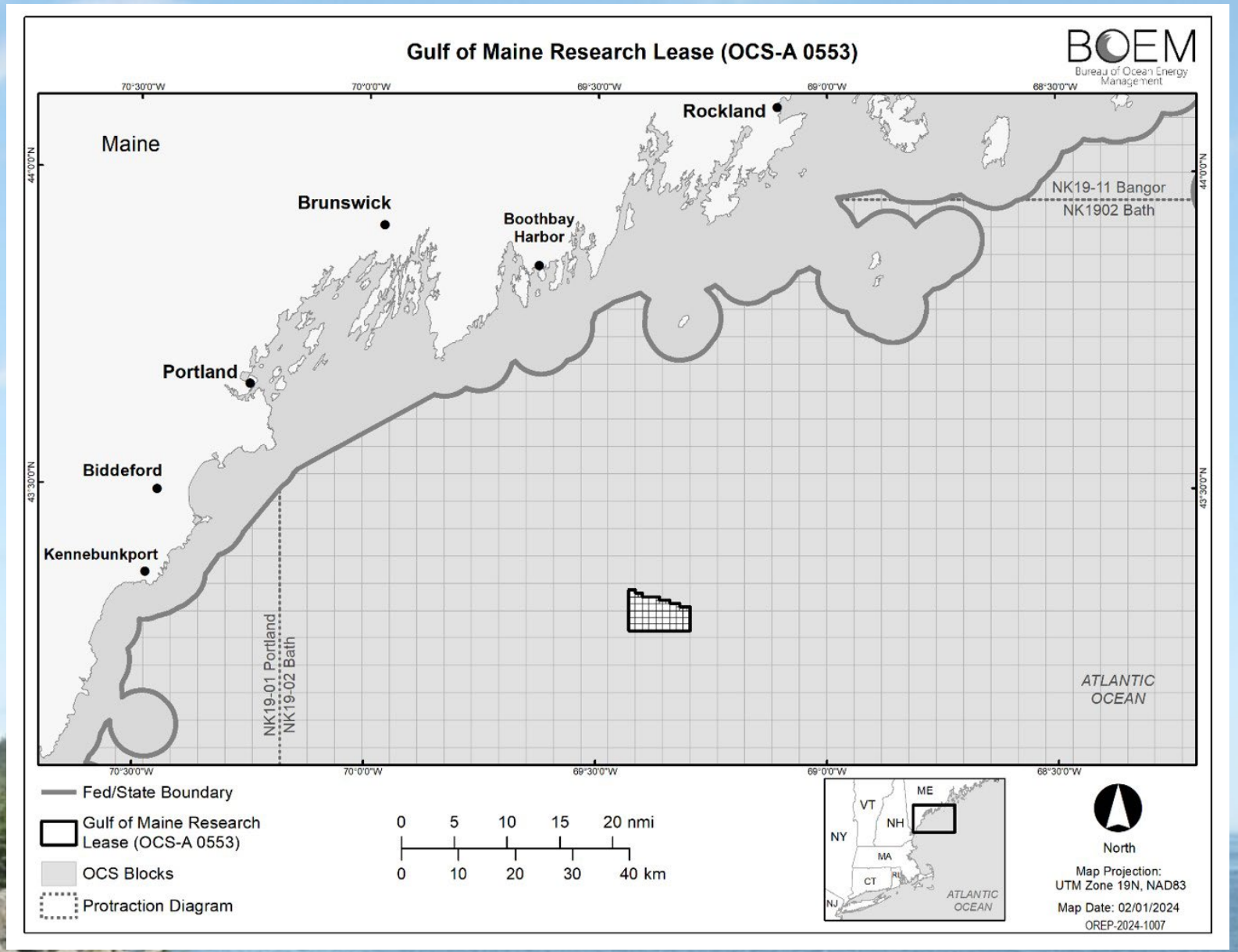
Massachusetts Habitat Working Group

Maine Update

October 10, 2024

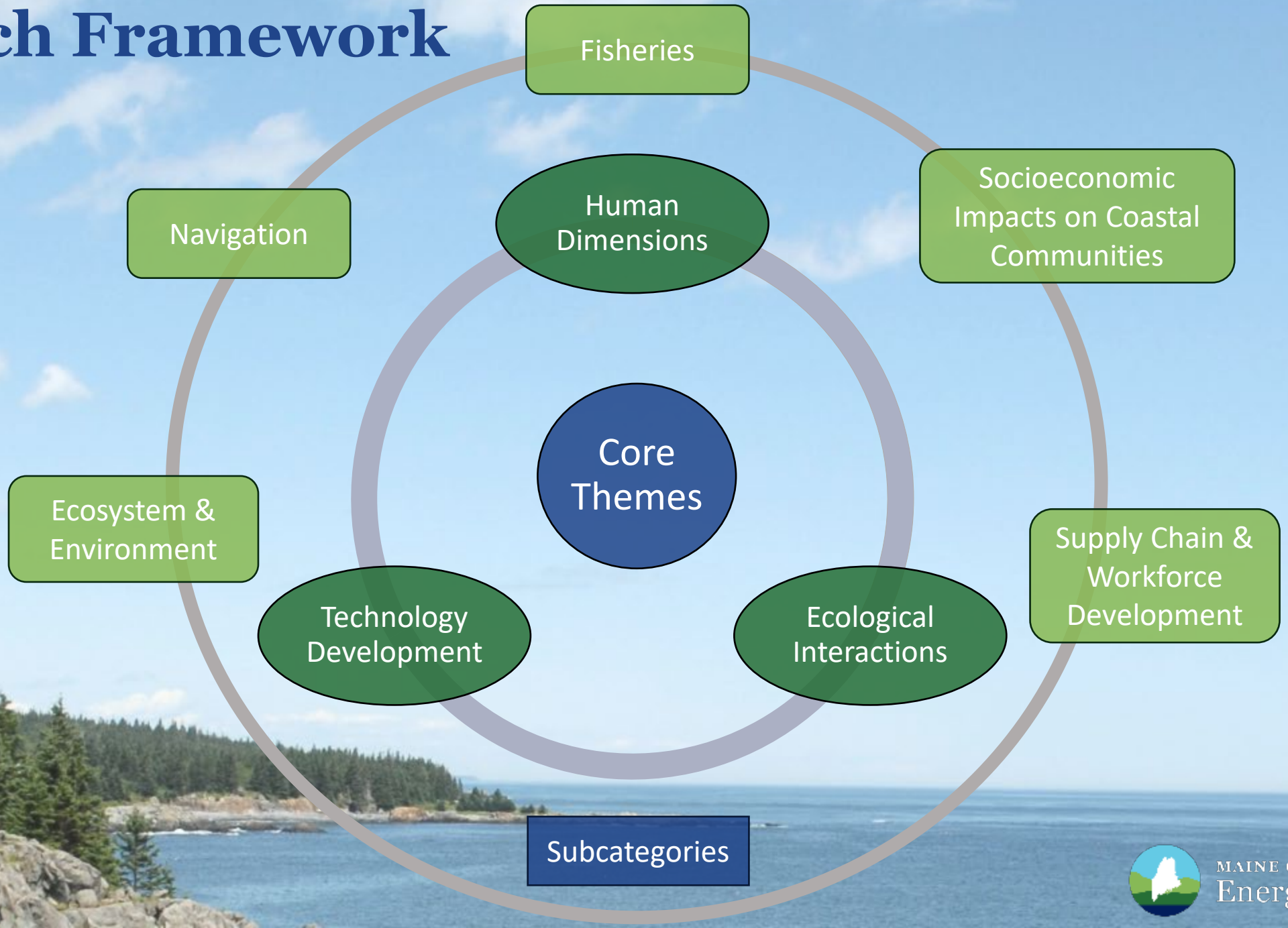
Casey Yanos
Marine Resource Scientist
Maine Department of Marine Resources

Research Lease Location



MAINE GOVERNOR'S Energy Office

Research Framework



MAINE GOVERNOR'S Energy Office

Research Underway

- Baseline surveys, monitoring, research (DMR)
- Baseline data collection and coexistence research (Maine Offshore Wind Research Consortium)
- Other baseline and research activities

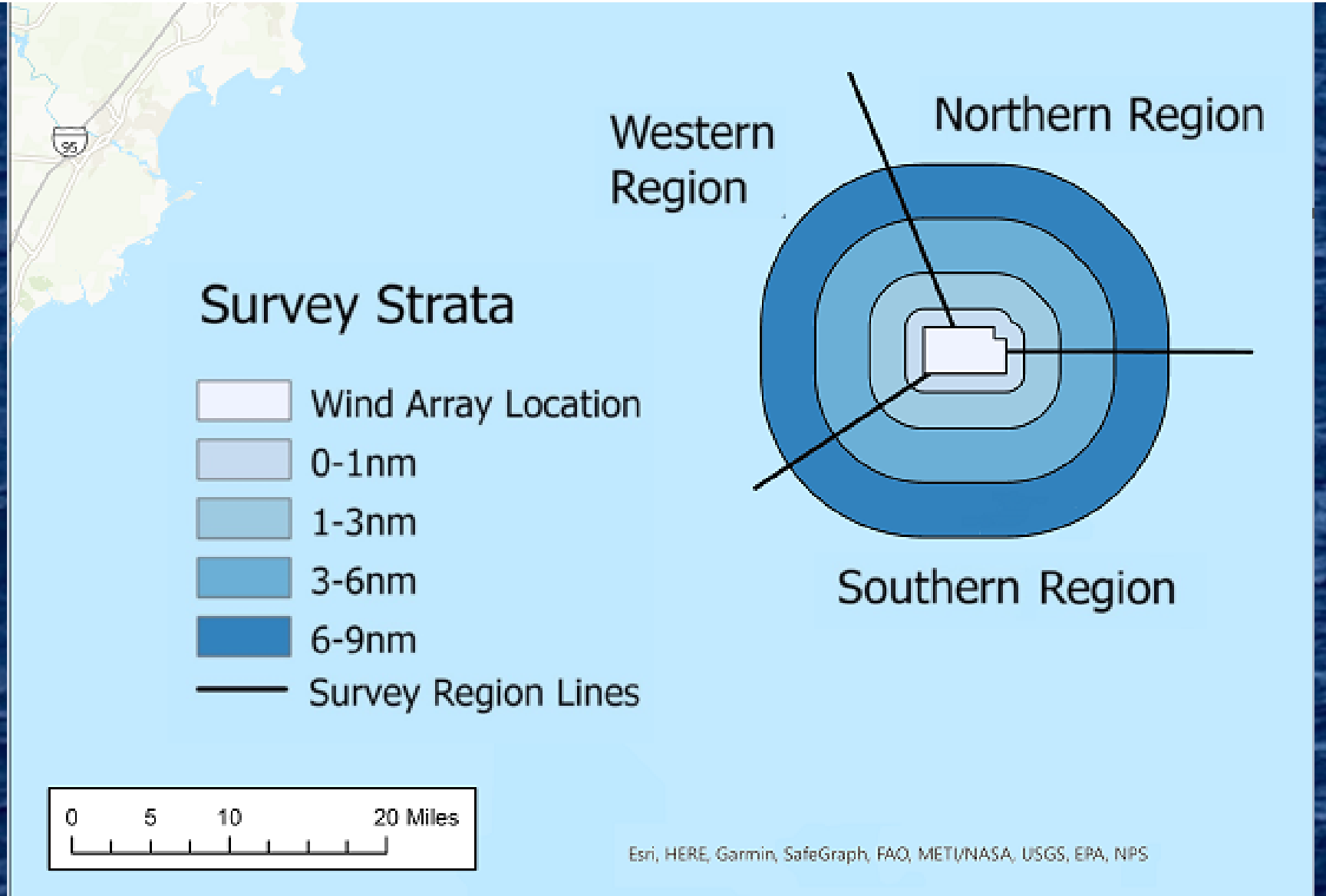
State Research Array Survey Plans

- **Trying to set up a framework for understanding impacts to the whole ecosystem**
  - **Setting up surveys to measure causal links**
- Align with developer survey plans where possible
- Work with industry vessels where possible
- Work with partner organizations where possible

State Research Array Survey Plans

- **Additive to permitting requirements, based on recommendations of Offshore Wind Roadmap Fisheries Working Group**
- **Similar work to other surveys being conducted in the Gulf of Maine already, with higher intensity**
- **Subject to same permitting and consultation requirements that any similar survey work would be**

Before-After-Gradient Design



Maine DMR Research at the Array

Survey	Layout	Frequency
Visual Wildlife	Transect	Monthly
Mapping and Benthic Habitat Sampling	Before-After Gradient (BAG)	Undetermined
Passive Acoustic Monitoring	Grid	Continuous
Highly Migratory Species Monitoring	Grid	Continuous
Active Acoustic Survey	Transect	Every Six Weeks
Lobster Trap Survey	BAG	Seasonally
Oceanographic Monitoring	Undetermined	Monthly
Plankton and Larval Lobster Survey	Modified BAG	Monthly
Bottom Trawl Survey	BAG	Seasonally

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Other Research at Array

- Regional oceanographic modeling
- Oceanographic monitoring
- PAM
- Zooplankton changes in Western GoM
- EDNA
- Avian species distribution and modeling
- HFR currents
- Soundscapes
- Metocean data
- Expansion of buoy network
- Real-time data sharing infrastructure – Offshore Wind Metocean Data Pipeline (NERACOOS)
- Historic fishing use and Traditional Ecological Knowledge

Maine Offshore Wind Research Consortium

4 Research Areas:

- Reduce Co-Use Conflicts
- Reduce Impacts on Ecosystems
- Understand Socioeconomic Impacts and Community Benefits
- Advance Technology Development to Reduce Costs

Under each research area, there is a specific set of research topics and questions prioritized by the Advisory Board. These questions get refined through an iterative process with the Advisory Board, Collaborators, and other discussions – to ensure Maine is adding to the collective understanding of floating offshore wind in the Gulf of Maine.

Current Research Strategy is here:
https://www.maine.gov/energy/sites/maine.gov.energy/files/inline-files/MEOSWRC_DRAFT_Research%20Strategy.pdf

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Consortium Funded Projects

1. Socioeconomic Baseline Inventory

- Inventory data and metrics related to Maine's fishing communities through stakeholder engagement and research to inform a future socioeconomic impact assessment

2. Fisheries Coexistence

- Engage fishermen to explore definitions and considerations for coexistence and researching compatibility of FOW technologies with fishing gear used in the Gulf of Maine

3. Seafloor Mapping

- Map ~840 sq nm around the Research Array lease and potential cable corridors to fill habitat and seafloor classification data gaps

Consortium Next Steps

- **Fund research projects and raise additional funds for:**
  - Baseline data for bats in the Gulf of Maine
  - Baseline data on economics of fishing communities with goal to improve economic impact assessments
  - Risk assessments for secondary entanglement
  - Other topics identified in the Research Strategy

- Information from these projects will be shared widely with federal regulatory agencies, states, other governments, offshore wind developers, all stakeholders to inform responsible floating offshore wind development

Prioritized Research Needs

-Transmission planning/impacts (not explicitly in Research Strategy but came up a lot in prioritization #2)
-Necessary preparation for Maine's supply chain and workforce to support FOW
-Tech

- Floating wind technology and manufacturing developed in state
- Inter-array cables and other unique floating wind components
- Offshore transmission planning and technology improvements
- Advancing supply chain and workforce to support FOW
- Baseline bird surveys
- Technologies and approaches to reduce spatial footprint
- Technologies to monitor and minimize impacts to wildlife
- Socioeconomic impact assessment framework with longitudinal studies
- ~Wind Forecast Improvement Project in GoM
- Long-term research plan/strategy for the GoM (ex 10-year monitoring plan)

RWSC

Regional Wildlife Science Collaborative for Offshore Wind

Massachusetts Offshore Wind Habitat Working Group

Emily Shumchenia, RWSC Director

October 10, 2024

Implementing the Science Plan

Marine Mammals

Birds & Bats

Sea Turtles

Protected Fish Species

Habitat & Ecosystem (includes seafloor and oceanography

Technology

Data Governance

- Establishing the POWERON program with BOEM and NOAA Fisheries
- Annual Funding Strategy Meeting, Sept 10-11, 2024
- Characterizing the offshore wind and wildlife data landscape – Research Planning Map

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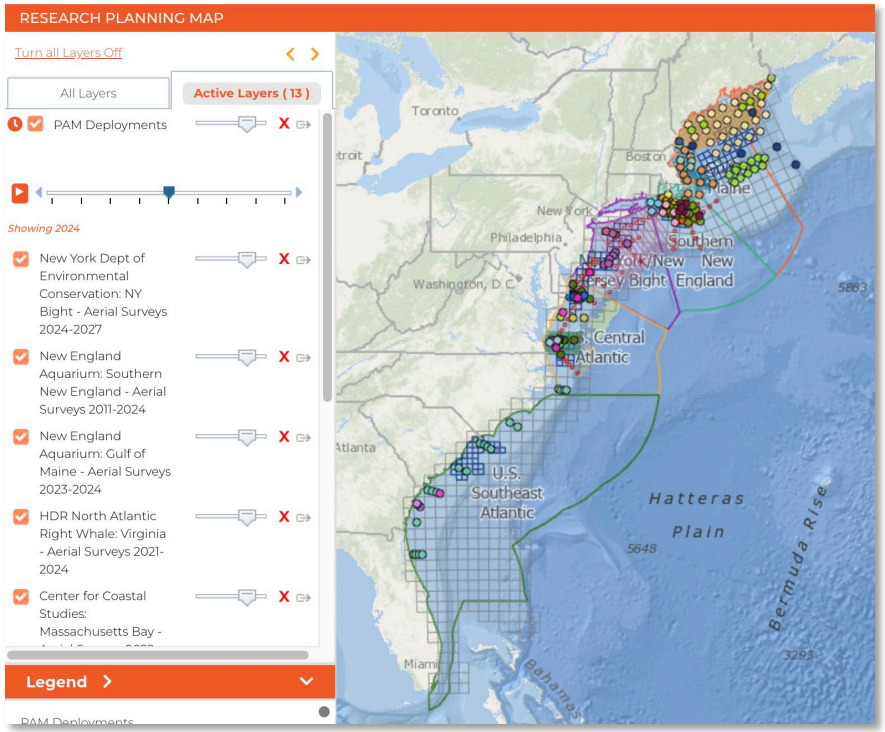
rwsc.org/science-plan

Establishing POWERON



- Partnership for an Offshore Wind Energy Regional Observation Network (POWERON)
- BOEM IRA funds to support marine mammal monitoring
- Contributions from offshore wind developers who opt-in to allow BOEM to conduct their required long-term PAM monitoring on their lease
- GOAL – coordinate a regional approach to deploying PAM, processing data, and long-term data management to support understanding of baleen whale movement and presence in U.S. Atlantic waters with respect to offshore wind

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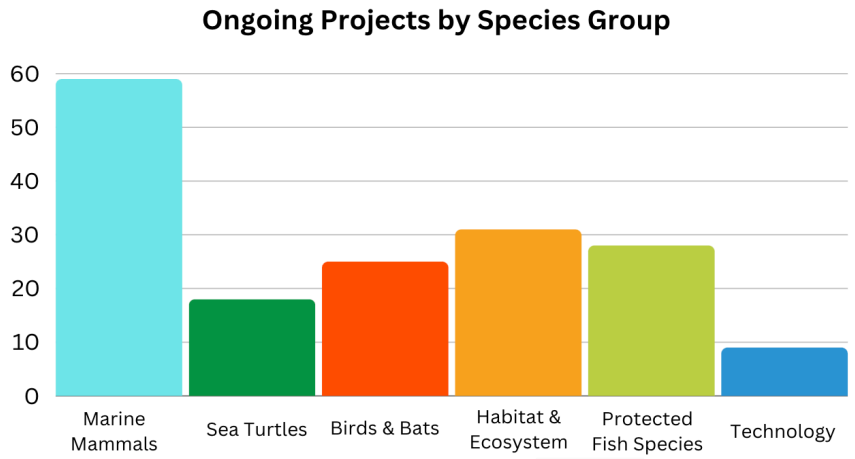
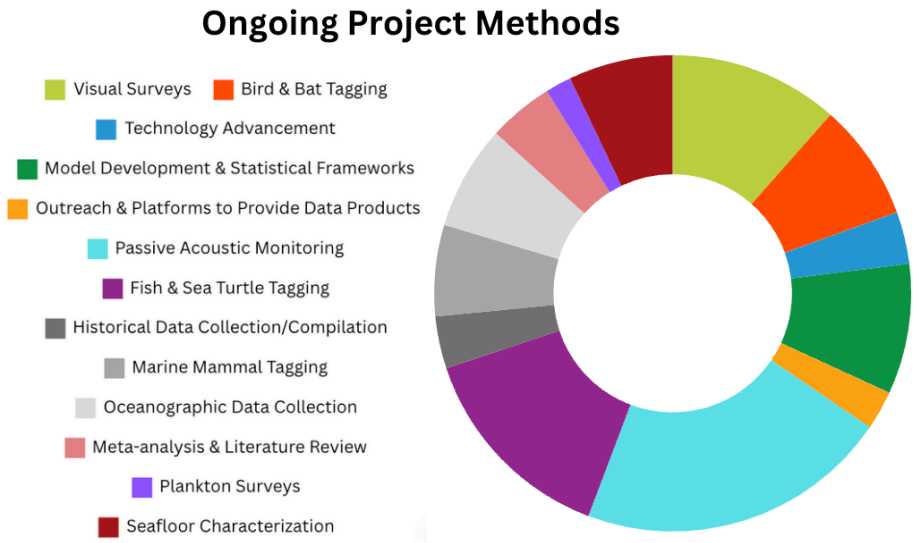
Establishing POWERON

- Funds to NOAA Fisheries to deploy/process/manage omnidirectional PAM sensors in Southern New England
- 36 months of funding ($4M) to RWSC to:
  - Maintain maps of who is funding/deploying PAM
  - Coordinate with PAM funders/interests including NOAA Fisheries, U.S. Navy, states, developers
  - Develop a PAM Field Plan each year, to be discussed and reviewed by the Marine Mammal Subcommittee
  - Implement the Field Plan (purchase and deploy hydrophones, QA/QC data, first-order detection data products, rolling uploads of raw data and data products to NCEI and NOAA PACM every 6 months
- Marine Mammal Subcommittee reviews Field Plan, Data Management Plan, and data submission reports

All Subregions together – 102 active projects; 31 total funders





Pending additional projects/funding:

- BOEM POWERON
- Projects to be selected by MassCEC
- Voluntary and/or required research funding associated with Tri-State RFP
- New Jersey RMI $4.75M, proposals due Oct ~~9~~ 22 2024
- Empire Wind 1 ($4.05M) and Sunrise Wind regional monitoring (NY requirement)
- NOAA/NFWF Vessel Strike Avoidance Fund
- Maine Offshore Wind Research Consortium (Fall 2024)
- DOE Research & Development Fund- $48.6 million, selection in Spring 2025
- NOWRDC Solicitation 4.0: Innovations in Floating Offshore Wind - $10.6 million, selection Feb 2024

RWSC Annual Funding Strategy Meeting

- Invitees are members from all four sectors, representing most funders/requierers of offshore wind data collection
- **Funding Strategy Action Plan:**

  1. Implement the data standardization, data management, and coordination recommendations from RWSC and its Subcommittees (https://rwsc.org/research-data)
  2. Coordinate funding goals and pool funding to achieve bigger results
  3. Collaborate with other Caucuses within RWSC

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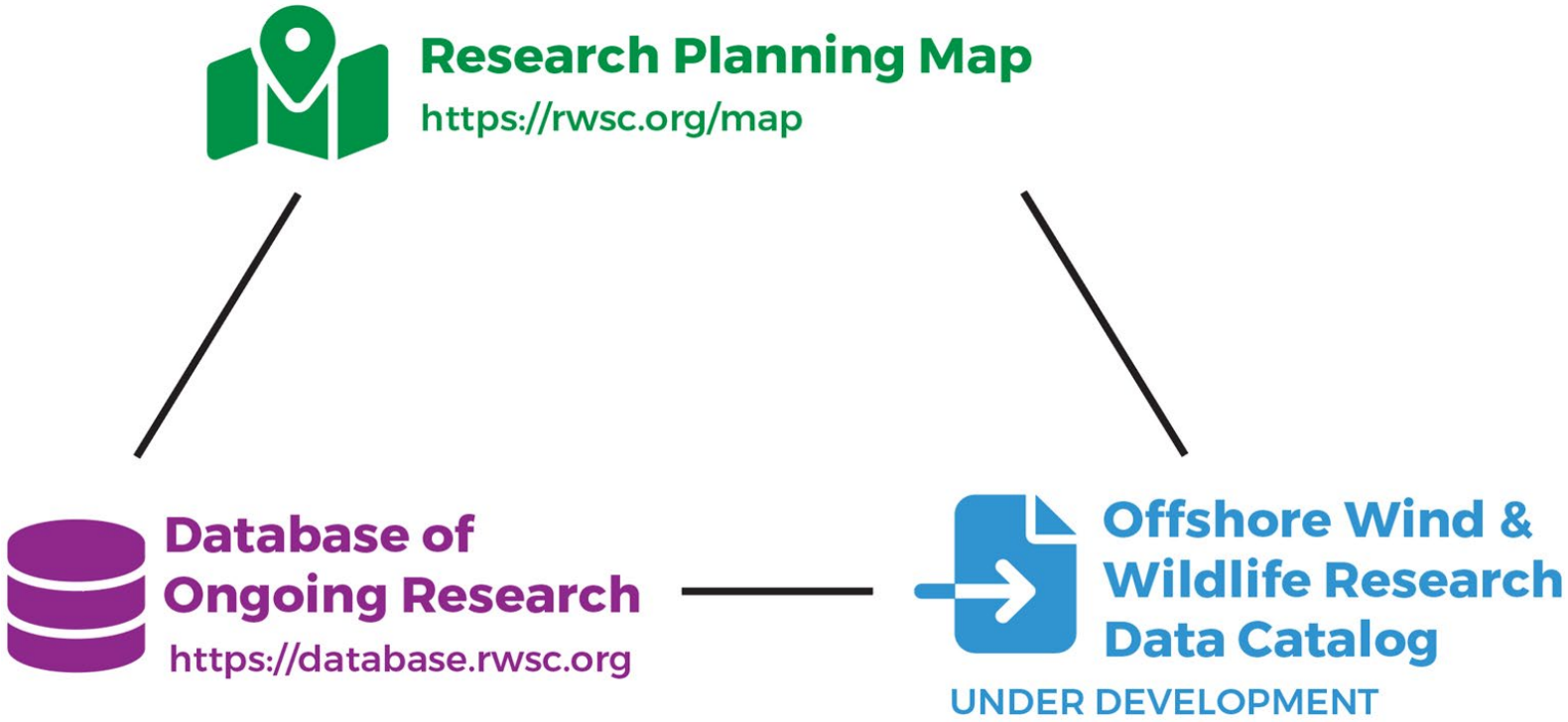
Regional Wildlife Science Collaborative for Offshore Wind

Offshore Wind & Wildlife Data Landscape



Who is funding what, and what is that funding producing?

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Repository Review Summary

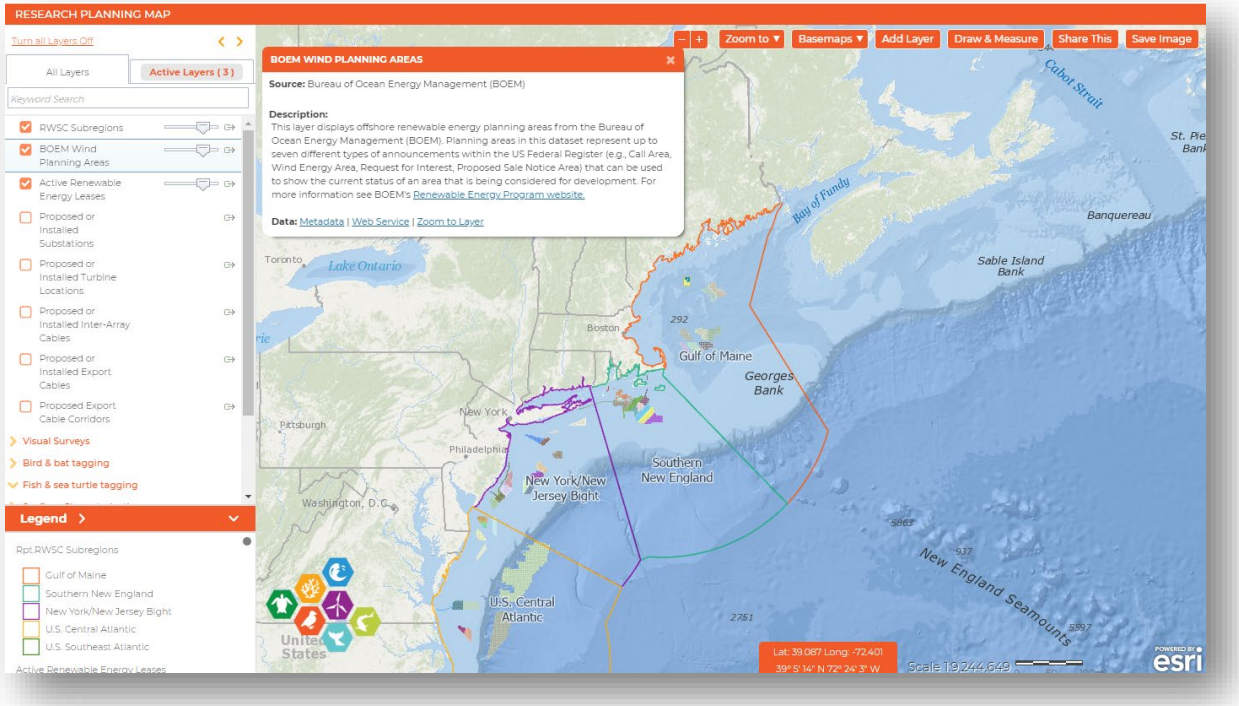
- 32 data places reviewed from all taxa/habitat chapters of the Science Plan
- ~10 were data repositories
- Many data places did not fully meet our criteria for true data 'repositories.' Under that definition, data repositories have to:
  - Accept data submissions and provide access for data reuse
  - Provide long-term data storage and preservation

And for connection to an Offshore Wind & Wildlife Data Catalog

  - Must share minimum metadata with the catalog

Research Planning Map

https://rwsc.org/map



- Shows the locations of where data are being collected/research conducted
- Includes POC for each effort and where available, includes links to:
  - Entry for project in RWSC Database
  - Where data are stored
- Funded by BOEM
  - Represents one year of data aggregations and app development (leverages Northeast Ocean Data Portal)
  - Another year remaining to refine data layers, build additional app functions, and determine long-term funding plan

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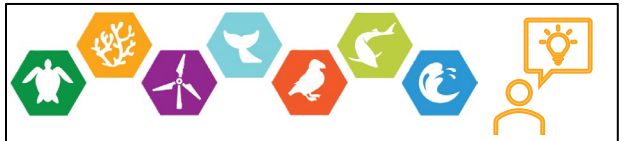
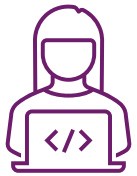
RWSC Research Planning Map Process



Data needs are identified by Subcommittee members

RWSC works to identify data source, or develops a template to collect data

RWSC GIS Staff, together with Duke MGEL, curates data for the RWSC Map



Metadata and GIS data are organized and uploaded to the Research Planning Map

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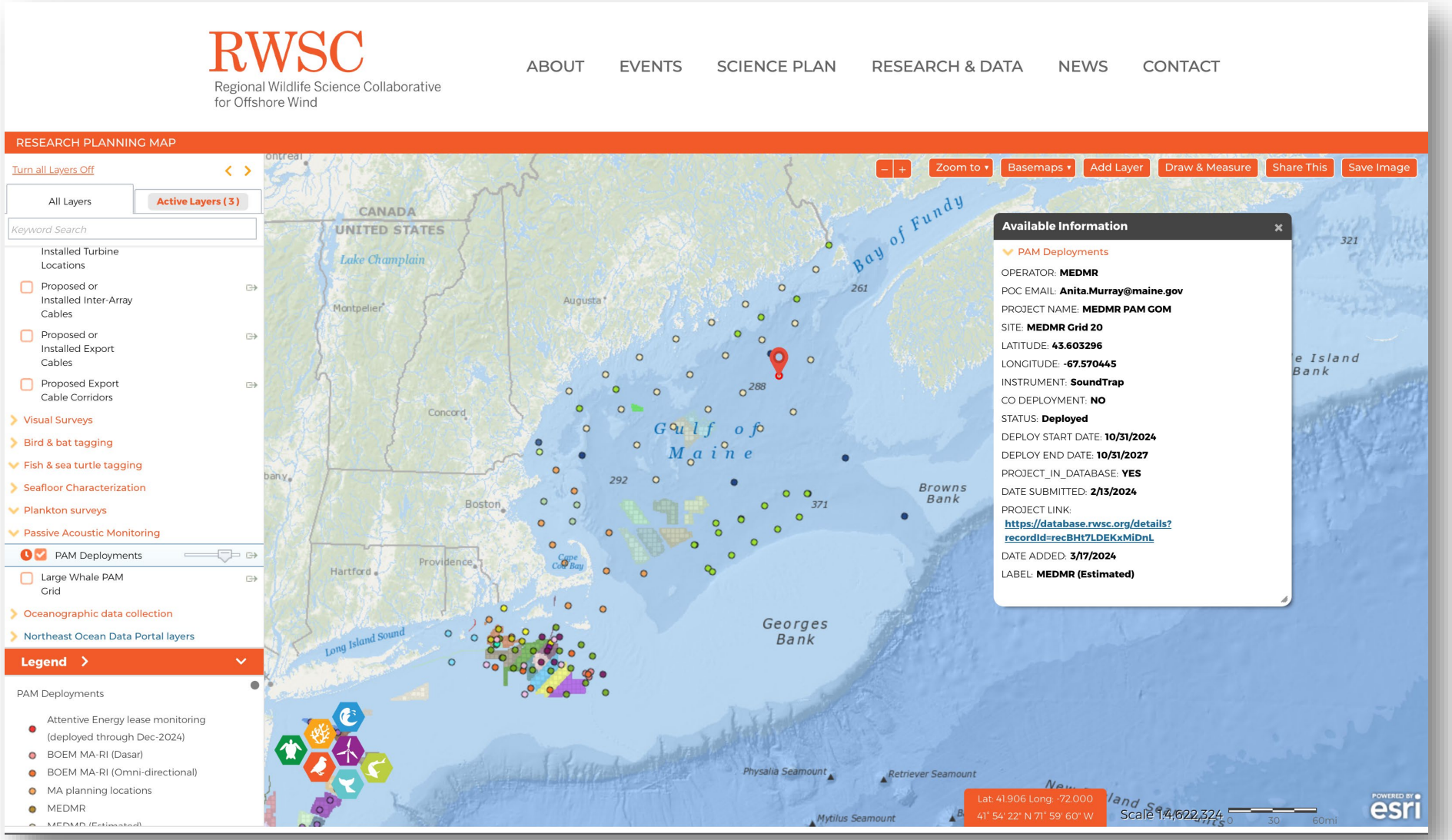
Research Planning Map

https://rwsc.org/map



Research Planning Map

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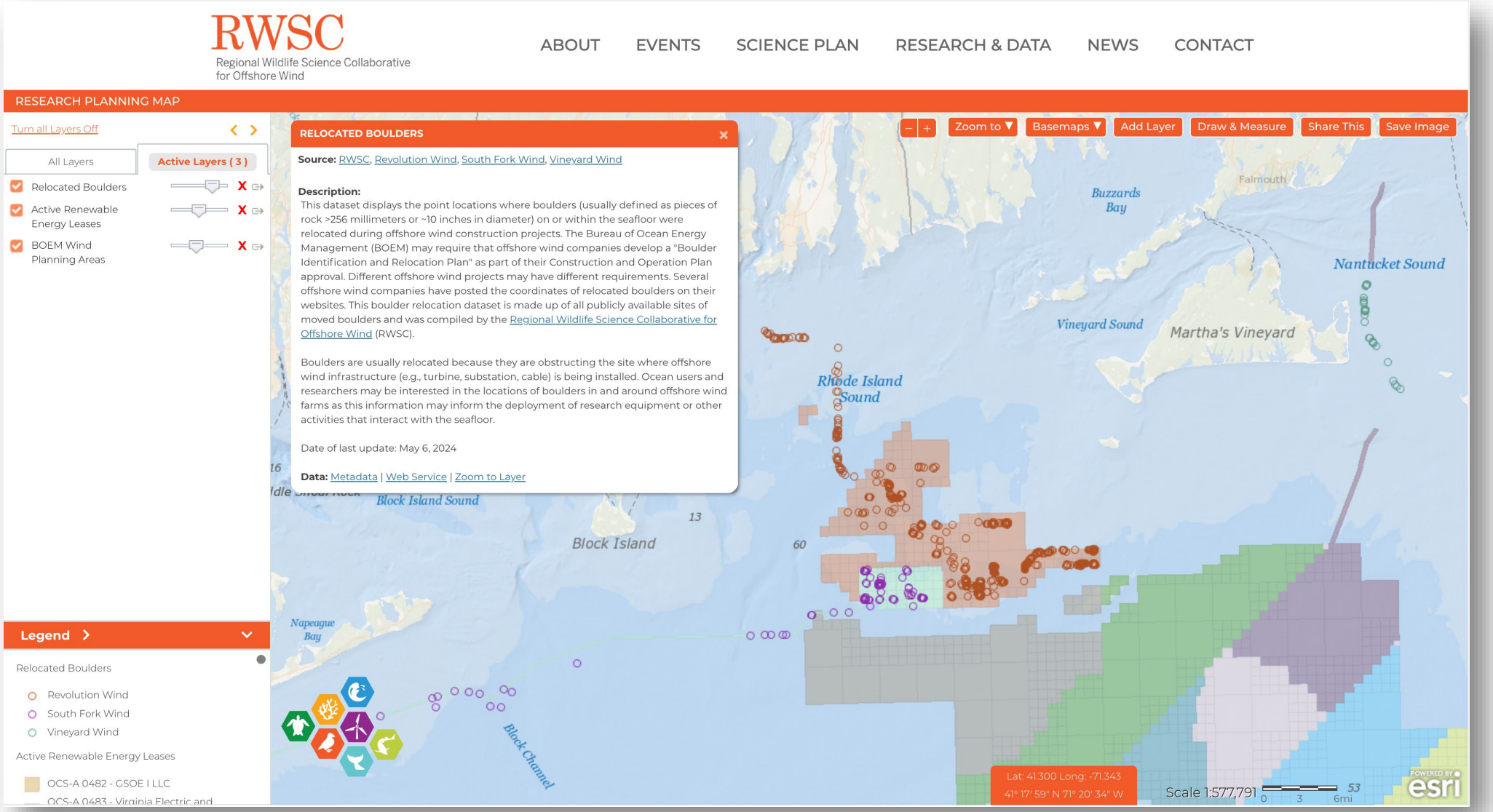
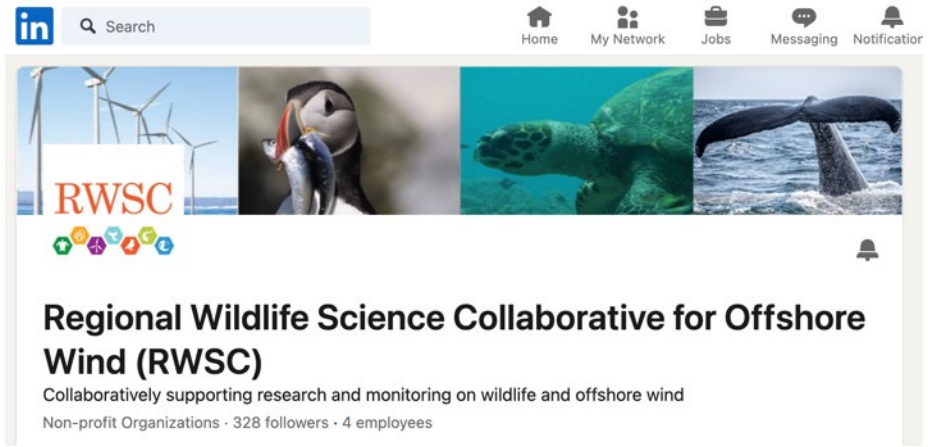


How to receive updates



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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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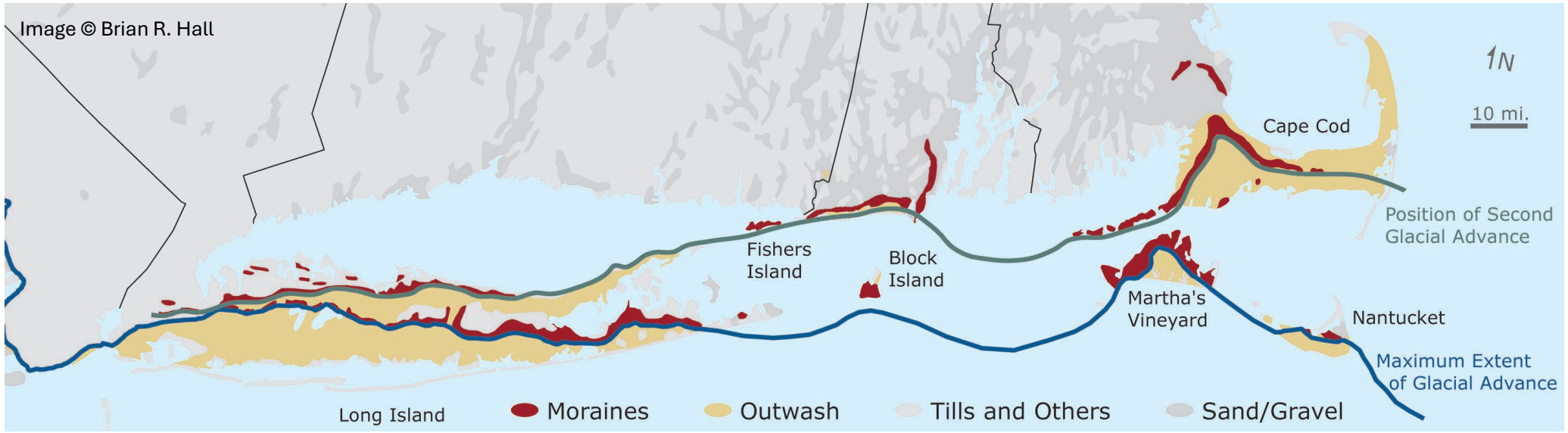
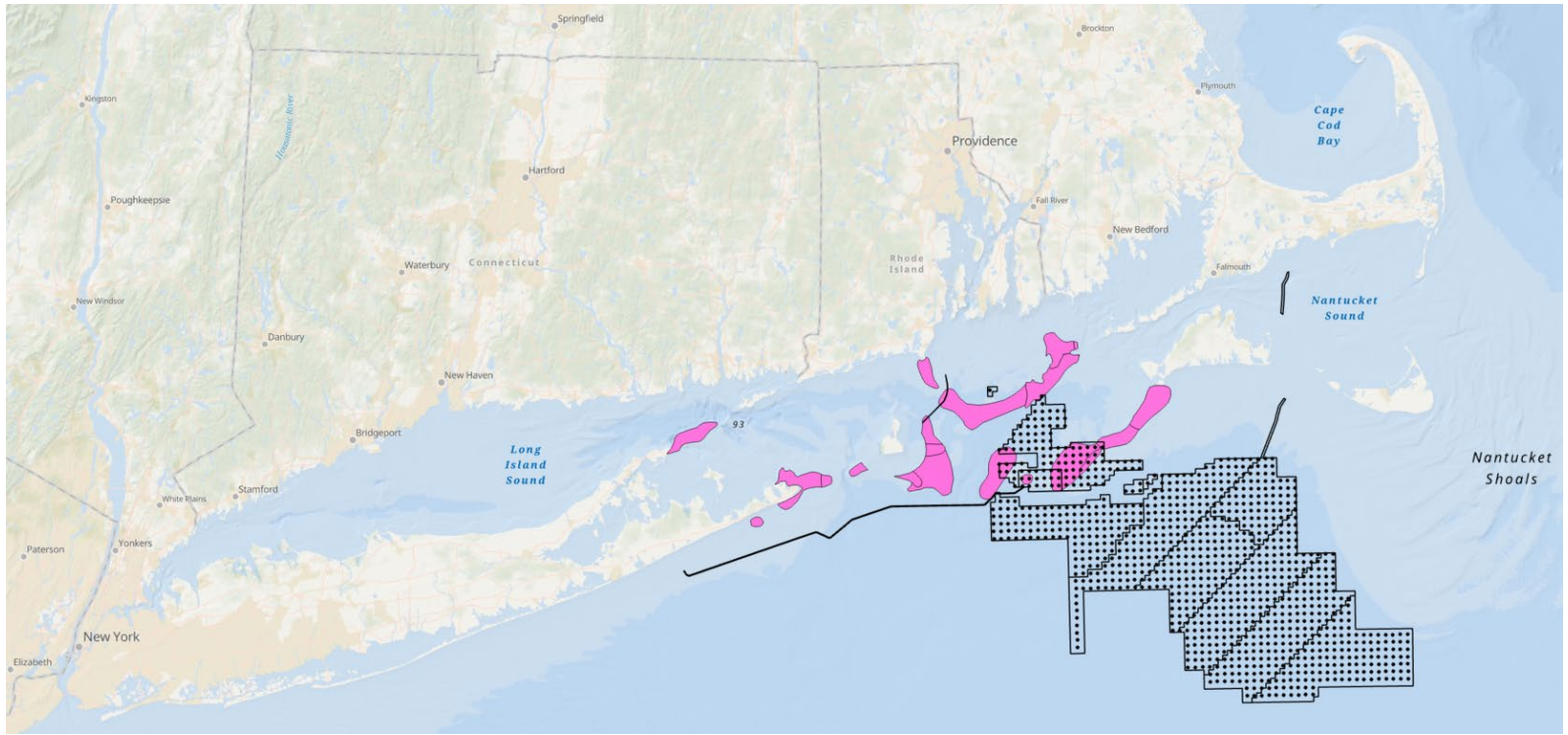
Boulder Relocation: Developing Management

Hollie Emery

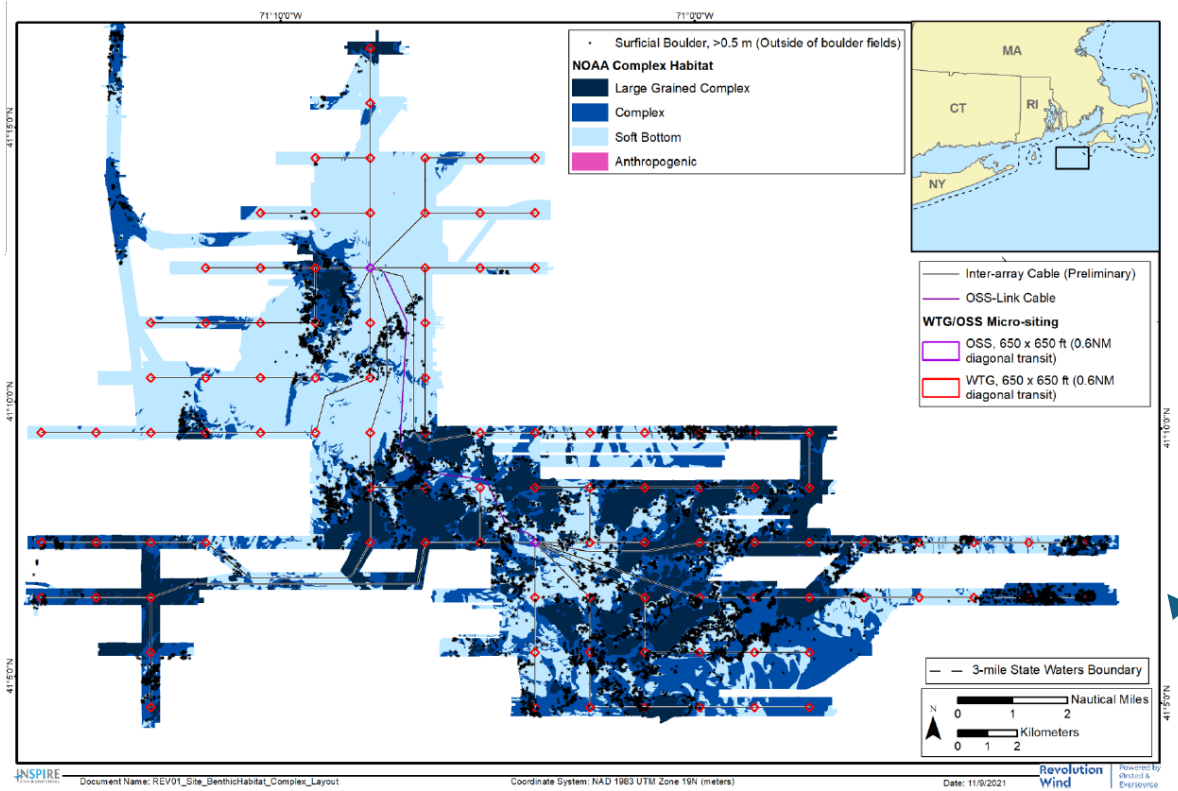
Massachusetts Office of Coastal Zone Management

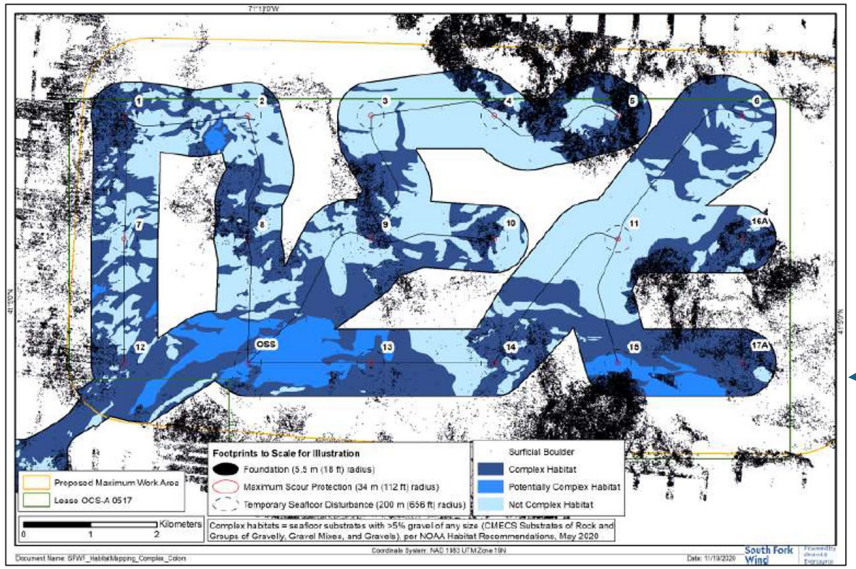


Geological Context

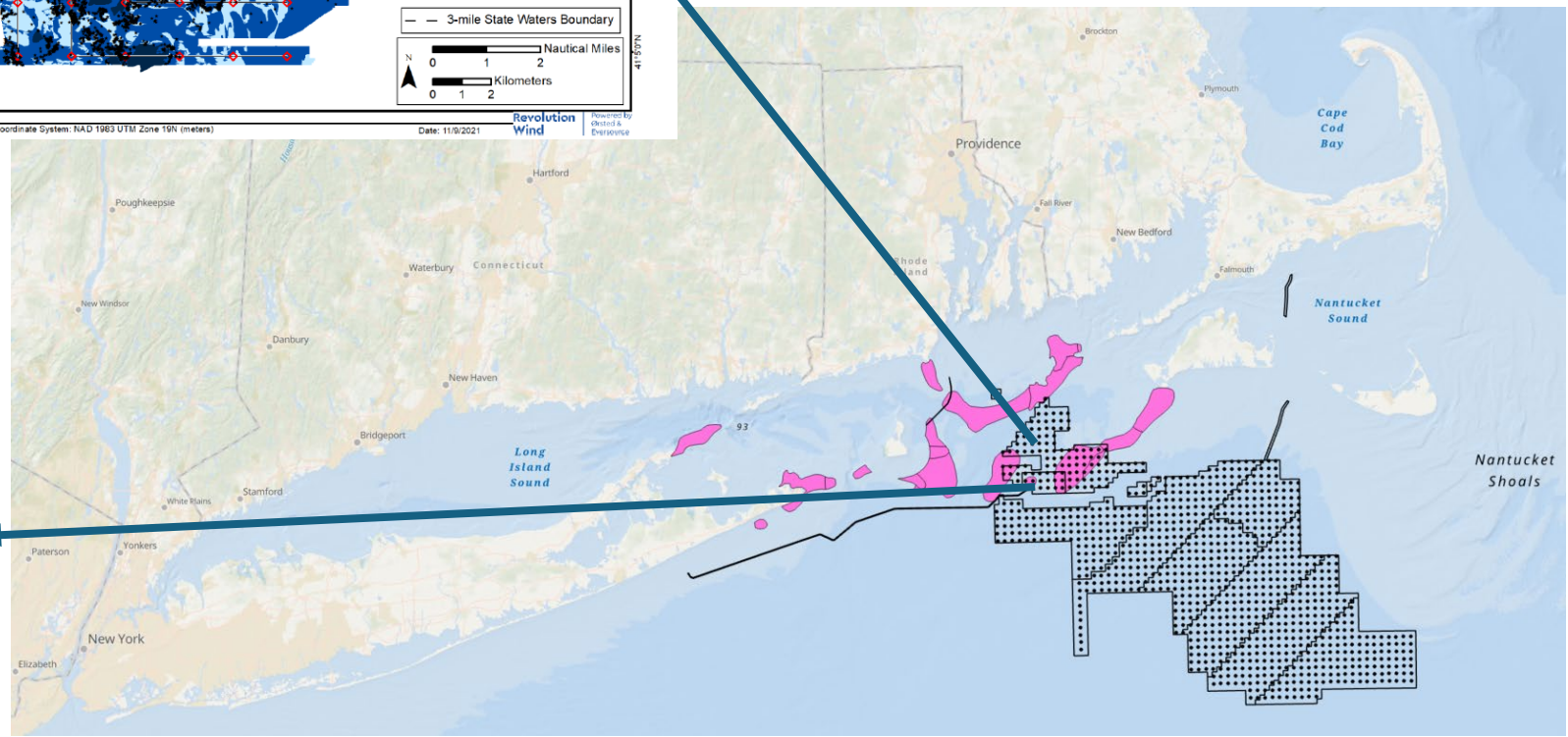


Revolution Wind DEIS
Figure 3.6-2





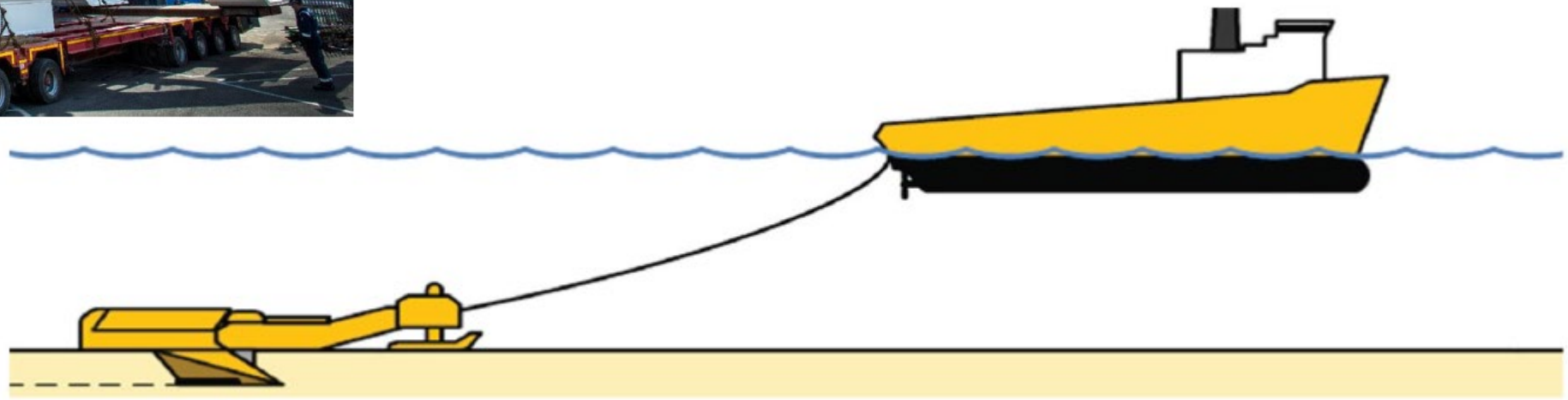
South Fork Wind DEIS Figure 3.4.2-1



Boulder relocation

Grab lift

Boulder plow

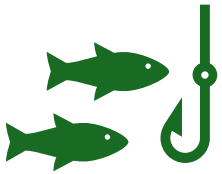


Figures from SouthCoast Wind COP and Sunrise Wind COP

Concerns raised by MA Fisheries Working Group

Safety

Creating new hangs



Fishing industry impacts

Gear damage

Loss of access

Habitat and stock impacts

Direct physical damage

Habitat conversion

Ecological changes

CZM developed a guidance document in response

Key Questions

For fishermen:

- What size boulder is a problem for what gear in what situations?
- How can impacts be minimized/mitigated?

For Offshore Wind developers:

- How/when/where are boulder moved?
- What options exist for beneficial reuse?

For fisheries managers and scientists:

- What studies have been done to understand impacts?

For regulators:

- What regulatory tools exist to address the above and are they working?

Potential boulder relocation impacts

Safety:

- New hangs pose a hazard to mobile gear

Other impacts to fisheries:

- Revenue loss due to reduction in fishable area
- Increased costs (e.g., gear damage or loss)
- Changes in stock levels due to displaced fishing
- Changes in stock levels due to habitat impacts

Potential boulder relocation impacts

Impacts to habitat and species (not limited to fisheries):

- Direct harm (e.g., crushing)
- Habitat conversion (sandy ←→ complex)
- Changes in predator/prey due to creation/loss of structure
- Invasive species spread (direct or indirect)
- Changes in habitat impacts from fisheries (e.g., if fishing is displaced)
- General impacts from seabed disturbance (not unique to boulders):
  - Sediment resuspension
  - Construction noise
  - Vessel strikes

Potential boulder relocation impacts

Location of impacts:

- Clearance area around foundations/scour protection (lease)
- Receiving areas distant from foundations (lease)
- Cleared/plowed cable corridors (easement)

Related impact producing factors:

- Scour protection
- Cable protection (e.g., concrete mattresses)
- Seabed disturbance (anchoring, jack-up, etc.)

Potential AMM

Avoid boulder relocation:

- Route cables away from boulder fields (sufficient surveys in the planning phase)
- Microsite cables around boulders

Minimize impacts when relocation is unavoidable:

- Minimize distance moved (habitat)
- Place boulders in groups or in existing boulder fields (safety and access)
- Individual relocation with grab vs plowing

Mitigate impacts when relocation is unavoidable:

- Beneficial reuse (scour protection, artificial reefs, etc.)
- Communication of final locations
- Consider boulder impacts when negotiating financial compensation agreements
- Note: Restoration not typically an option

Monitoring

- Before, during and after
- The right sampling modalities (photo/video/grab/DNA)
- Able to detect the key questions (e.g., presence of commercially important species, invasive species, etc.)
- MA CZM has guidance on best practices for monitoring, research, and mitigation: https://www.mass.gov/info-details/czm-offshore-wind-publications

Regulatory framework

Safety | Habitat

- BOEM COP approval Terms and Conditions
- NMFS Essential Fish Habitat consultation
- USACE
- State (e.g., MassDEP)

COP Terms & Conditions for Boulders and Berms

Avoid the relocation

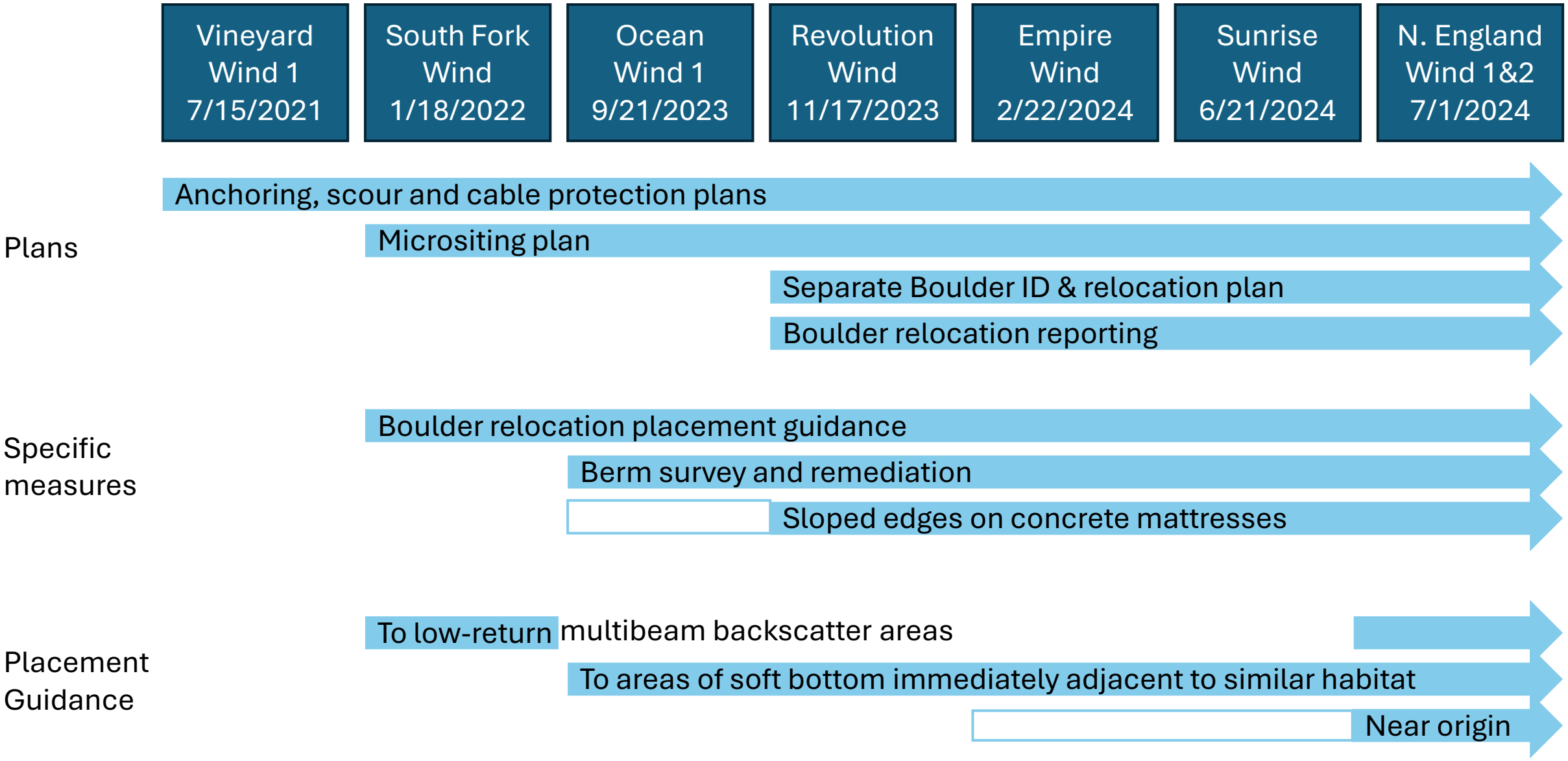
- Anchors, jack-ups, etc (must map boulders and try to avoid them)
- Cables, monopiles, etc (must try to microsite around boulders)

Minimize the impact if there is relocation

- Boulders required to stay inside lease/cable corridor
- Distance limits or “as close as practicable”
- Guidance on bottom type receiving the boulder
  - “in areas of soft bottom immediately adjacent to similar habitat”

Mitigate the impact that remains

- Berms remediated if they do not resolve
- Communicate new locations to agencies


Vineyard Wind 1 7/15/2021
South Fork Wind 1/18/2022
Ocean Wind 1 9/21/2023
Revolution Wind 11/17/2023
Empire Wind 2/22/2024
Sunrise Wind 6/21/2024
N. England Wind 1&2 7/1/2024
Plans
Anchoring, scour and cable protection plans
Micrositing plan
Separate Boulder ID & relocation plan
Boulder relocation reporting
Specific measures
Boulder relocation placement guidance
Berm survey and remediation
Sloped edges on concrete mattresses
Placement Guidance
To low-return multibeam backscatter areas
To areas of soft bottom immediately adjacent to similar habitat
Near origin

Boulder Reporting Requirements

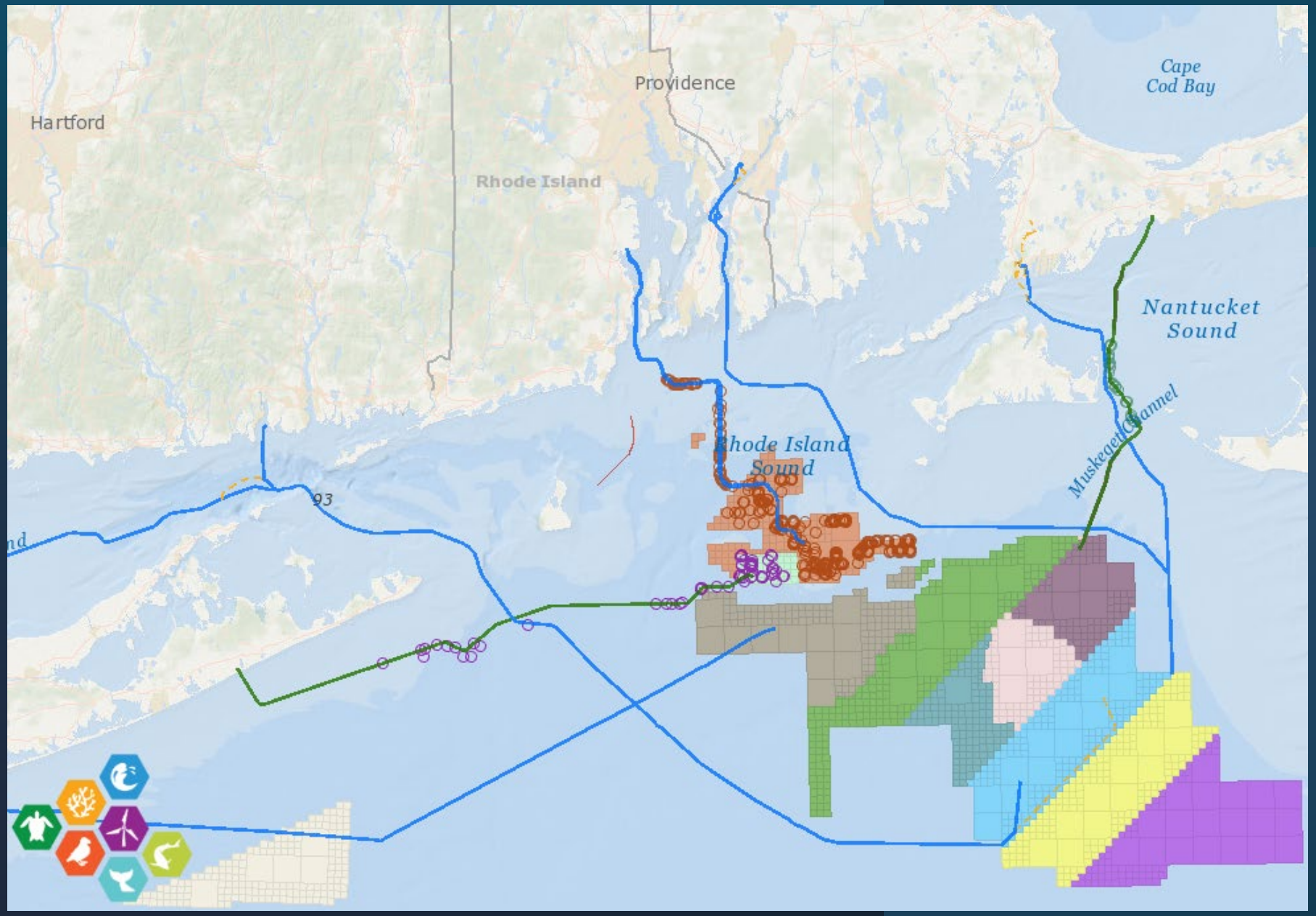
Boulder relocation report must be made to BOEM and BSEE at conclusion of boulder relocation: includes coordinates and dimensions of boulders as a shapefile

Coordinates (not dimensions) of largest boulders (> 2m) are to be reported to other federal and state agencies (and usually to the public) within 30 days of moving them

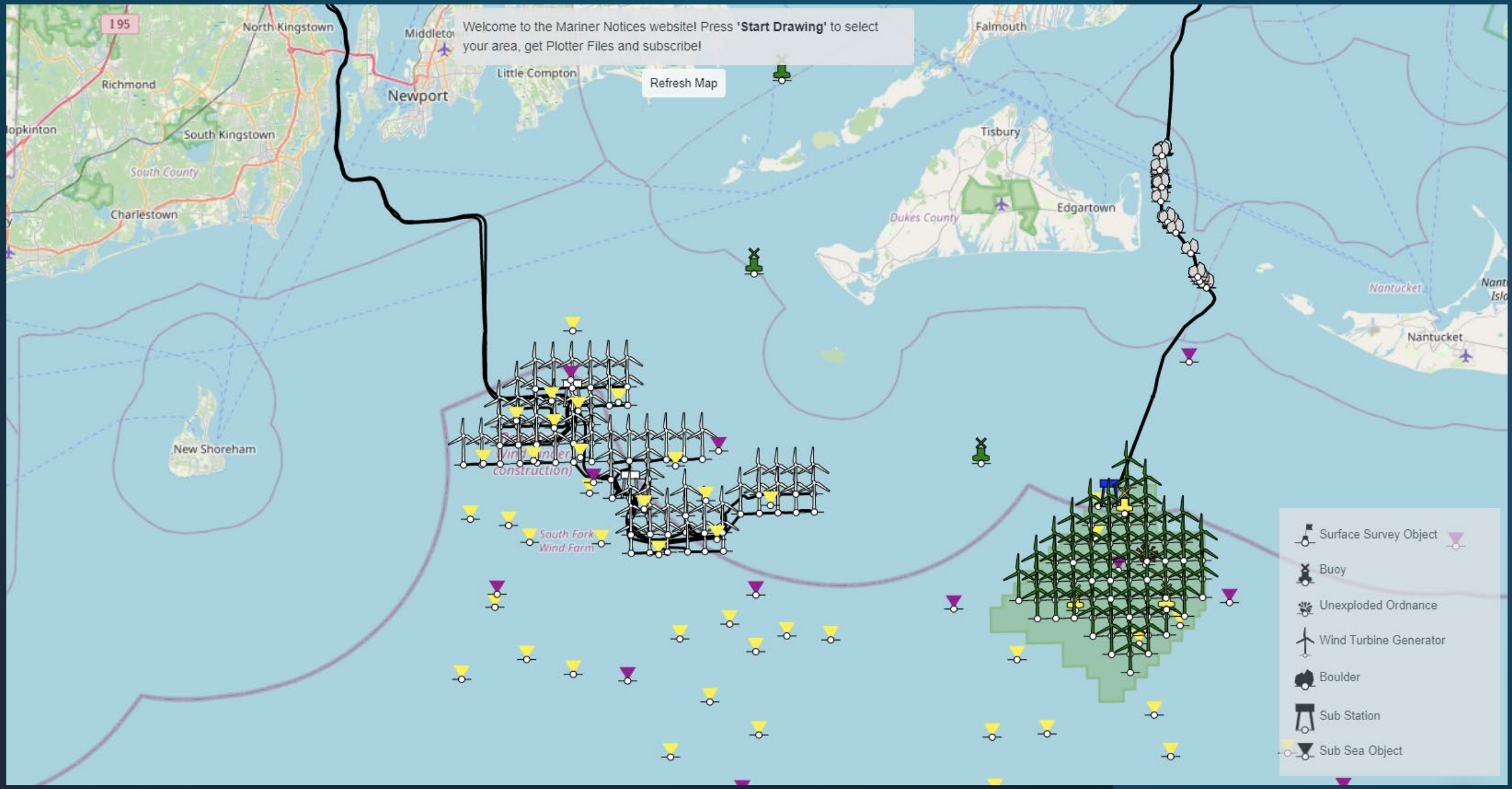
Boulder coordinates from Notices to Mariners

GIS layer available:

- RWSC Research Planning Map
- Northeast Ocean Data Portal



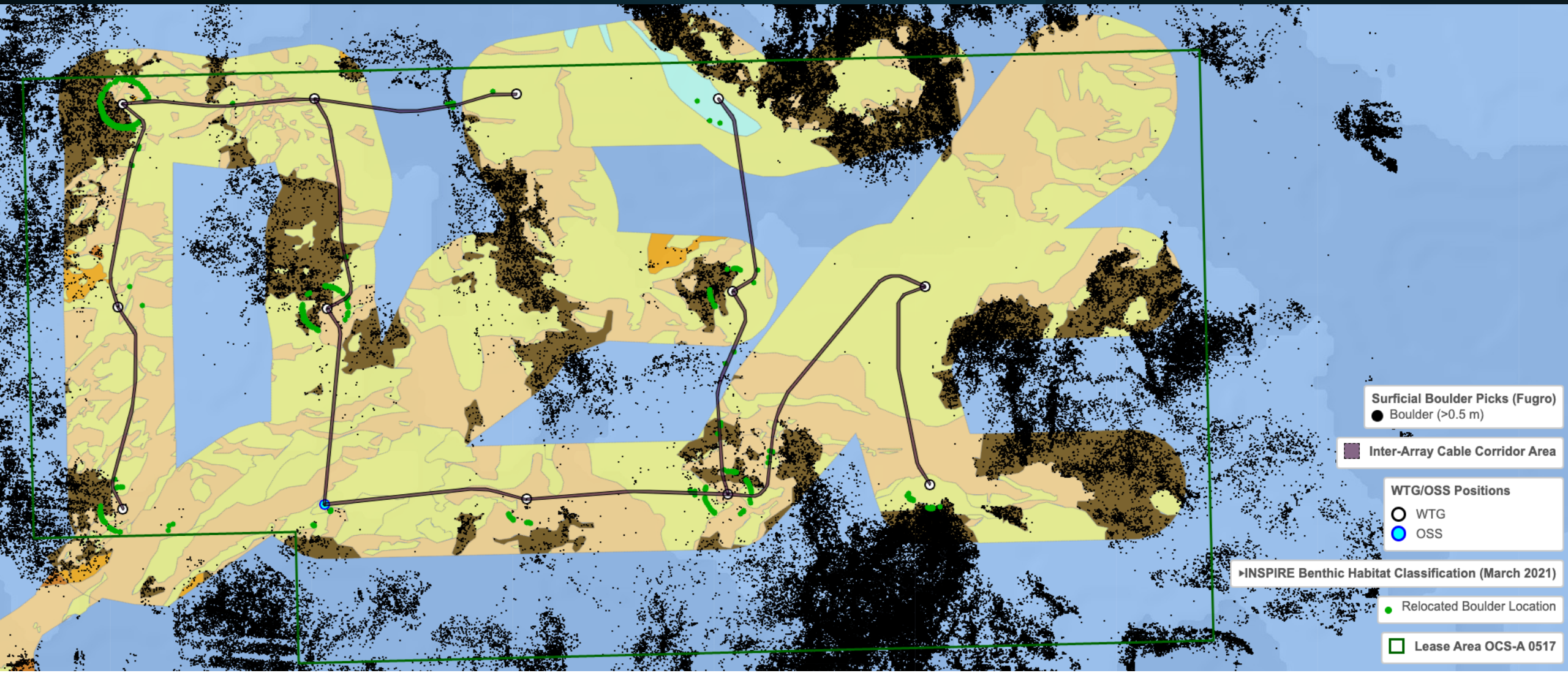
Quintham – provides plotter files



Boulder relocation

Image courtesy Annie Murphy

Black: original boulders
Green: relocated boulders



Boulder relocation

Image courtesy Annie Murphy

Black: original boulders
Green: relocated boulders

Future Directions

Actual impacts to habitat from boulder relocation are uncertain

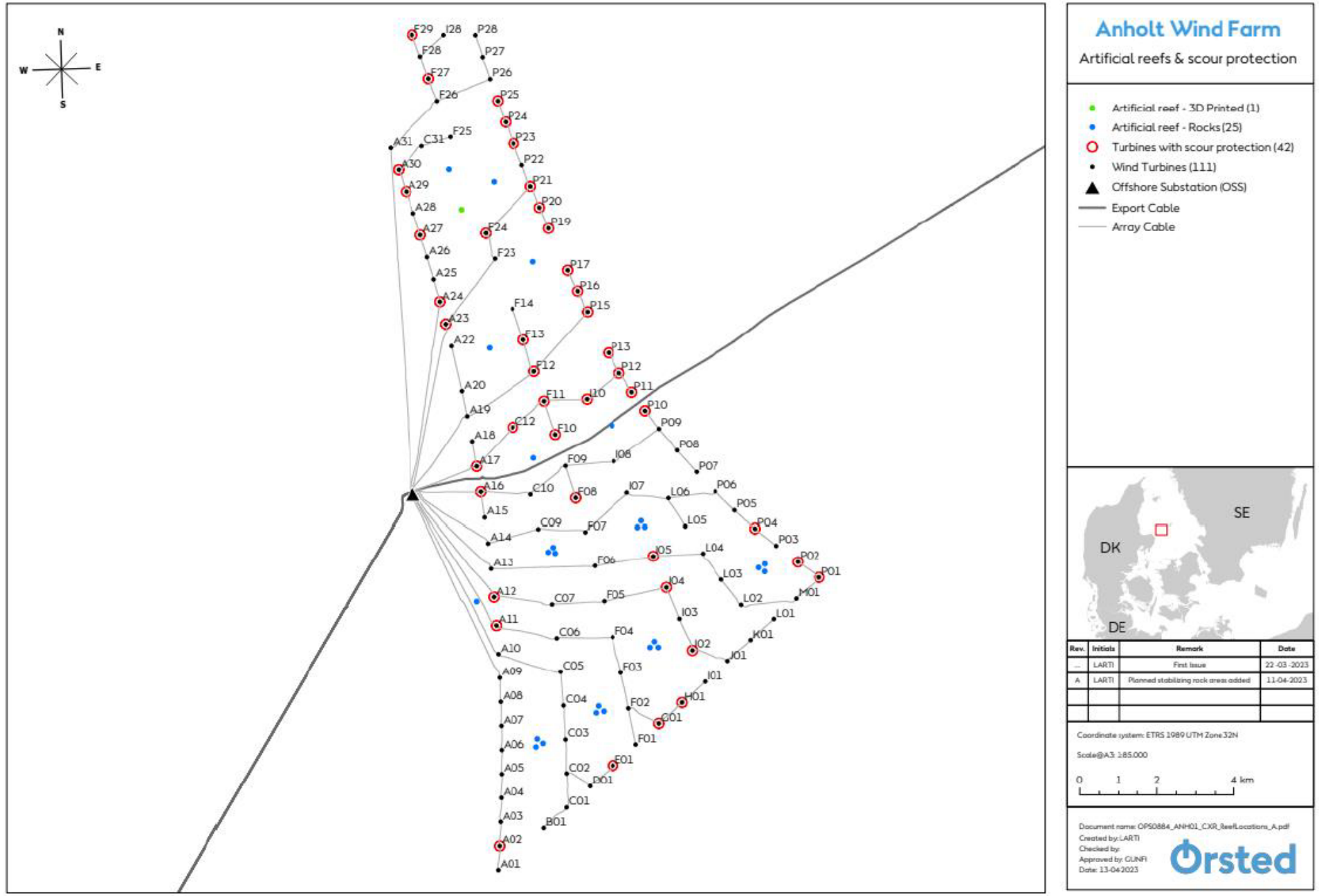
- Studies are underway

Actual impacts to fishing from offshore wind are uncertain

- Study is needed

Can communication of boulder locations be improved? How?

Options for beneficial reuse should be explored



Rev.	Initials	Remark	Date
...	LARTI	First issue	22-03-2023
A	LARTI	Planned stabilizing rock areas added	11-04-2023

Figure 2: Location of boulder reefs in Anholt Offshore Windfarm

Feedback?

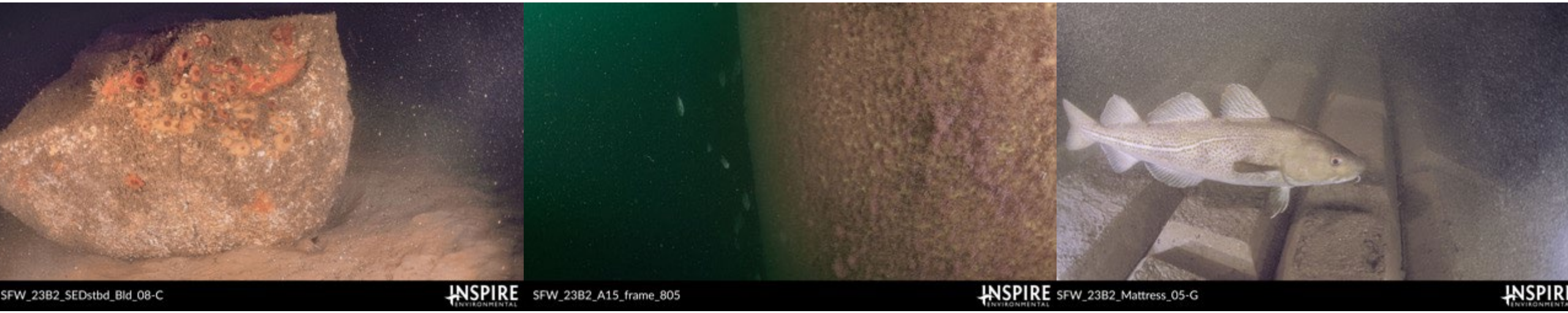
https://www.mass.gov/info-details/czms-role-in-offshore-wind

hollie.e.emery@mass.gov

South Fork Wind Boulder Relocation Benthic Monitoring

Annie Murphy

October 10 and 18, 2024



South Fork Wind | Powered by Ørsted & Eversource

annie@inspireenvironmental.com

INSPIRE ENVIRONMENTAL

Overview

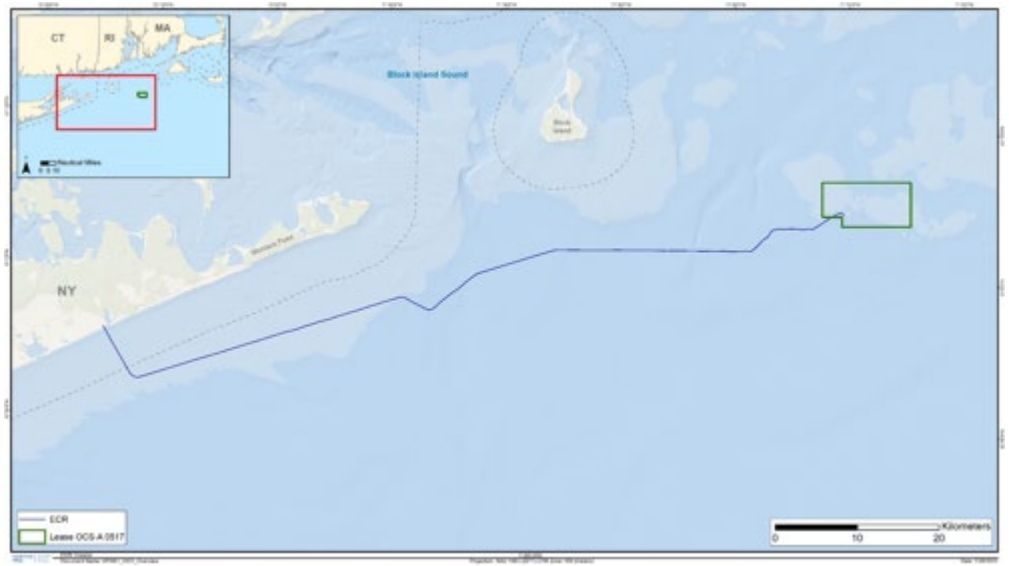
Monitoring plan
- Focused Benthic Studies
- Overview of Monitoring Schedules

Boulder Study
- Hypotheses
- Survey Design
- Methods

Results
- Image review
- Key results

Conclusions
- Implications
- Next steps

Visualization tools
- Popup
- Story Map



INSPIRE ENVIRONMENTAL

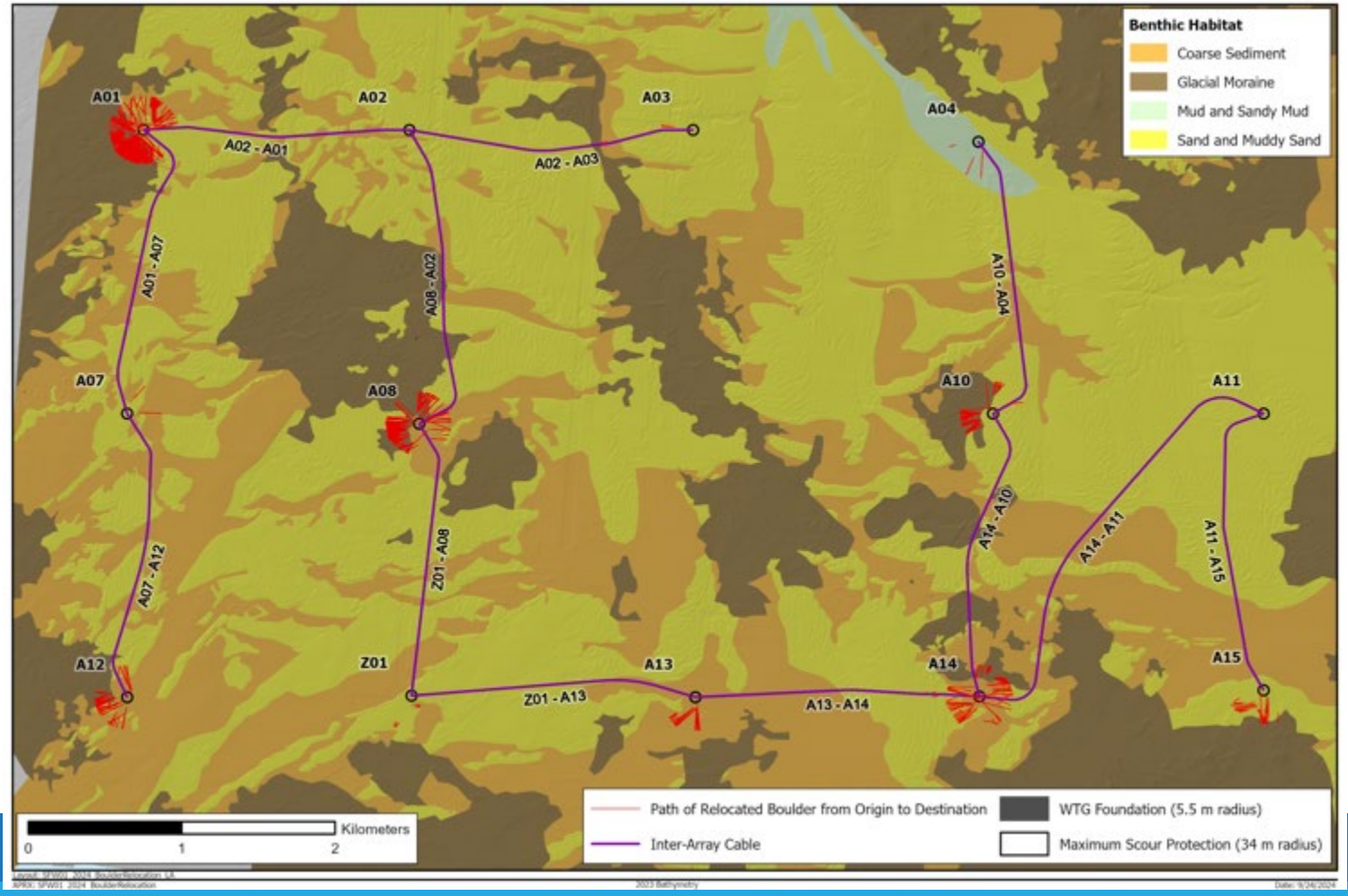
Monitoring Plan

	Native Boulder Habitat	Novel Surfaces	WTG Foundation-associated	Cable-associated
Hypothesis	Boulder relocation alters the physical habitat Physical characteristics determine community composition	Structure attracts taxa Community compositions vary in space and time	Structure-associated taxa affect sediment Effects on sediment and infauna depends on distance from	Structure disturbs the benthic community Benthic community returns to its initial condition
Approach	ROV-imagery	ROV-imagery	SPI/PV imagery	SPI/PV imagery
Design	Control-Impact	Time-series	Before-After-Gradient	Before-After-Gradient
Schedule	Y0 (2023), Y1, Y2, Y3+	Y0 (2023), Y1, Y2, Y3, Y5	Y0 (2023), Y1, Y3, Y5, 5+	Y0 (2023), Y1, Y3, Y5, 5+

Boulder Monitoring

Hypothesis

Relocation of existing natural hard bottom habitats (boulders) will alter physical habitat characteristics (rugosity, complexity, density) with potential for rapid colonization of relocated boulders

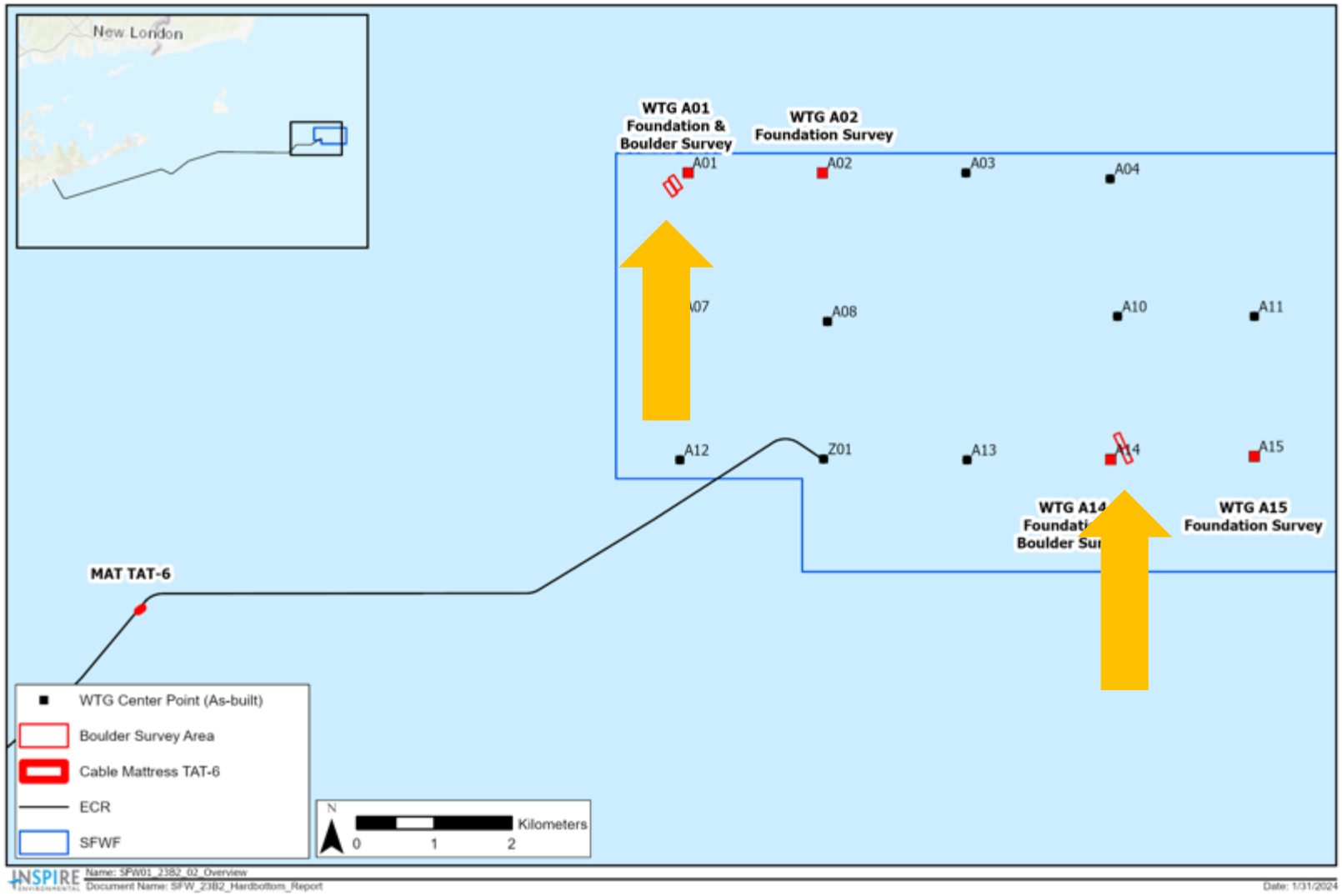


Objectives –

- Measure changes over time in the nature and extent of macrobiotic cover (% cover, relative abundances) of relocated boulders in comparison to undisturbed boulders
- Characterize larger-scale changes to the physical attributes of the benthic habitats

Survey Design

Do communities on relocated boulders differ from control boulders?

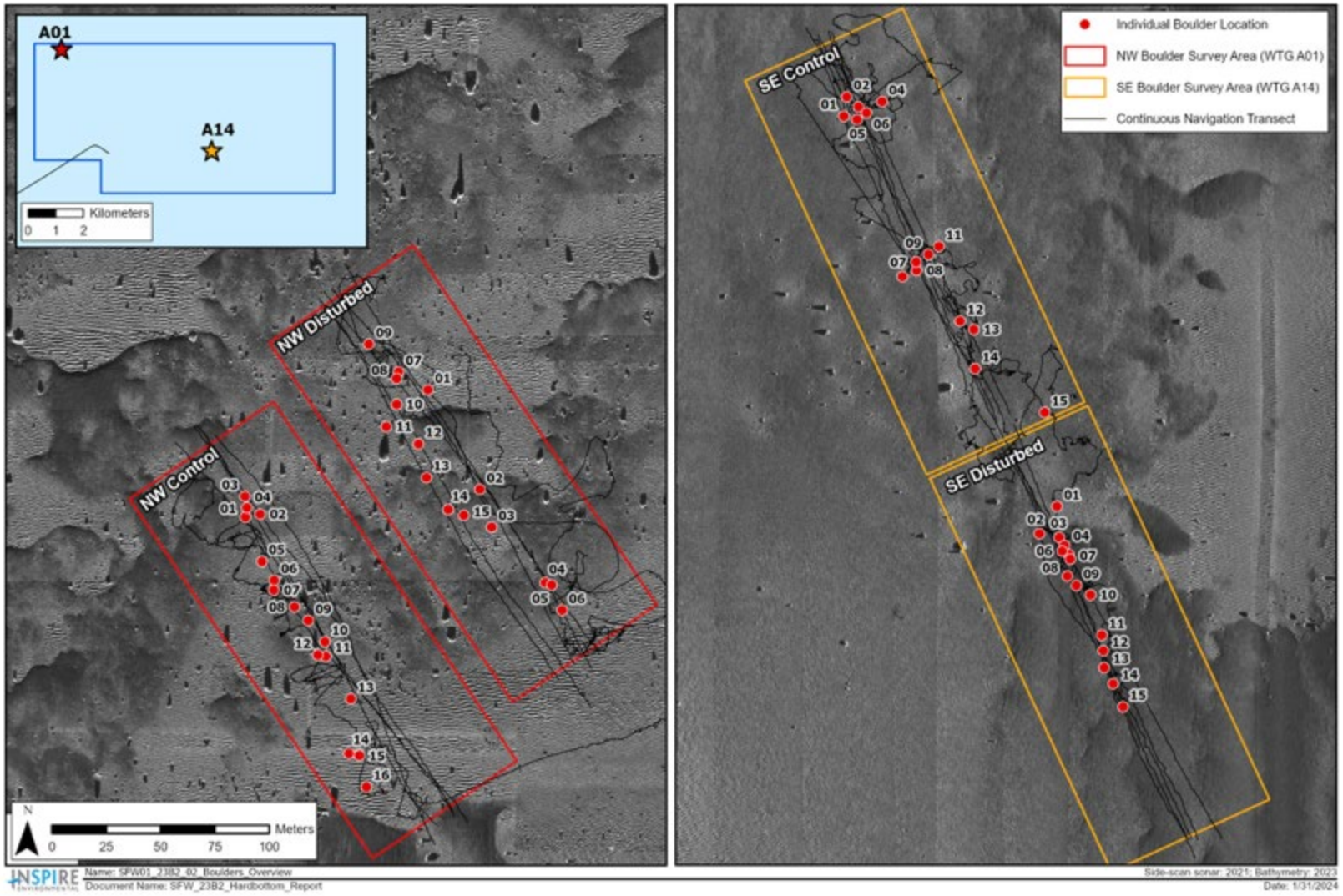


Two paired survey areas –

- Relocated boulders
- Control boulders

Survey Design

Do communities on relocated boulders differ from control boulders?



Two paired survey areas –

- Relocated boulders
- Control boulders

Boulders were relocated between October 2022-June 2023

This first survey was conducted October 2023

Sampling Methods

Marine Imaging Technologies
Evan Kovacs & David Ullman

Investigator 90
Observation Class ROV

Motion camera system
ZCam E2-S6
Continuous, RAW, 6K

Machine vision stereo camera
Lucid, 3D
3D, 4K, redundancy

Take Home Messages

2023 (Y0) Native Boulder Habitat

1. Relocated boulder communities resemble control boulders

- Invertebrate turf dominates all surfaces –
  - Hydrozoa, bryozoa, amphipods, and barnacles
- Taxa presence and abundance similar on controls and relocated boulders, in most cases
  - Black sea bass, anemones, sea stars

2. Encrusting pink/orange taxa cover a small percentage of boulder surfaces

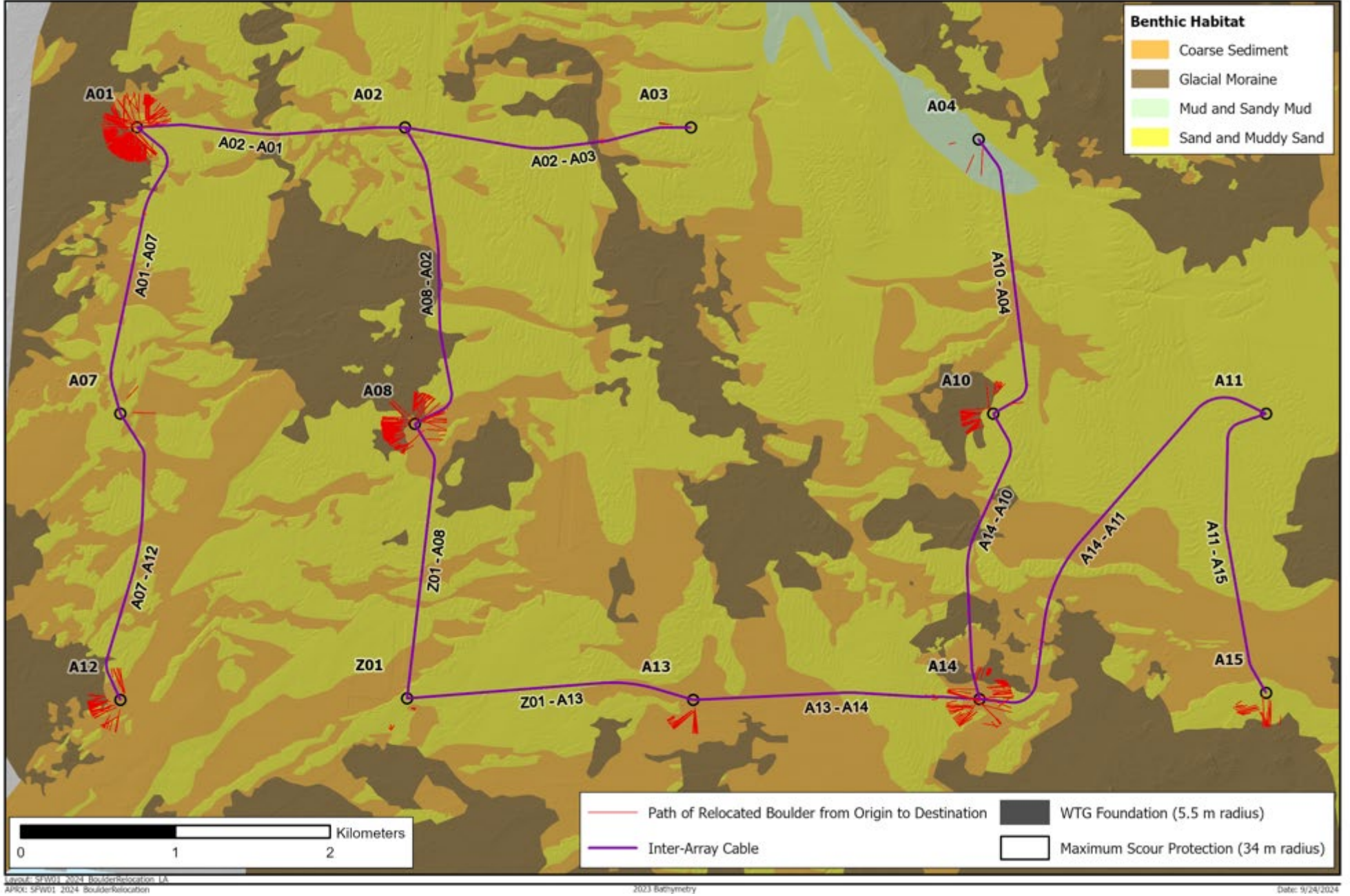
- Possibly non-native tunicate
- Higher cover on relocated boulders

3. Physical shift in boulder distributions

- Reduced complexity in some areas
- Increased complexity and boulder density in discrete areas

Landscape Level

- Boulder relocation focused near WTG foundations
- Boulders were not moved far (relatively)
- Boulders placed generally in similar habitat as their original location



Landscape Level

- Divots visible at original locations
- Boulders placed in centric-shaped arcs around the WTG foundation locations
- Potentially predictable, intuitive positioning using foundation as a landmark
- Distance between boulder arc and foundation is ~200-300 m

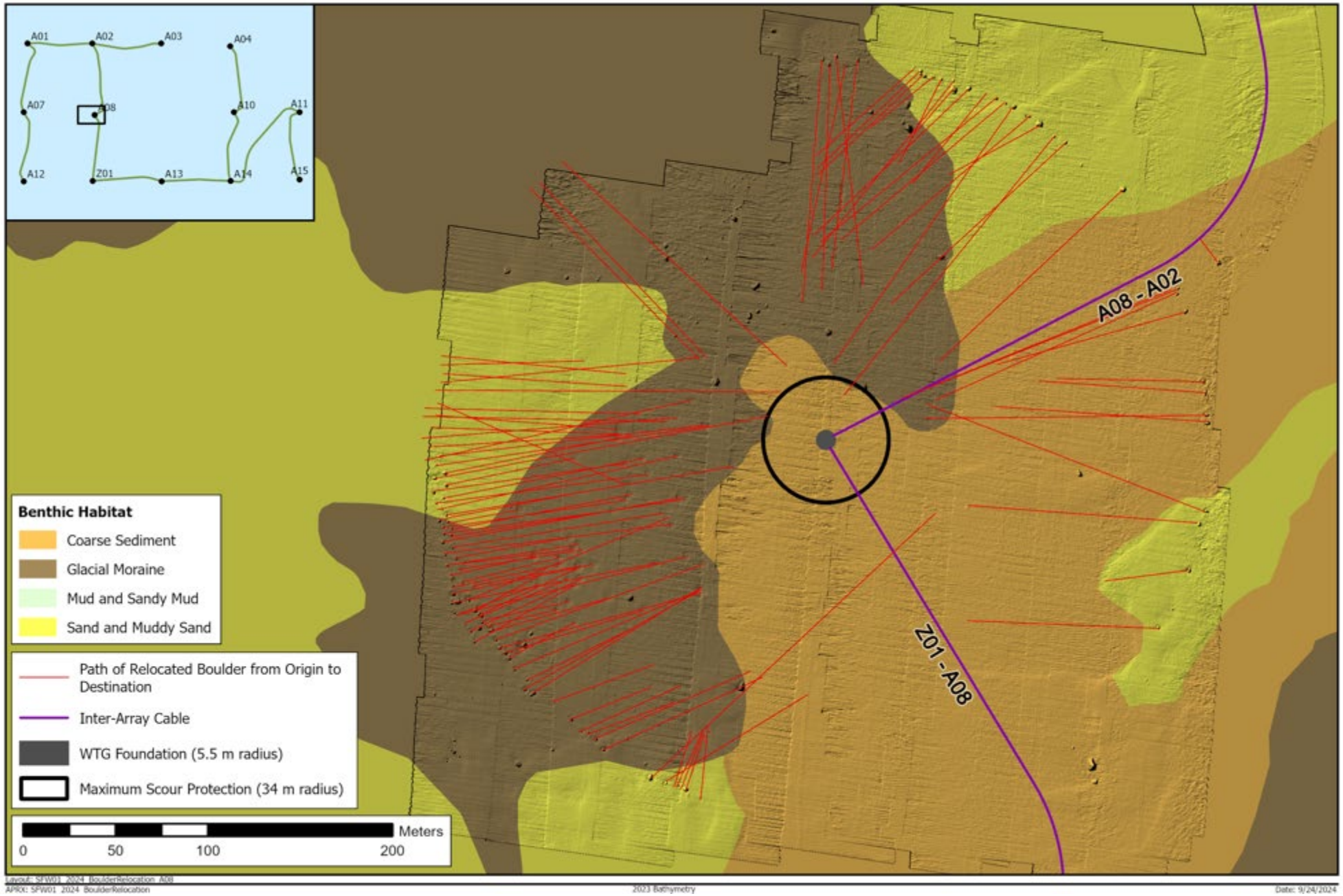
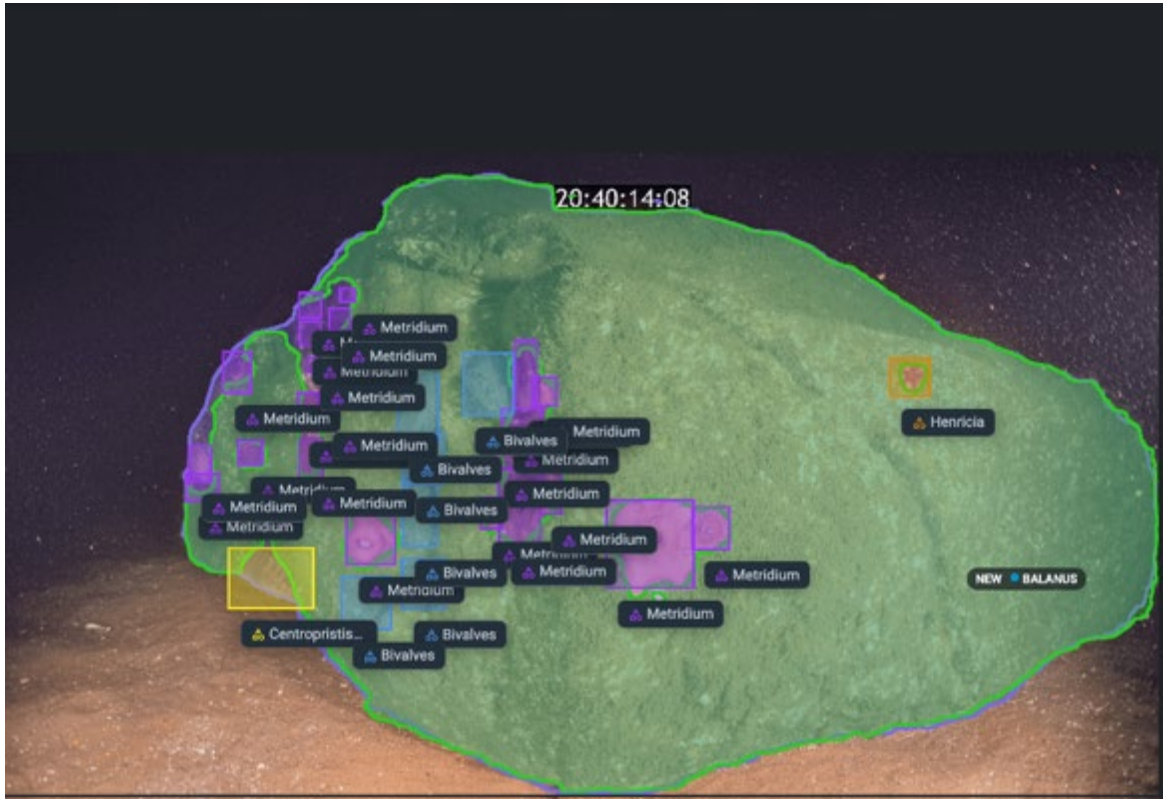
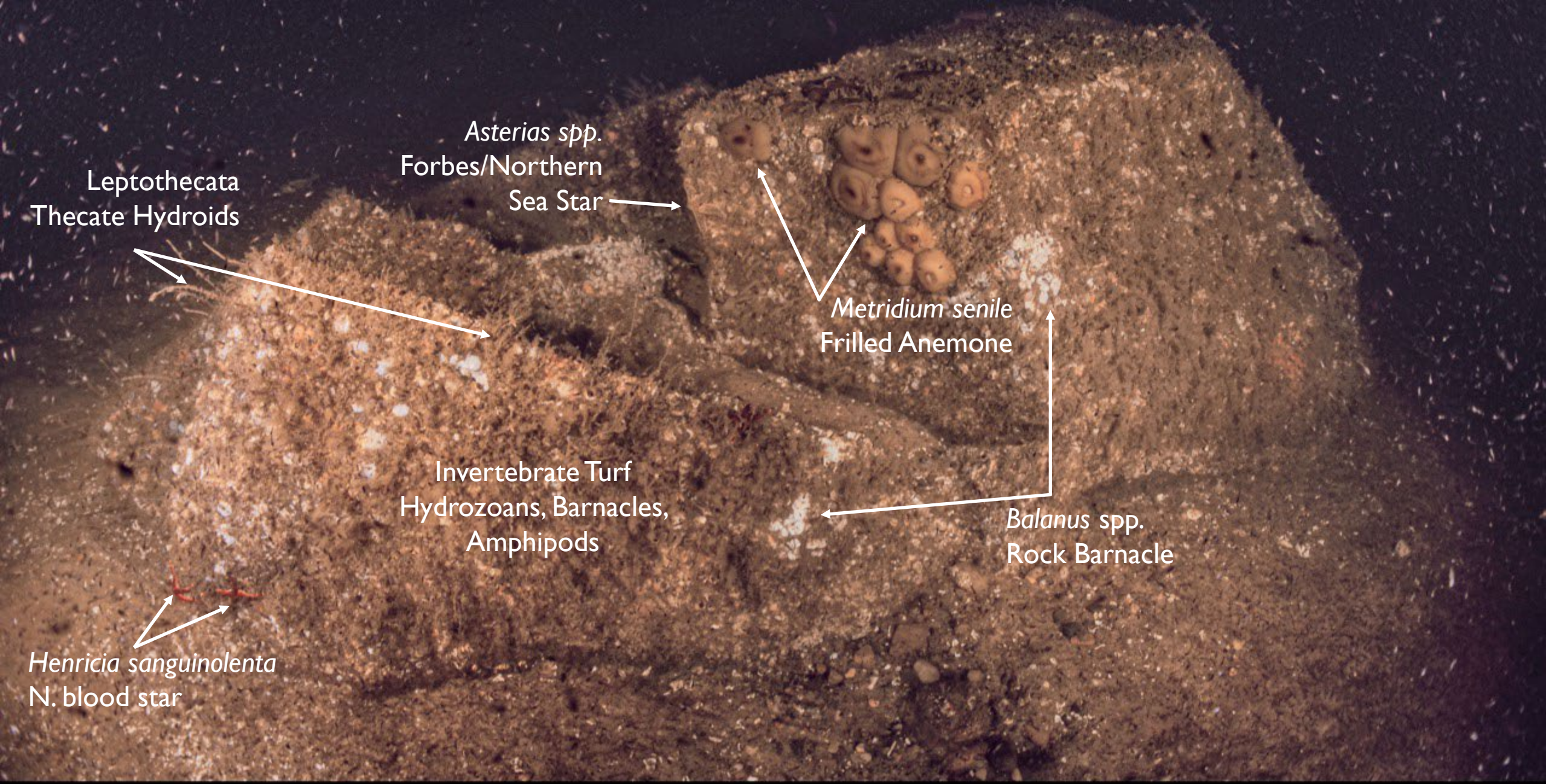


Image Analysis

Macrofaunal Community

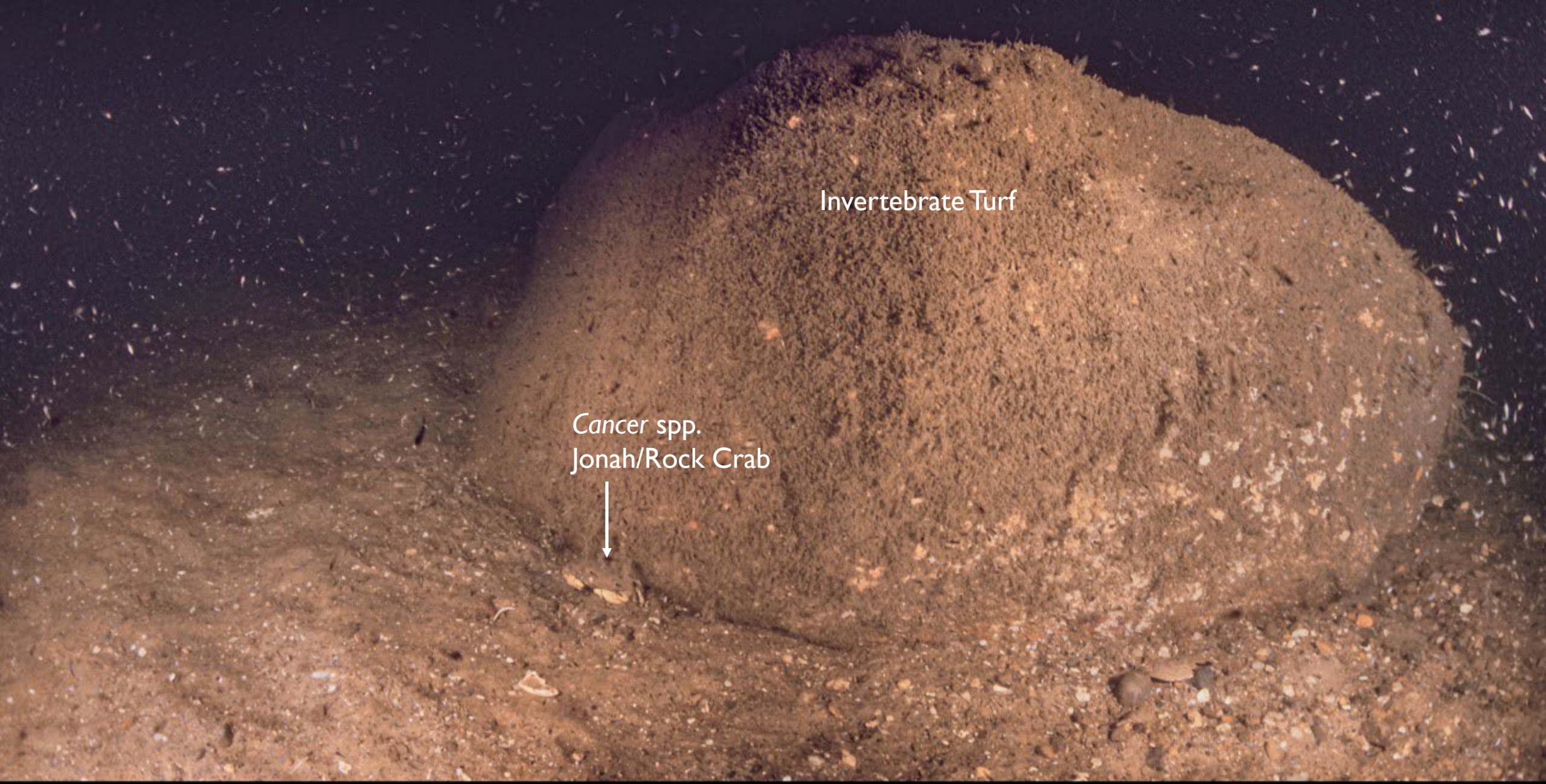




SFW_23B2_NWCtrl_Bld_11-B

Undisturbed Boulder

INSPIRE ENVIRONMENTAL



SFW_23B2_NWCtrl_Bld_06-A

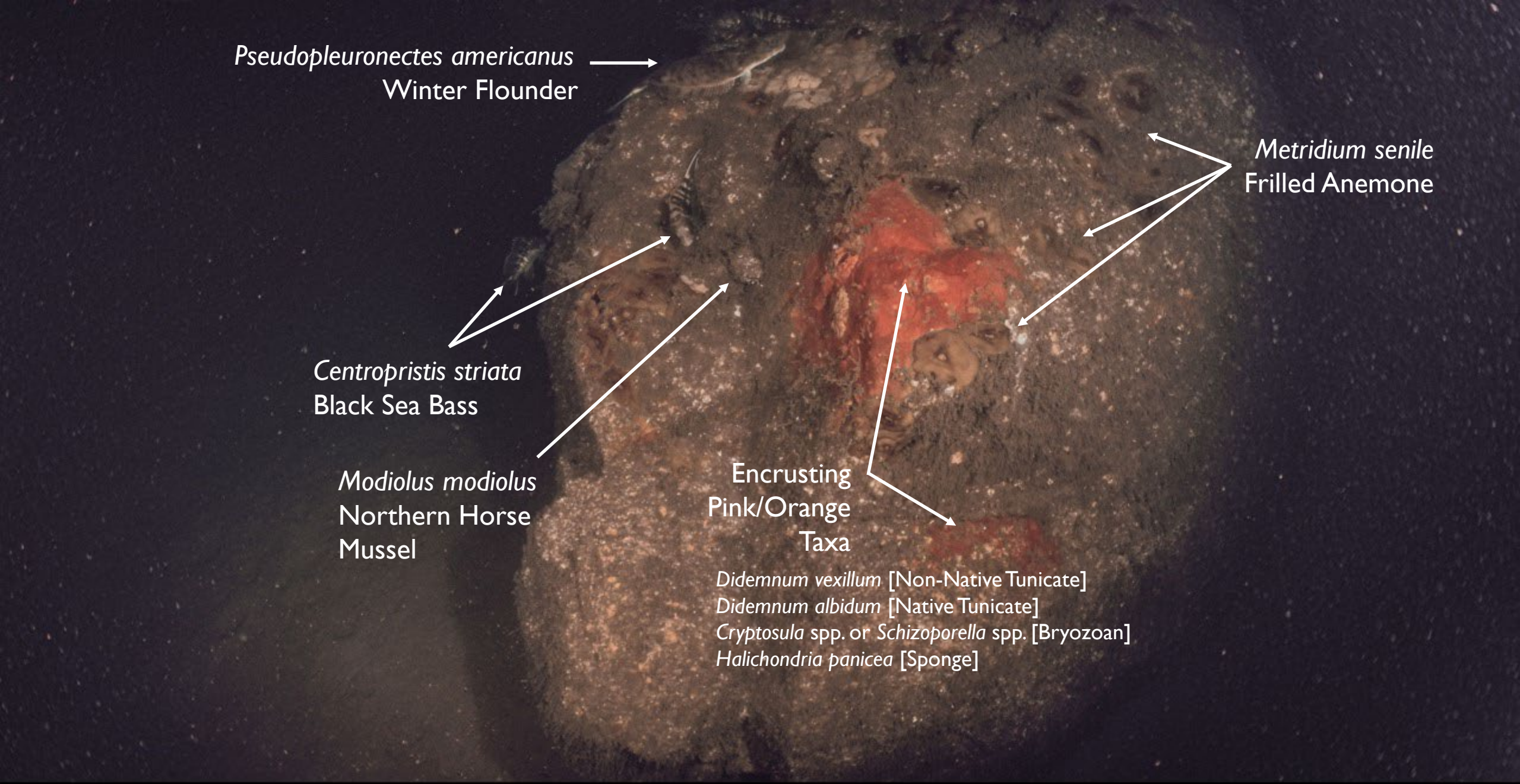
Undisturbed Boulder

INSPIRE ENVIRONMENTAL

SFW_23B2_NWCtrl_Bld_10-C

Undisturbed Boulder

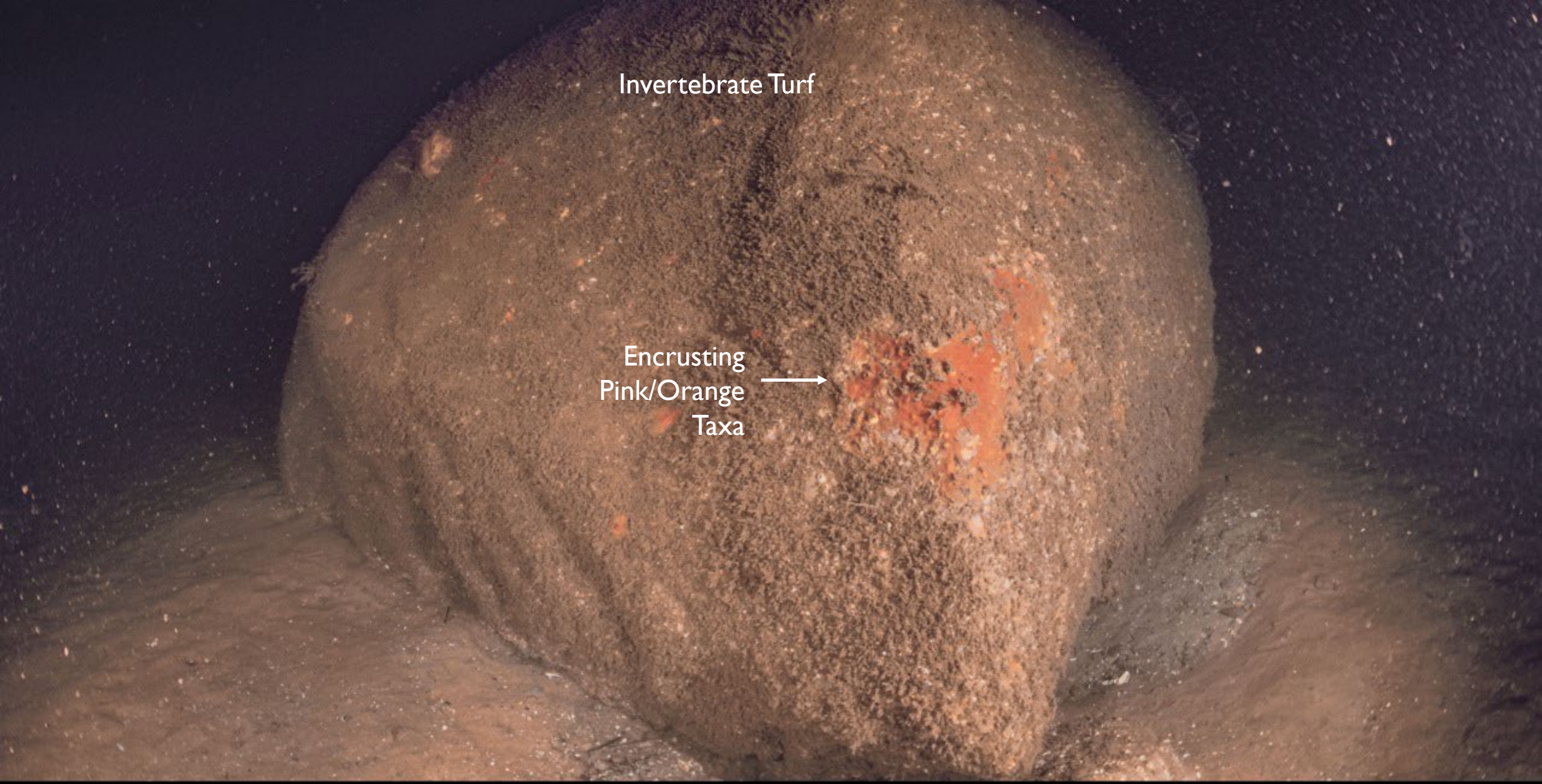
INSPIRE ENVIRONMENTAL



SFW_23B2_SEDstbd_Bld_03-D

Relocated Boulder

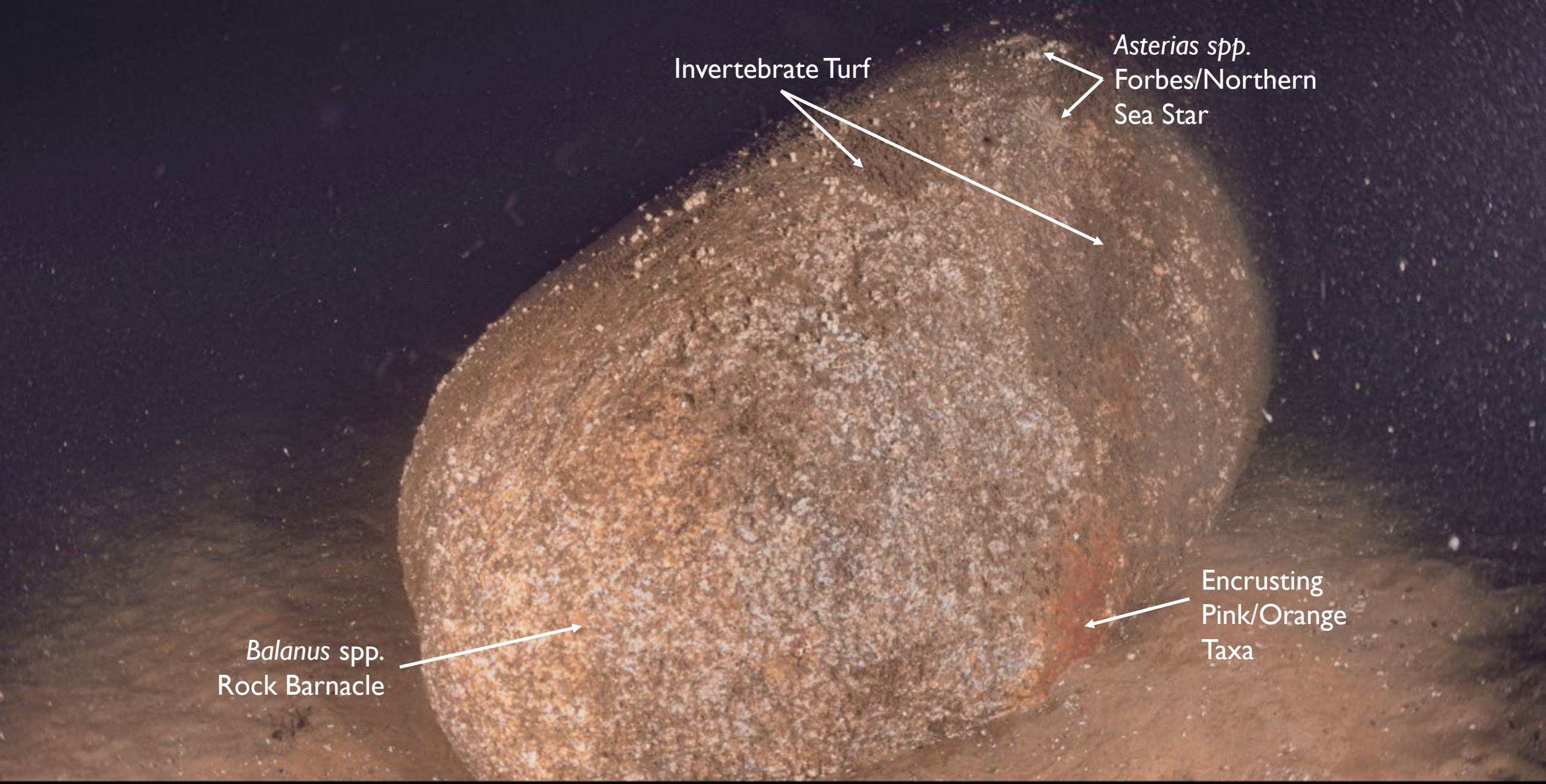
INSPIRE ENVIRONMENTAL



SFW_23B2_SEDstbd_Bld_02-A

Relocated Boulder

INSPIRE ENVIRONMENTAL

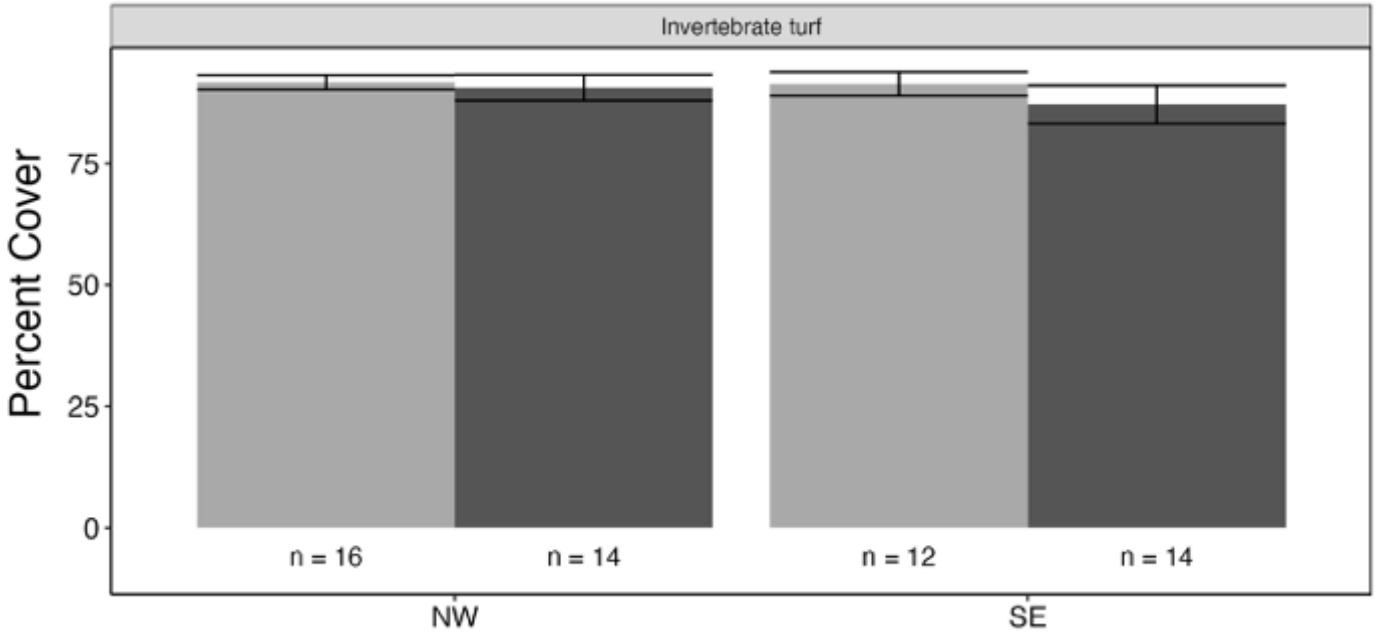


SFW_23B2_SEDstbd_Bld_09-A

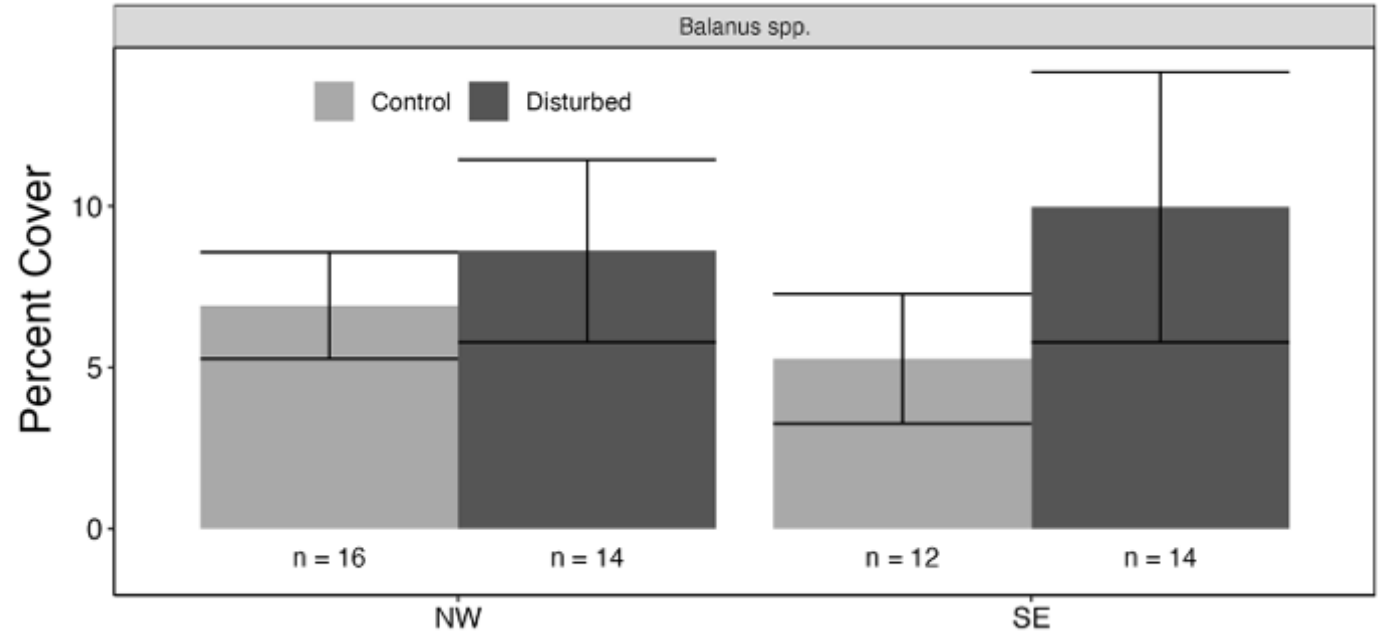
Relocated Boulder

INSPIRE ENVIRONMENTAL

Results

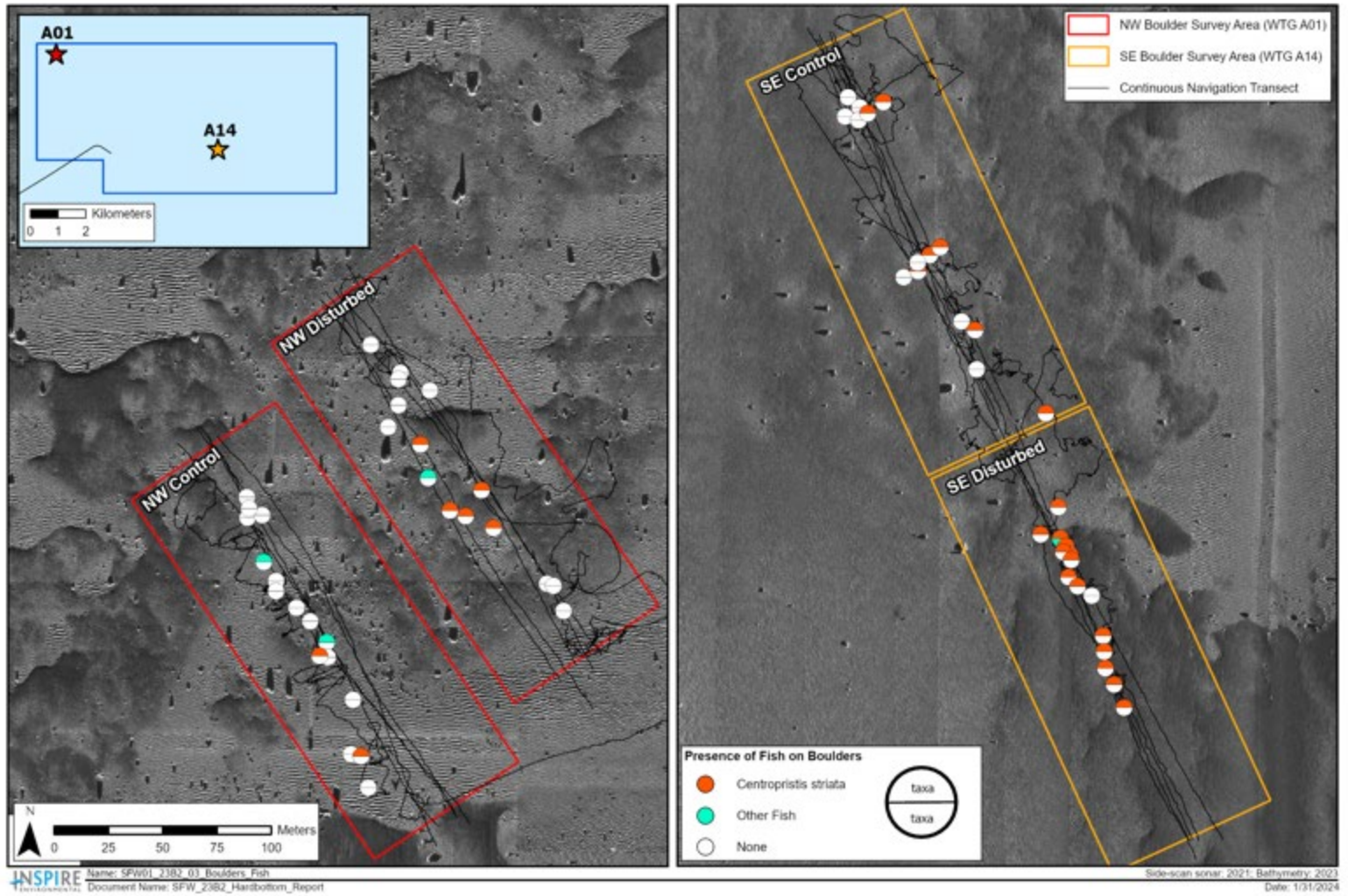

Invertebrate turf
Percent Cover
75
50
25
0
n = 16
n = 14
n = 12
n = 14
NW
SE


Invertebrate turf


Balanus spp.
Control
Disturbed
Percent Cover
10
5
0
n = 16
n = 14
n = 12
n = 14
NW
SE


Balanus spp.
Rock Barnacle

Results

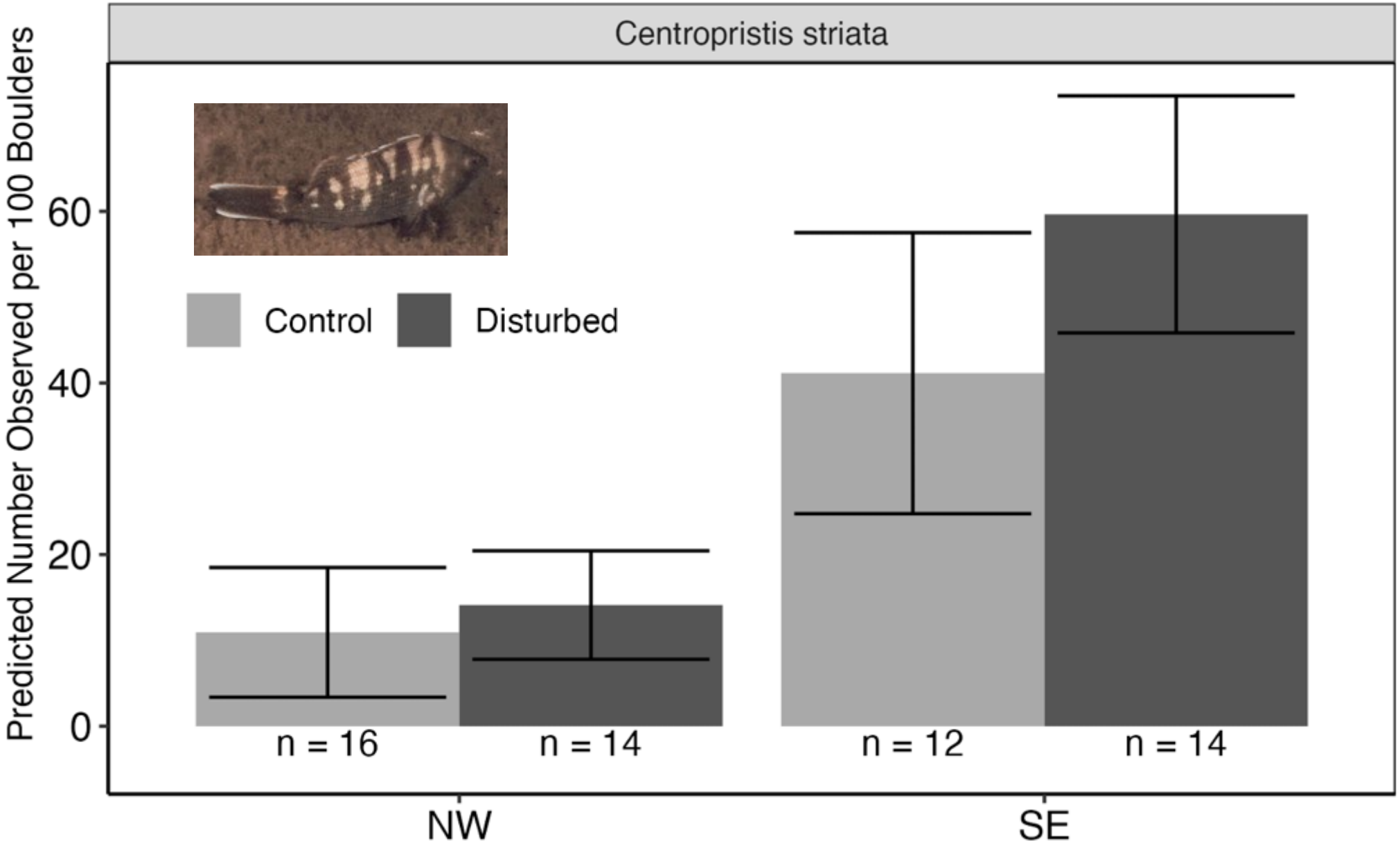

A01
A14
Kilometers
0 1 2
NW Control
NW Disturbed
SE Control
SE Disturbed
NW Boulder Survey Area (WTG A01)
SE Boulder Survey Area (WTG A14)
Continuous Navigation Transect
Presence of Fish on Boulders
Centropristis striata
Other Fish
None
taxa
taxa
N
0 25 50 75 100
Meters
INSPIRE
Name: SFW01_23B2_03_Boulders_Fish
Document Name: SFW_23B2_Hardbottom_Report
Side-scan sonar: 2021; Bathymetry: 2021
Date: 1/31/2024


Centropristis striata
Black Sea Bass

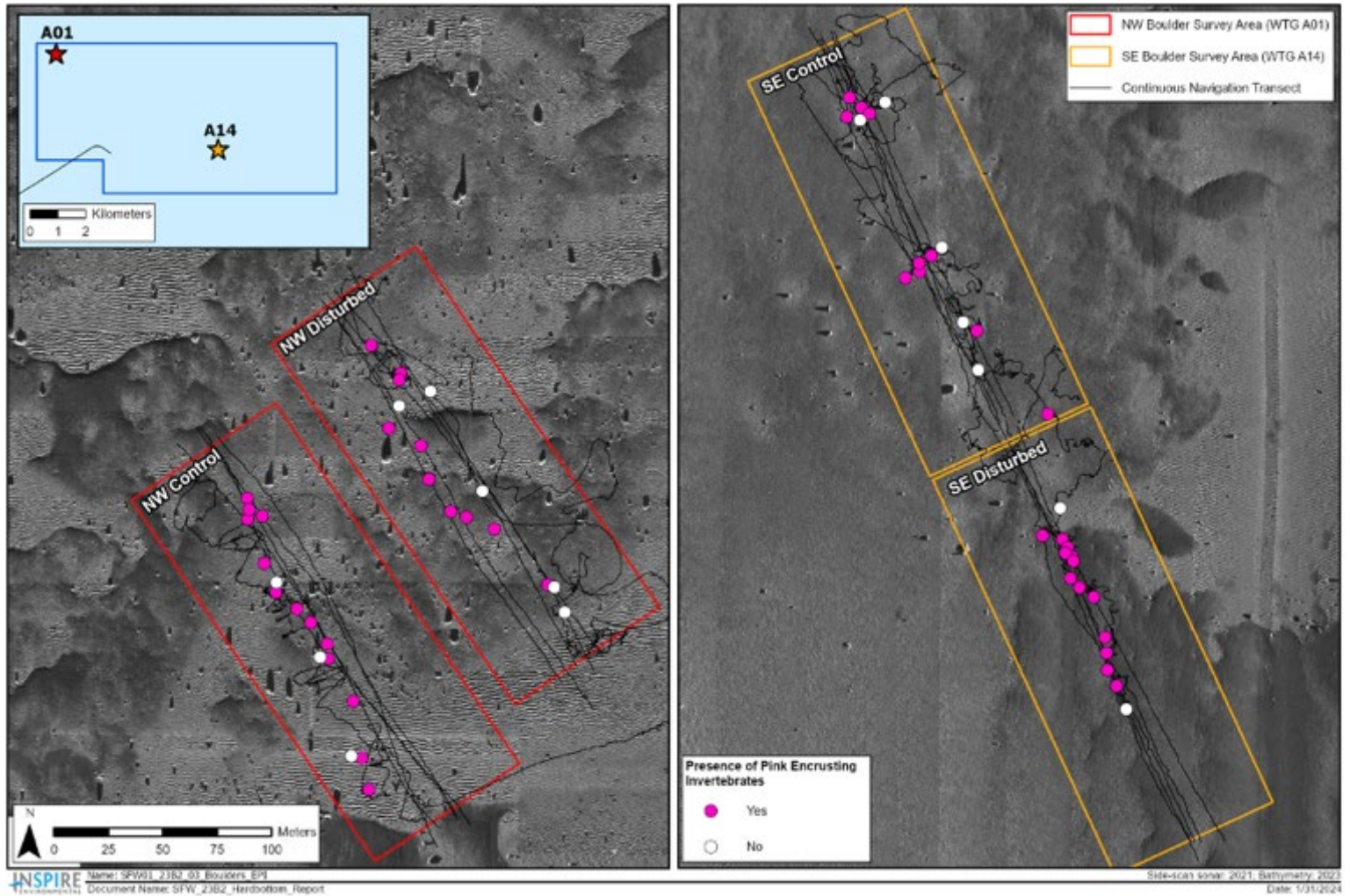

Leucoraja sp.
Little/Winter Skate

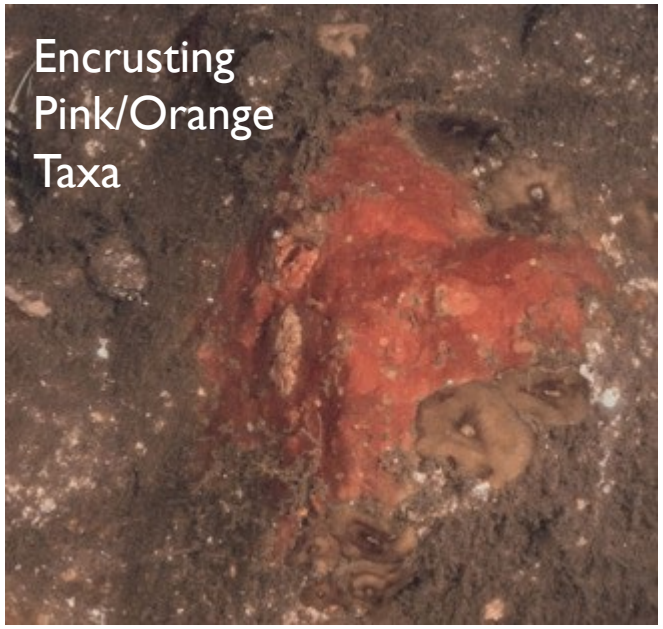

Pseudopleuronectes americanus
Winter Flounder

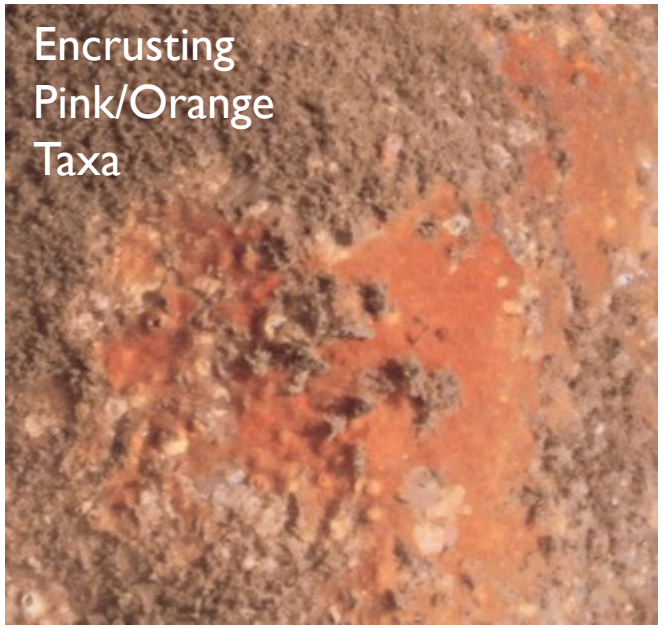
Results


Centropristis striata
Predicted Number Observed per 100 Boulders
0
20
40
60
Control
Disturbed
n = 16
n = 14
n = 12
n = 14
NW
SE

Results

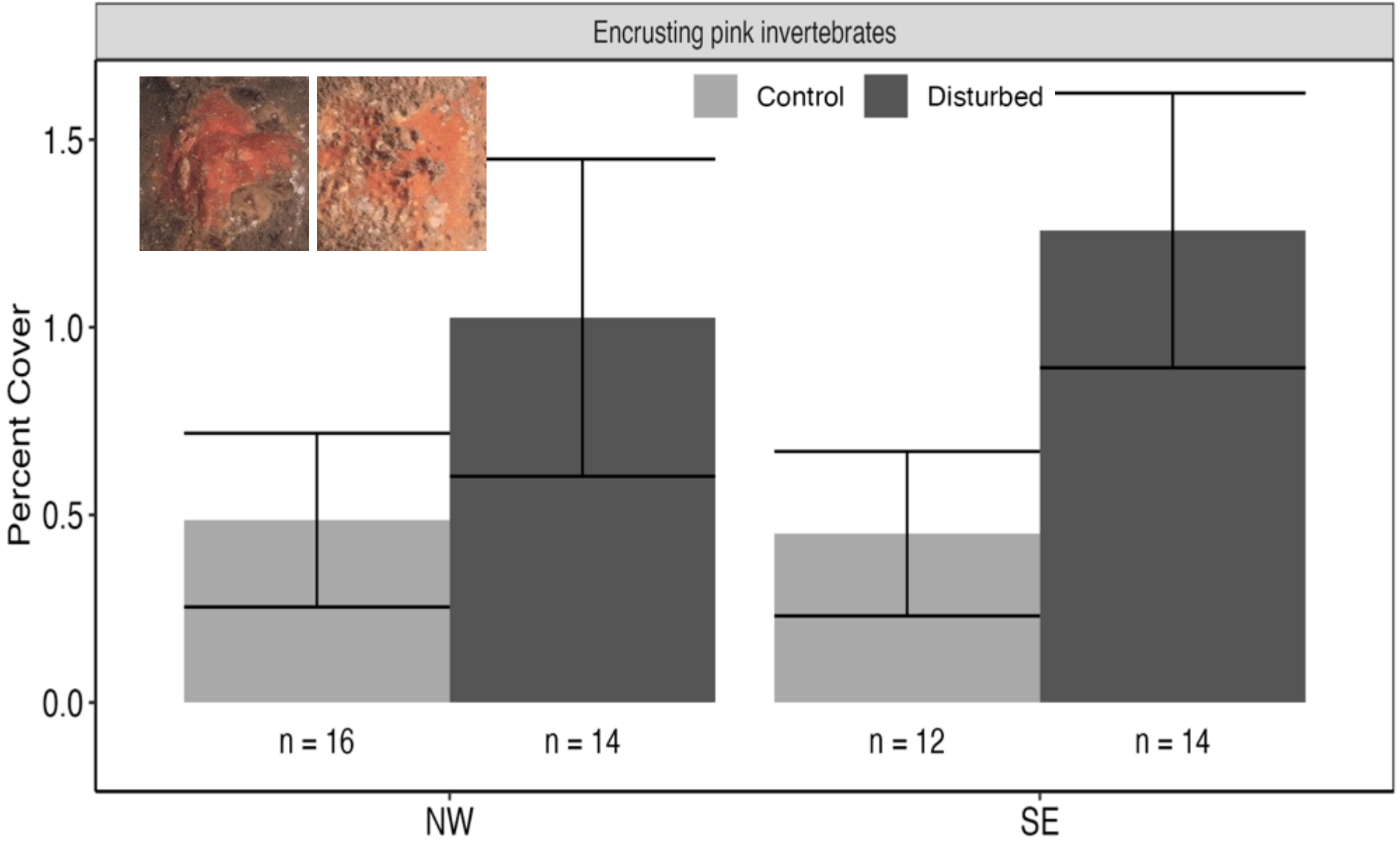






INSPIRE ENVIRONMENTAL

Results


Encrusting pink invertebrates
Control
Disturbed
Percent Cover
1.5
1.0
0.5
0.0
n = 16
n = 14
n = 12
n = 14
NW
SE

Conclusions

- Relocated boulder communities resemble control boulders
  - Invertebrate turf dominates all surfaces
  - Taxa presence and abundance similar on controls and relocated boulders, in most cases
- Encrusting pink/orange taxa cover a small percentage of boulder surfaces
  - Possibly non-native tunicate
  - Higher cover on relocated boulders
- Next surveys (2024, 2025…)
  - Confirm that relocated boulder communities continue to resemble control boulders
  - Track the distribution of encrusting pink invertebrate cover
- Research project
  - Paired visual survey (w/ AI) and physical samples (w/ eDNA)
  - Molecular samples to identify encrusting taxa – GMGI develop qPCR assay, additional amplicon sequencing (12S, COI)