LIS Seafloor Habitat Mapping Initiative Update

Kevin O'Brien

Supervisor, Technical Resources

Land & Water Resources Division

CT Dept. Energy & Environmental Protection

NROC Meeting - April 13, 2023

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Creation of the LIS Cable Fund

- Resulting from a June 2004 settlement between CT & NY with Cross Sound Cable Company, Northeast Utilities, and the Long Island Power Authority creating a $6M fund for research/restoration projects in LIS

- Managed by a bi-state, multi-agency Steering Committee:
  - **Led by CTDEEP, EPA LISS, NYDEC, NYDOS CT & NY SeaGrants**
  - **Priority Goal:** ***provide data products for resource management & infrastructure siting in LIS***

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Collaborative Partners Identified

LISMaRC

Long Island Sound Mapping and Research Collaborative

NOAA OCS

Ocean Service Collaborative
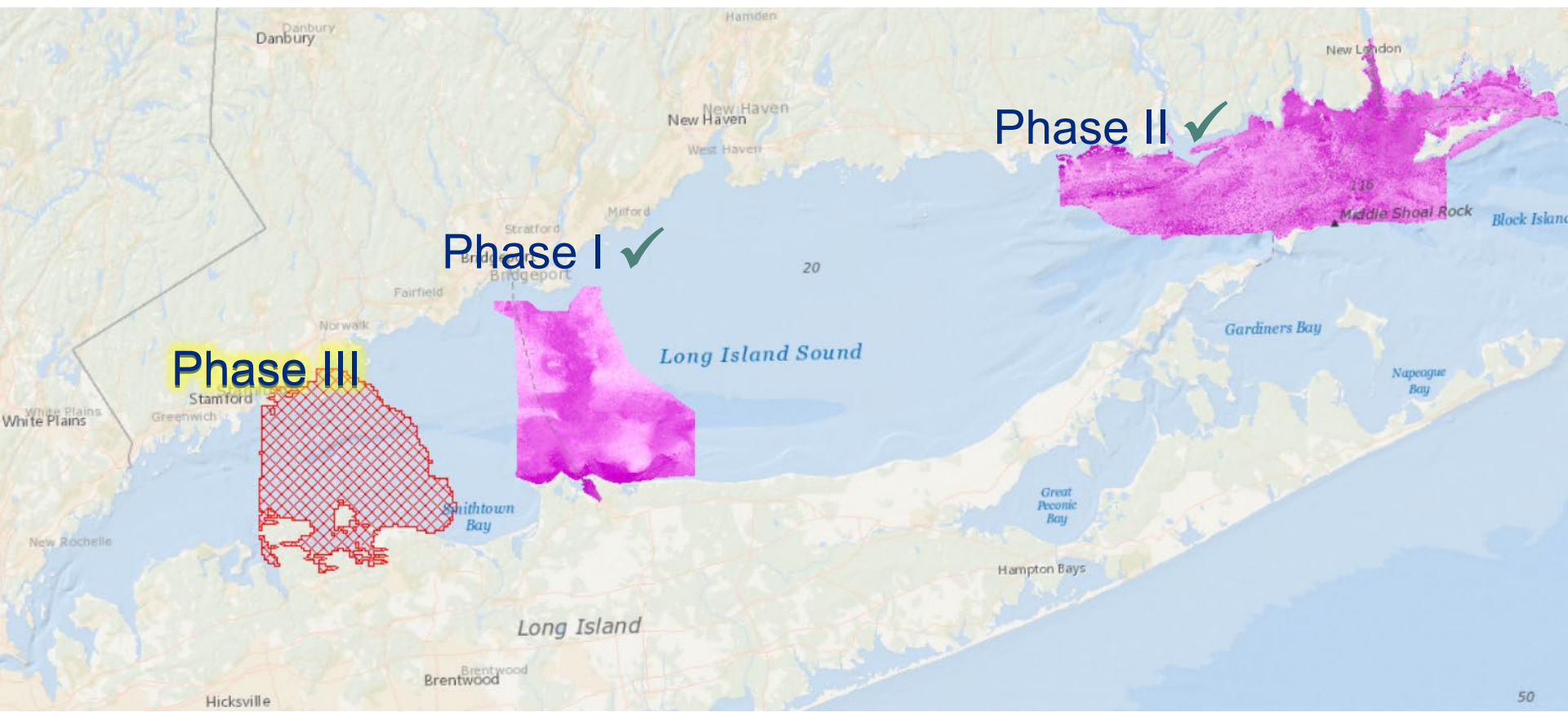
National Centers for Coastal Ocean Science NCCOS

Office of Coast Survey OCS

LDEO

Lamont - Doherty Earth Observatory Collaborative

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Priority Mapping Areas

Phase II ✓

Phase I ✓

Phase III

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Project Mapping Goals

- Implement technical components for a mapping program focusing on:
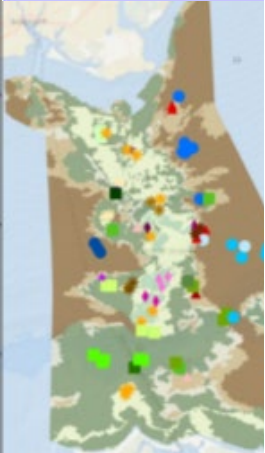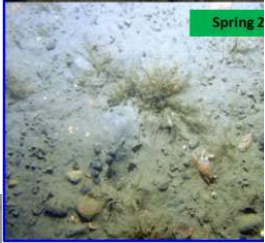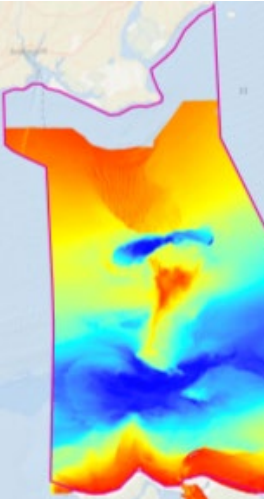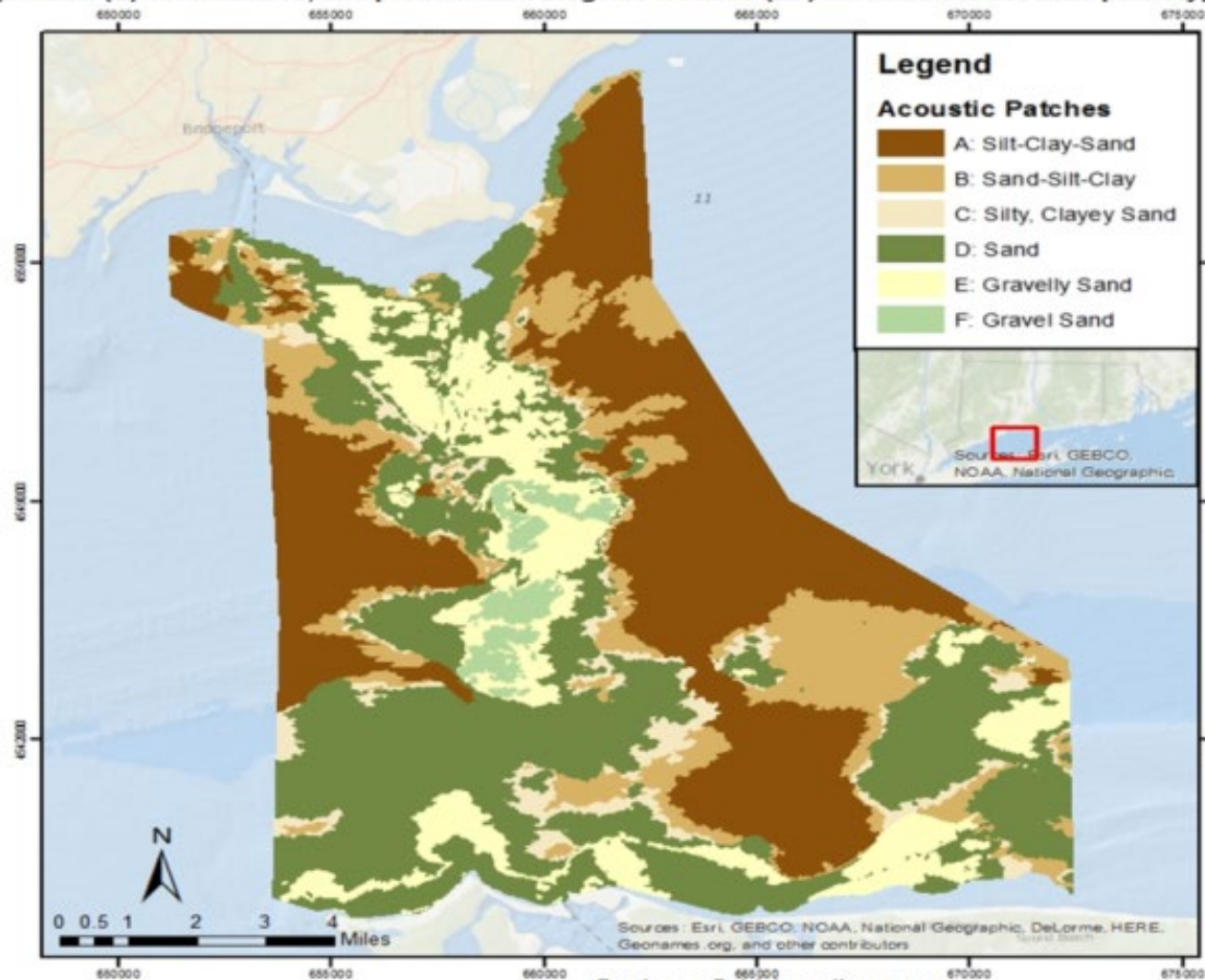
Acoustic Intensity / Seafloor Topography	Benthic Habitats & Ecology
Sediment Texture & Grain Size	Physical Environments
Sedimentary Environments	Data Management System

  – Report on methods, analysis, results and conclusions/recommendations

  – Assess implementation strategies

Integrated Habitat Map

Based on mean bottom tidal stress, defining ecological characteristics of infaunal (I) and epifaunal (E) communities, and predominant biogenic features (BF) in relation to acoustic patch types.

Legend

Acoustic Patches

- A: Silt-Clay-Sand
- B: Sand-Silt-Clay
- C: Silty, Clayey Sand
- D: Sand
- E: Gravelly Sand
- F: Gravel Sand

Sources: Esri, GEBCO, NOAA, National Geographic.

Sources: Esri, GEBCO, NOAA, National Geographic, DeLorme, HERE, Geonames.org, and other contributors

0 0.5 1 2 3 4 Miles

Patch type A: low-medium stress
I: Mixed burrowing and tubiculous taxa
E: Solitary ascidians, *Mytilus*
BF: Shell, burrows

Patch type B: low-high stress
I: Tubiculous taxa, motile surface feeders
E: Bivalve, *Corymorpha*, solitary ascidian
BF: Shell

Patch type C: predominantly medium stress
I: Variable mix of tubiculous taxa and burrowers
E: *Mytilus*, *Corymorpha*, solitary ascidian
BF: Burrows, shell

Patch type D: high-medium stress
I: Small tubiculous taxa (polychaetes and amphipods);
High density of bivalves
E: Hydroids, *Mytilus*, barnacle
BF: High coverage of shell patches and burrows

Patch type E: predominantly high stress
I: Oligochaetes and archiannelids, small tubiculous taxa,
deep burrowing taxa
E: Hydroids, *Mytilus*, *Astrangia*
BF: High coverage of shell patches

Patch type F: predominantly high stress
I: Oligochaetes and archiannelids, small tubiculous taxa
(polychaetes and amphipods), moderate bivalve abundances
E: *Crepidula*, *Diadumene*, *Astrangia*
BF: High coverage of shell patches
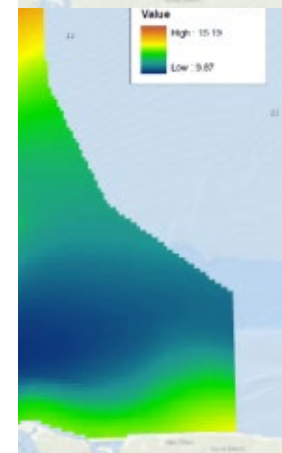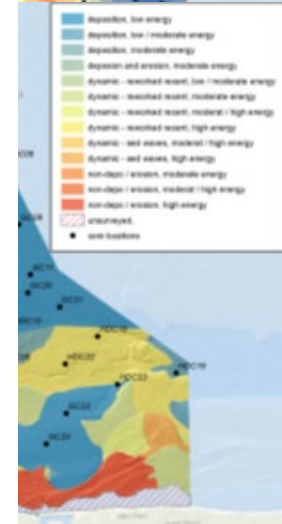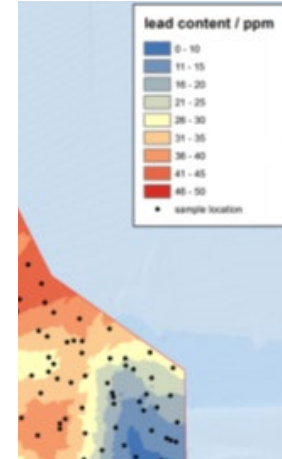
Example Phase I Findings

- Ecological Processes
  - revealed consistent patterns in high diversity, persistent across seasons in simple species richness & diversity.

- Geological & Ecological Connections
  - General faunal response in grain size gradient (i.e., fine to coarse) with increasing tidal stress
  - Species shift from short-lived to long-lived fragile epifaunal species, and from burrowed sediments to shell reef coverage.
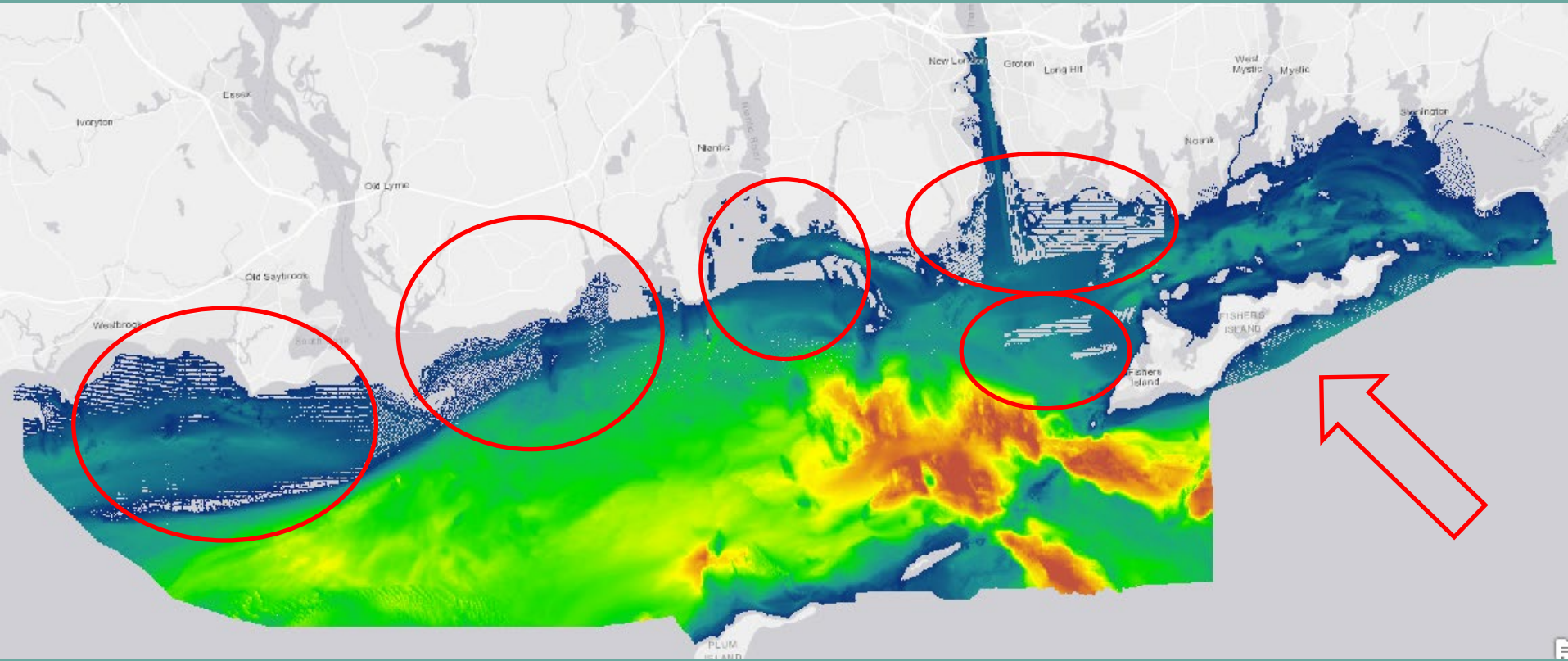
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Phase II Mapping Goals

1. Product deliverables to identify/help understand:
   ⇨ Predominant topographic, geologic, physical, and ecological characteristics
   ⇨ Distribution of characteristics
   ⇨ Physical, ecological or geological attributes/functions of an area based on various characteristics
2. Data collection & processing
3. **Improvements to Pilot processes:**
   a. **Communication/cohesiveness about standards and processes**
   b. **Timelines and scheduling of inter-team dependencies**
   c. **Earlier feedback on draft products**
   d. **Distribution & access of final data products**

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Acoustic Data - Gaps

Bathymetry – ca 2013

Acoustic Data Integration
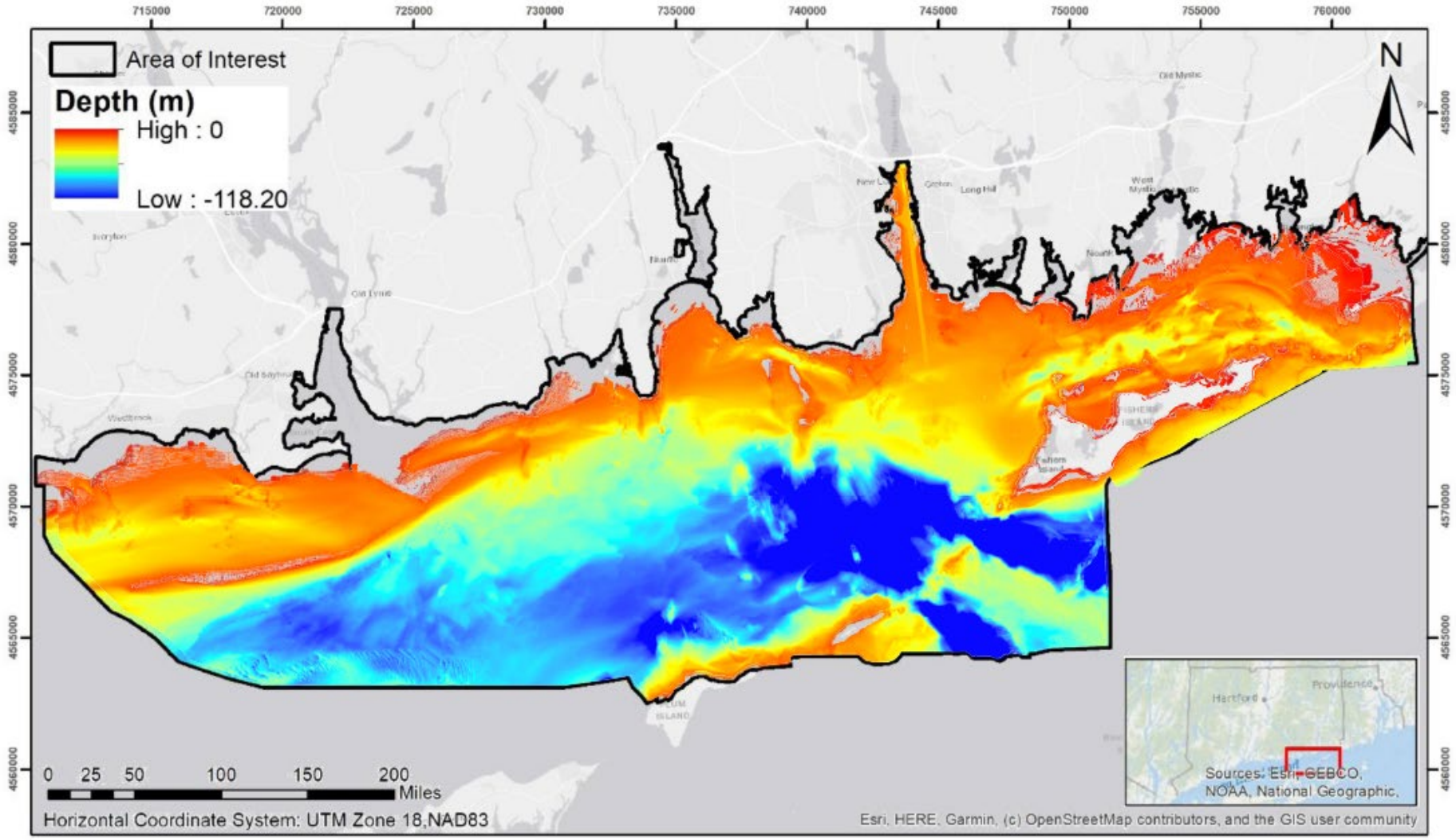
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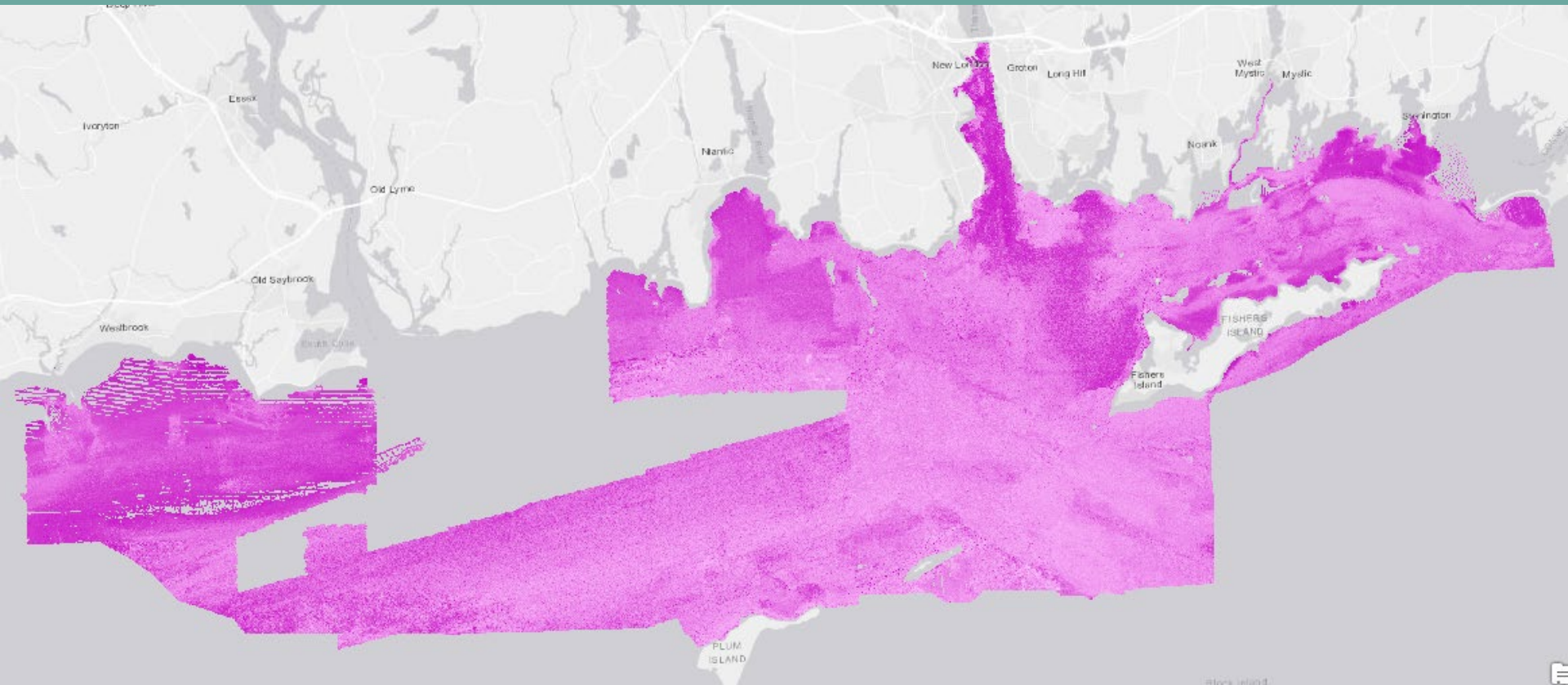
Acoustic Data - Gaps

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Acoustic Data – Acquisition/Integration
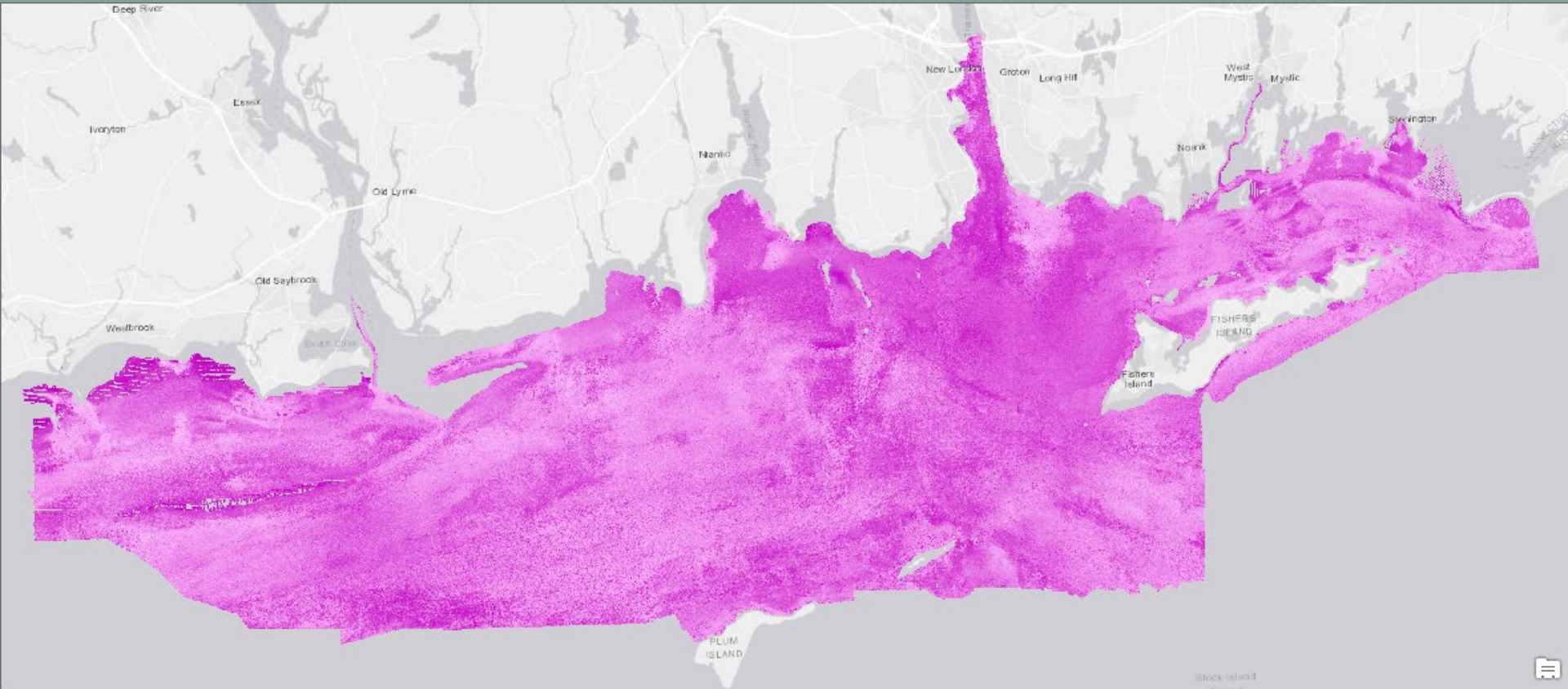
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Sediment Grab and Core Locations

- LDEO samples: white dots

LISMaRC:

- Red dots: fall 2017 – 75 samples;
- Green dots: spring 2018 – 77 samples

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Surficial Chemistry

LIS Cable Fund Mapping Phase II: Surface Nitrogen Content
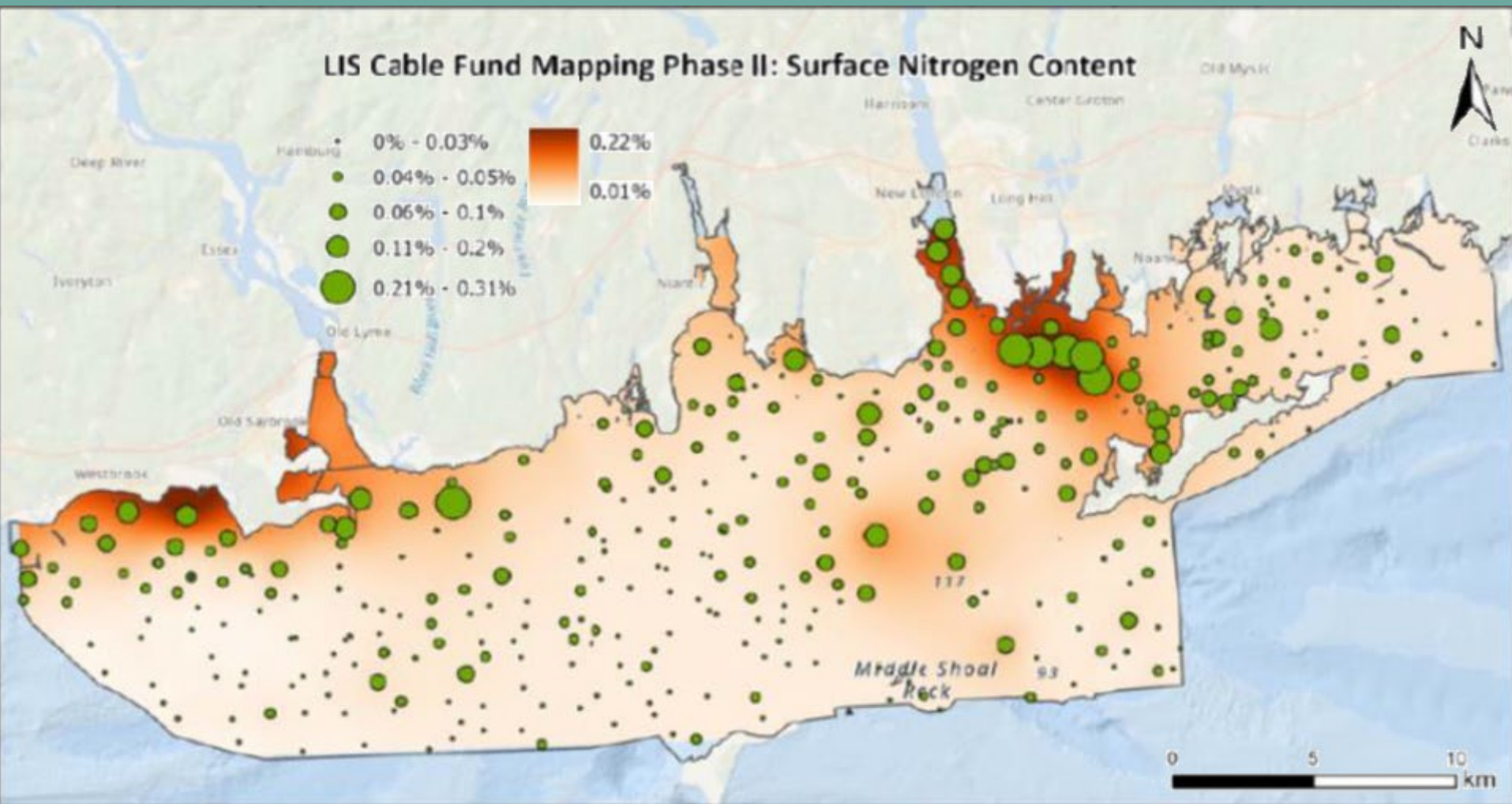
Seafloor/Habitat Characterization
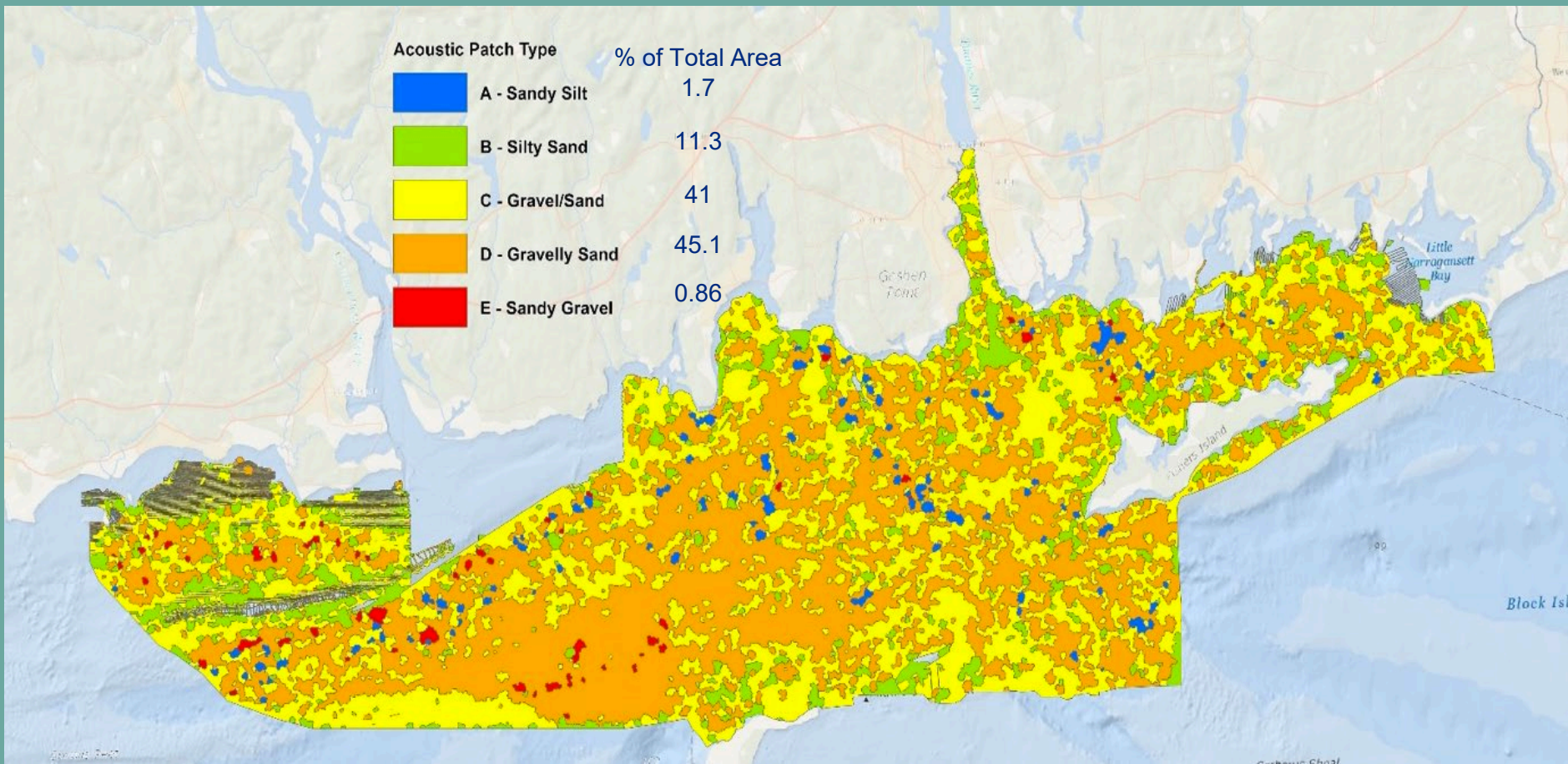
Acoustic patch types identified using eCognition

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Ecological Sampling

Sites (blocks – multiple samples, sites – single samples)
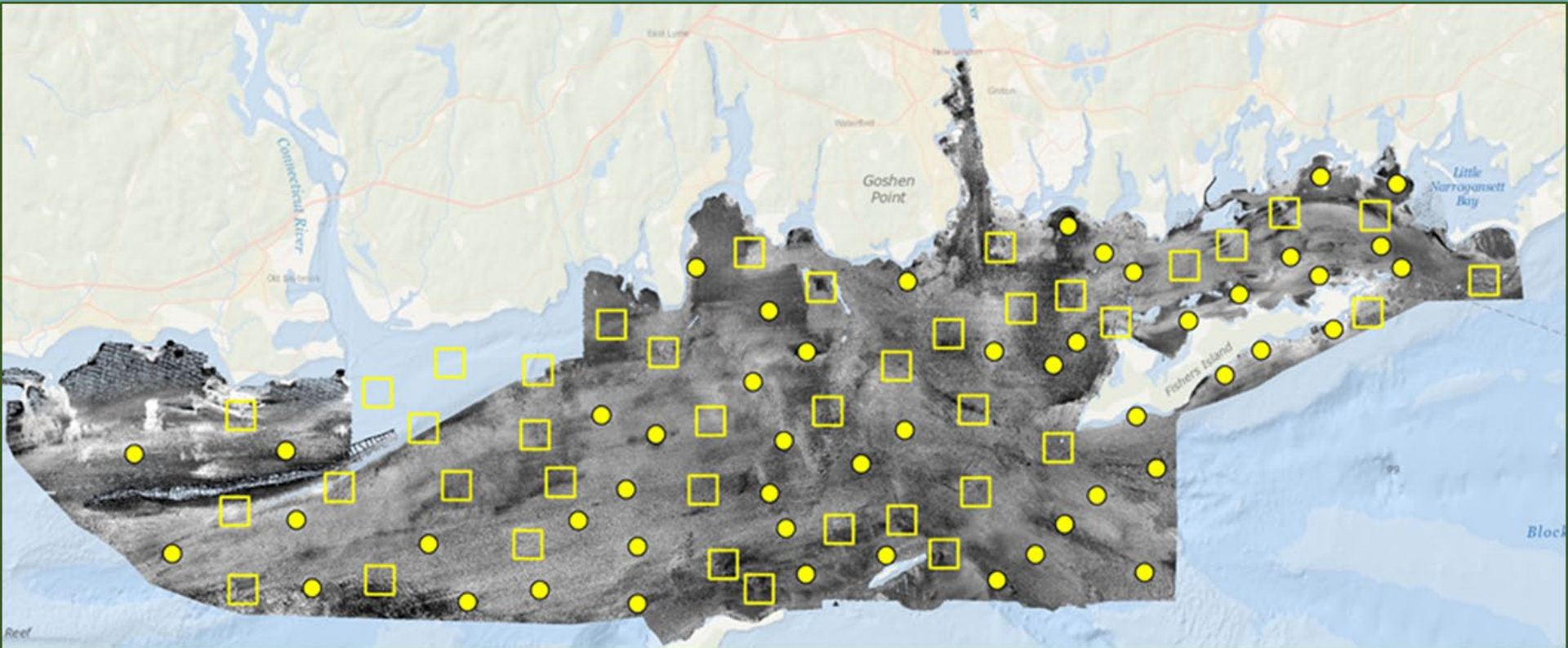
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Ecological Sampling

- 40 sample *blocks* (1 km^2)/50 sample *sites*: 3 random grab samples within blocks; 1 per site

- Video transects at sample blocks and sites (minimum of 3/block, 1/site)

- Transects were selected to maximize seafloor complexity & sediment transitions from one habitat type to another to delineate and validate boundaries between habitats

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Ecological Characterization: Infauna

Example of three grab samples used for infaunal characterization from the same Sample Block (SB) #71

Dive light | Grab | 360 camera | HD GoPro camera | Std Definition camera | Strobe light
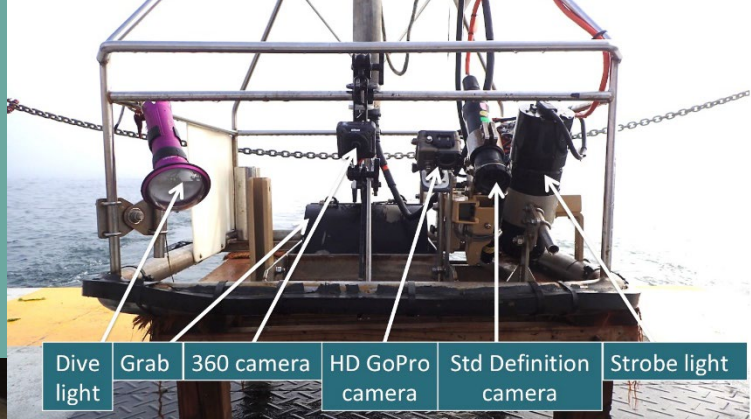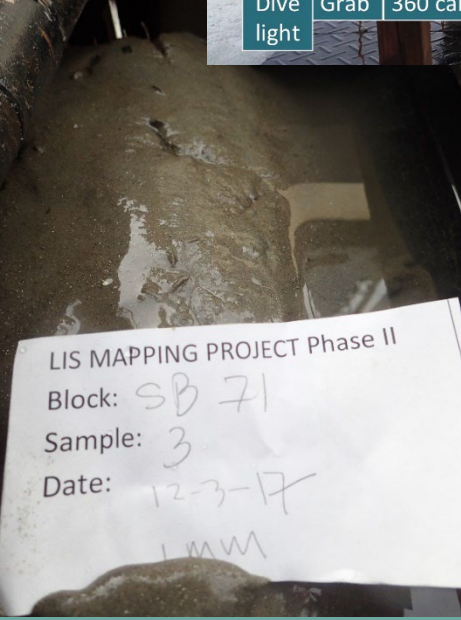
USGS SEABOSS used for infaunal sampling

LIS MAPPING PROJECT Phase II
Block: SB 71
Sample: 1
Date: 12-3-17

LIS MAPPING PROJECT Phase II
Block: SB 71
Sample: 2
Date: 12-3-17

LIS MAPPING PROJECT Phase II
Block: SB 71
Sample: 3
Date: 12-3-17
LMM

Sand   Gravely Sand / Shell Hash   Muddy Sand

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Ecological Characterization: Epifaunal
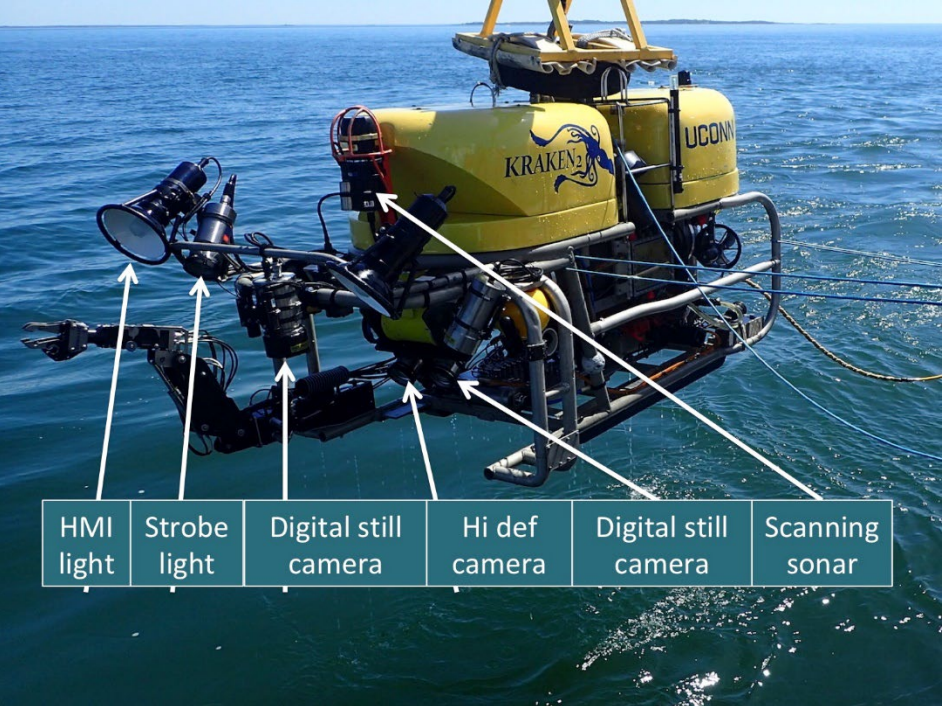
HMI light | Strobe light | Digital still camera | Hi def camera | Digital still camera | Scanning sonar

Kraken2 ROV - Spring 2018
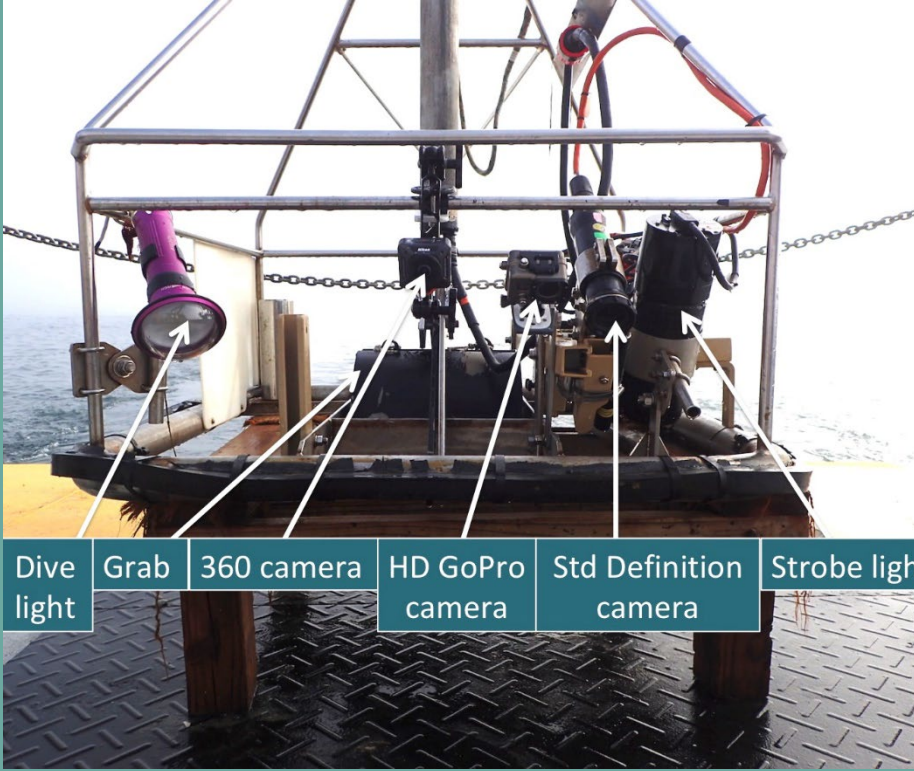
Dive light | Grab | 360 camera | HD GoPro camera | Std Definition camera | Strobe light

USGS SEABOSS - Fall 2017 and Spring 2018

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Ecological Characterization: Epifaunal

- ~600 images collected
- Field of View divided into 216 grid cells
- Organisms and biogenic structures identified to lowest taxon in each cell

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Spatial Variability of Taxonomic Richness
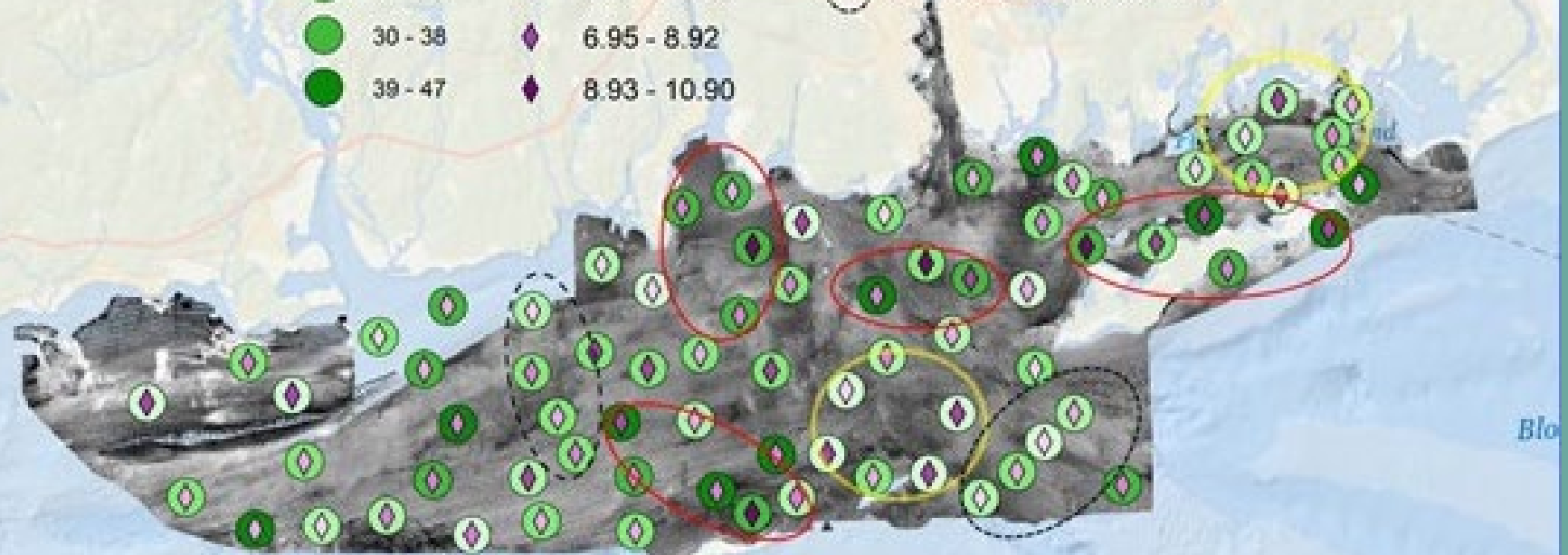
Physical Oceanography

CTD Sampling Locations
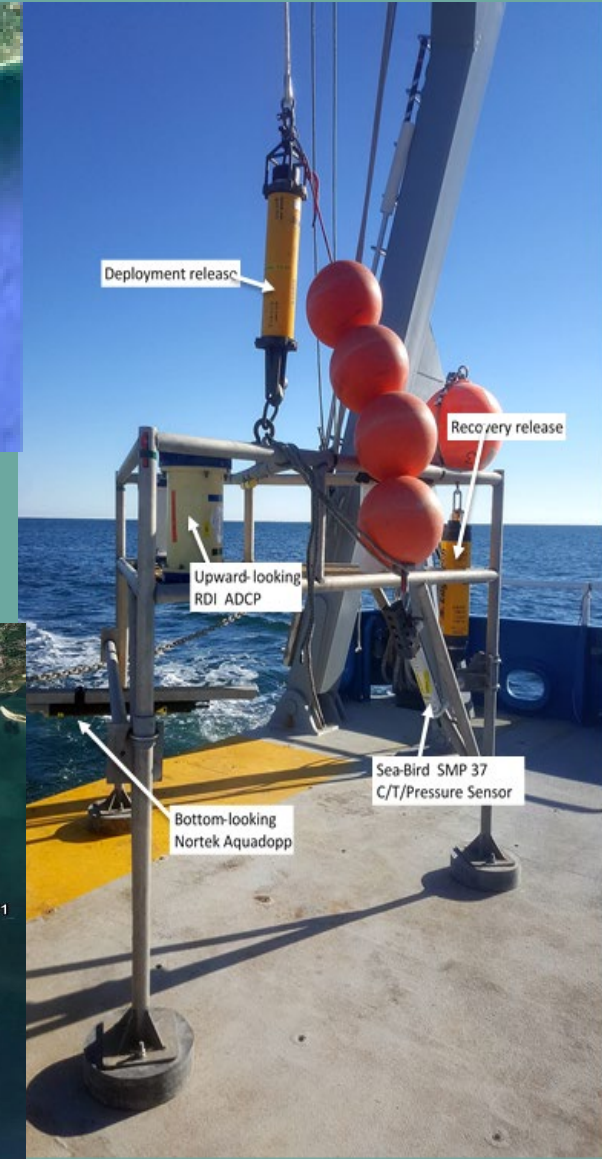
Bottom observation platforms:
- salinity, currents, and bottom stress

Phase II Integrated Habitat Map

Acoustic Patch Type

- A - Sandy Silt
- B - Silty Sand
- C - Gravel/Sand
- D - Gravelly Sand
- E - Sandy Gravel

0   1.25   2.5   5   7.5   10
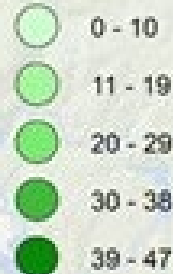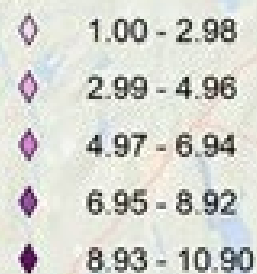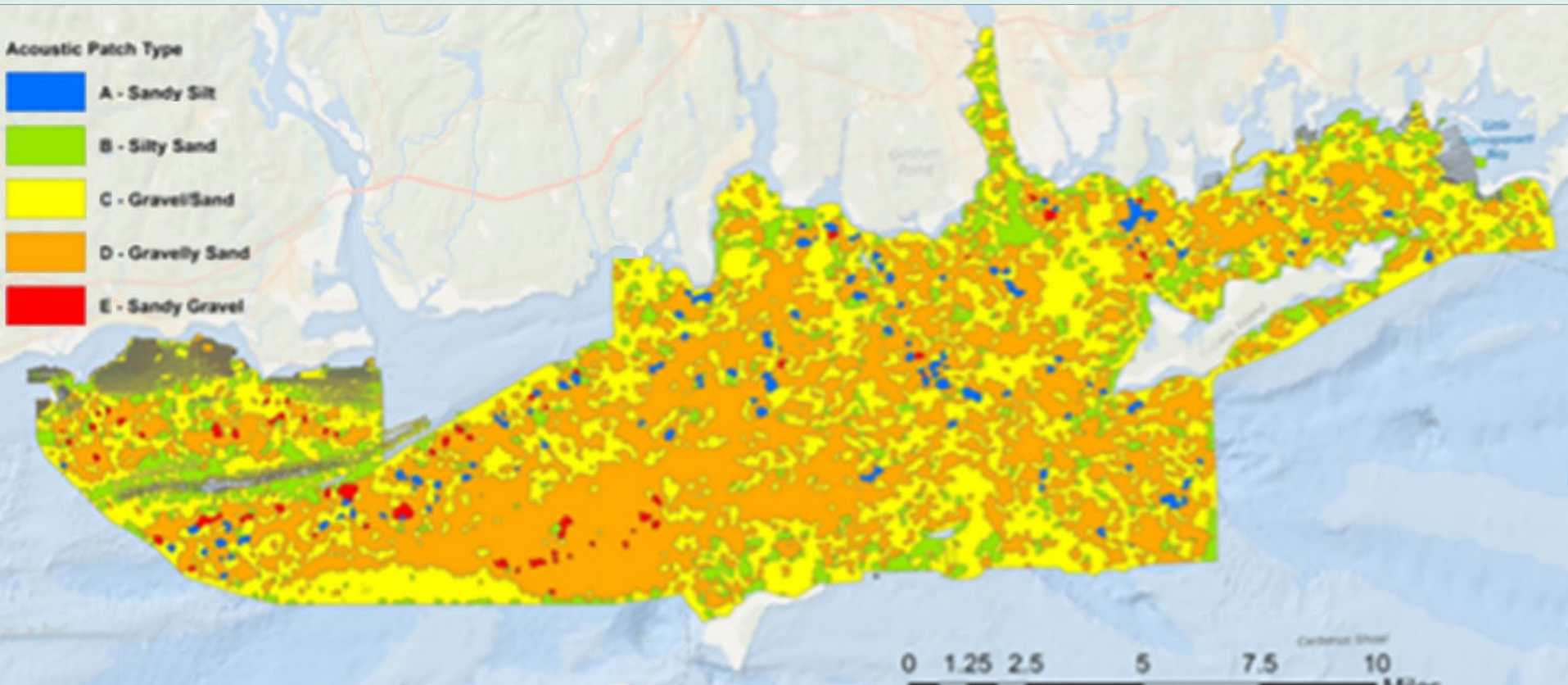
Patch type A - *Physical:* Generally shallow, low complexity, low energy. *Biogenic:* Lowest coverage of shell, low *Zostera* debris; *Infaunal taxa:* Tube building and burrowing fauna, molluscs, *Ampelisca*, bamboo worms, burrowing anemones; *Epi- emergent- taxa:* Low hydrozoan-bryozoan turf, high *Crepidula*, high *Cliona*, high Rhodophyta (some shallow sites).
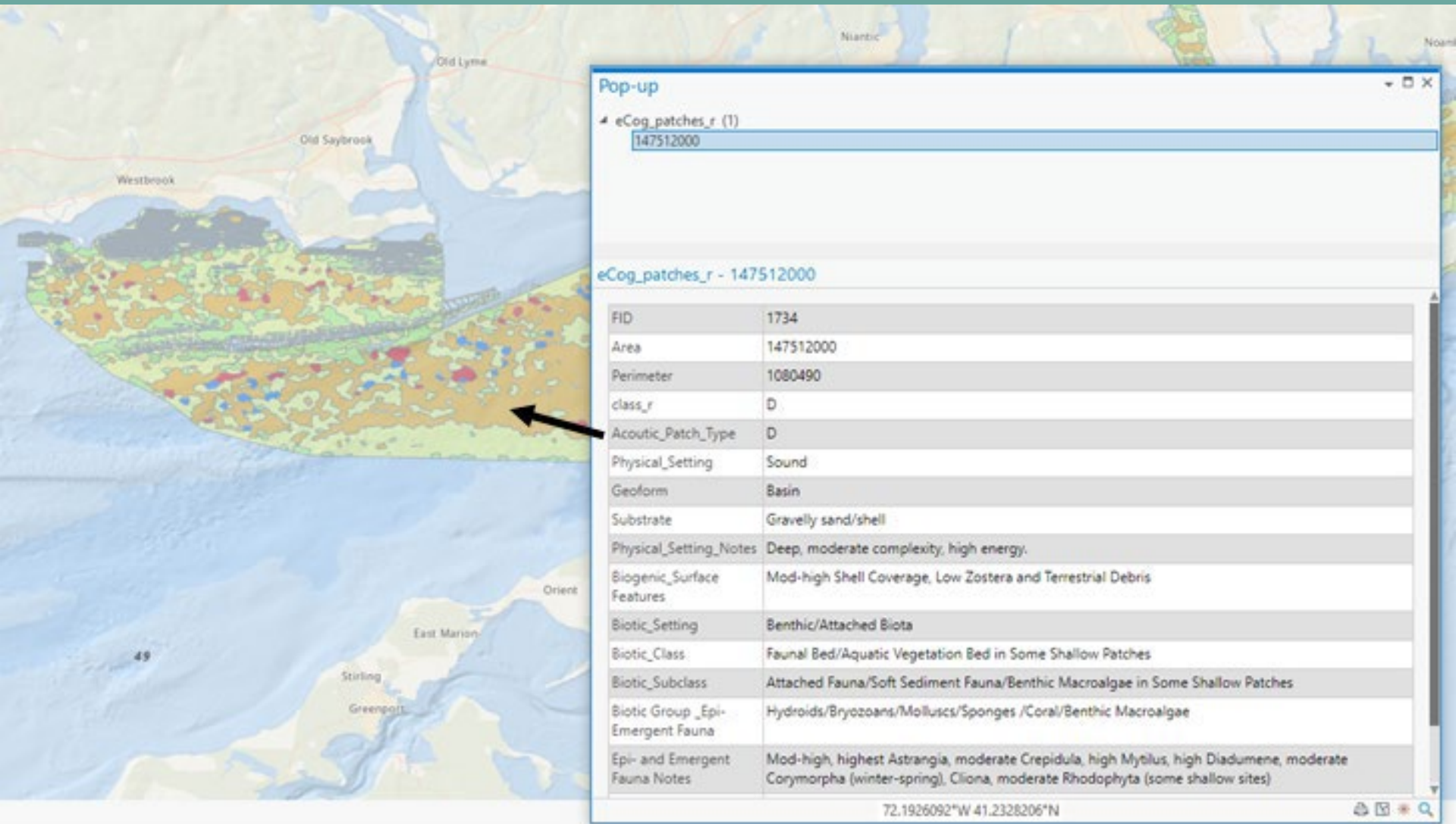
Patch type B - *Physical:* Moderate depths, moderate to high complexity, low to moderate energy. *Biogenic:* Low-mod shell coverage, moderate *Zostera* and terrestrial debris; *Infaunal taxa:* Tube building and burrowing fauna, hermit crabs, amphipods, bamboo worms, burrowing worms, sand dollars; *Epi- emergent- taxa:* Low-mod hydrozoan-bryozoan turf, low *Astrangia*, low *Crepidula*, low *Mytilus*, *Diadumene*, *Corymorpha* (winter-spring), *Cliona*, high Rhodophyta cover at some shallow sites.

Patch type C - *Physical:* Deepest, highest complexity, moderate to high energy; *Biogenic:* Moderate shell coverage, moderate *Zostera* and terrestrial debris; *Infaunal Taxa:* Tube building and burrowing Fauna, molluscs, *Astarte* spp., amphipods, bamboo worms, burrowing worms, sand dollars; *Epi- emergent- taxa:* Moderate hydrozoan-bryozoan turf, moderate *Astrangia*, moderate *Crepidula*, moderate *Mytilus*, *Diadumene*, moderate *Corymorpha* (winter-spring), *Cliona*, moderate Rhodophyta (some shallow sites).

Patch type D - *Physical:* Deep, moderate complexity, highest energy; *Biogenic:* Mod-high shell coverage, low *Zostera* and terrestrial debris; Infaunal Taxa: Molluscs, *Astarte* spp., tube building and burrowing fauna, amphipods, bamboo worms, sand dollars. *Epi- emergent- taxa:* Moderate-high to highest *Astrangia*, moderate *Crepidula*, high *Mytilus*, high *Diadumene*, moderate *Corymorpha* (winter-spring), *Cliona*, moderate *Rhodophyta* (some shallow sites).

Patch type E - *Physical:* Shallow to moderate depths, low complexity, high energy; *Biogenic:* Highest coverage of shell; *Infaunal taxa:* Molluscs, *Astarte* spp. tube building and burrowing fauna, ophiuroids, sand dollars; *Epi- emergent- taxa:* Highest hydrozoan-bryozoan turf, high *Astrangia*, low *Crepidula*, moderate *Mytilus*, high *Corymorpha* (winter-spring).

CMECS Classification

Pop-up   ▼ ☐ ✕

▲ eCog_patches_r (1)
  147512000

eCog_patches_r - 147512000

FID	1734
Area	147512000
Perimeter	1080490
class_r	D
Acoutic_Patch_Type	D
Physical_Setting	Sound
Geoform	Basin
Substrate	Gravelly sand/shell
Physical_Setting_Notes	Deep, moderate complexity, high energy.
Biogenic_Surface Features	Mod-high Shell Coverage, Low Zostera and Terrestrial Debris
Biotic_Setting	Benthic/Attached Biota
Biotic_Class	Faunal Bed/Aquatic Vegetation Bed in Some Shallow Patches
Biotic_Subclass	Attached Fauna/Soft Sediment Fauna/Benthic Macroalgae in Some Shallow Patches
Biotic Group _Epi- Emergent Fauna	Hydroids/Bryozoans/Molluscs/Sponges /Coral/Benthic Macroalgae
Epi- and Emergent Fauna Notes	Mod-high, highest Astrangia, moderate Crepidula, high Mytilus, high Diadumene, moderate Corymorpha (winter-spring), Cliona, moderate Rhodophyta (some shallow sites)

72.1926092°W 41.2328206°N

Example Phase II Findings

- Ecological Characterization
  - Total abundance, taxonomic richness and diversity were highest in the central and eastern portions
  - Ecological pattern comports with sediment composition; patterns of diversity and dominance shift across patches but draw from a similar species pool

- Physical Characterization
  - Bottom stress influences recruitment rates and benthic feeding and impacts substrate attachment and survivorship during storm events
  - Use of FVCOM for spatial interpolation was further validated, improved results from Pilot.
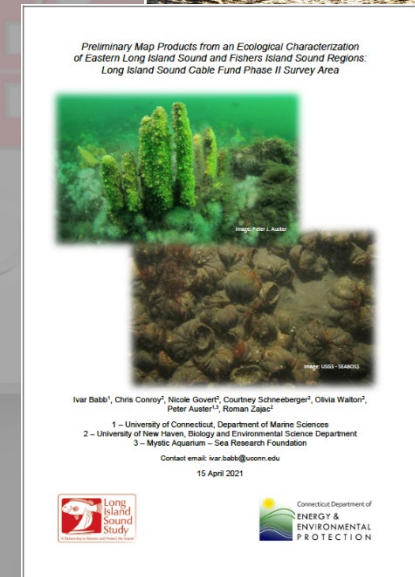
Phase II Mapping Goals - Revisited

Improvements to Pilot processes:

1. **Communication/cohesiveness about standards and processes**
   - **More frequent and targeted check-ins and common reporting formats.**

2. **Timelines and scheduling of inter-team dependencies**
   - **Remains challenging; need to separate initial acoustic efforts from other collection phases.**

3. **Earlier feedback on draft products**
   - **Provides teams more ability to refine and edit as needed.**

4. **Distribution & access of final data products**
   - **Broadening the options to include several points of access.**

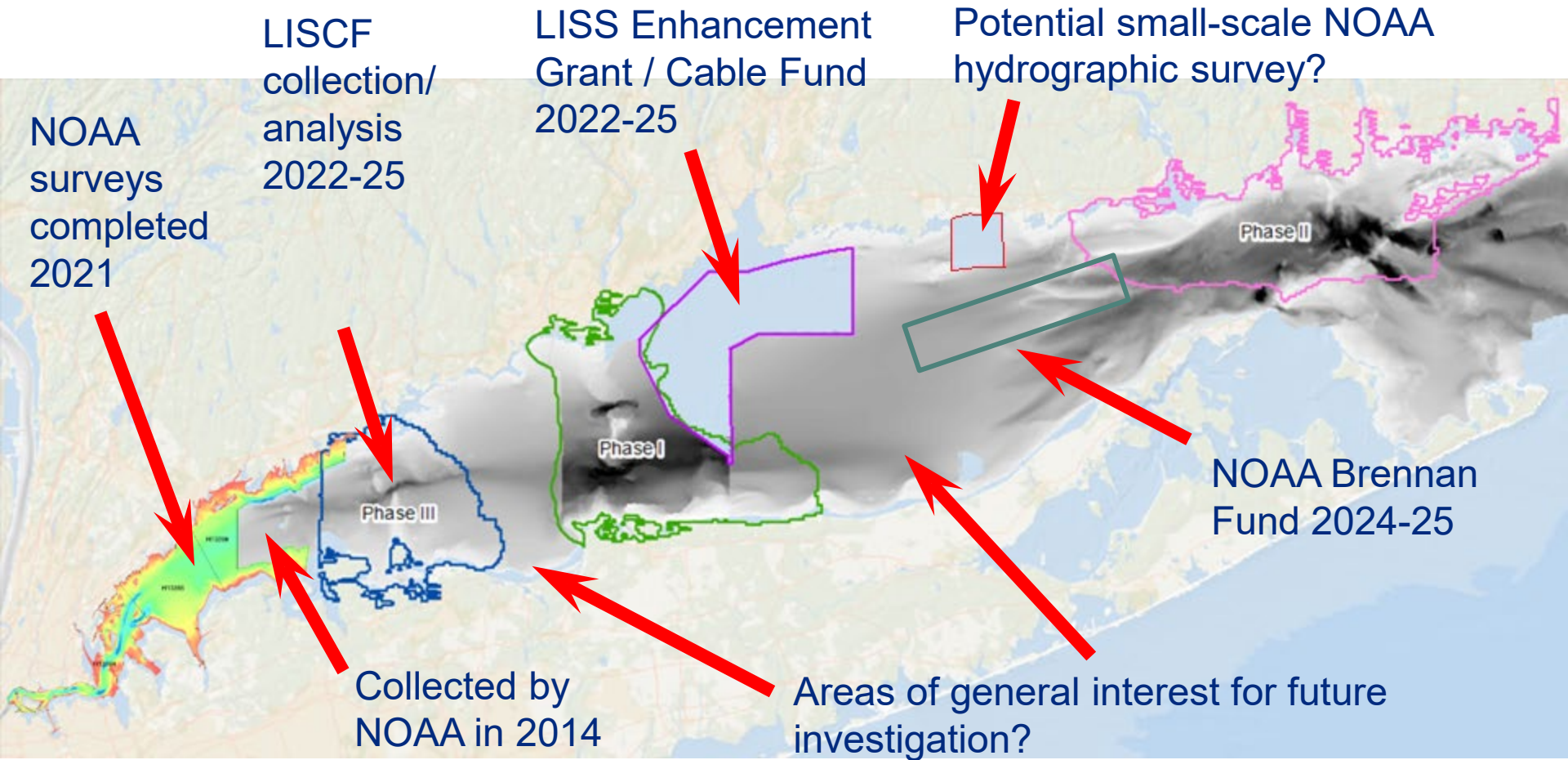Connecticut Department of Energy and Environmental Protection

Phase I and II Outcomes

- Results were included in the LIS Blue Plan inventory (e.g., cold water corals, areas of seafloor complexity)

- A preliminary report was generated in 2021 to guide cable routing decisions in LIS

- Data were provided to NYSERDA in 2022 to also guide cable routing

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Phase III & Beyond

LISCF collection/ analysis 2022-25

LISS Enhancement Grant / Cable Fund 2022-25

Potential small-scale NOAA hydrographic survey?

NOAA surveys completed 2021

Phase II

Phase I

Phase III

NOAA Brennan Fund 2024-25

Collected by NOAA in 2014

Areas of general interest for future investigation?

Also holding stakeholder feedback meetings later in 2023.

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LIS Mapping Initiative Resources

LISS: https://longislandsoundstudy.net/research-monitoring/seafloor-mapping/

- Original website - general project info

LDEO: http://www.marine-geo.org/portals/lis/

- Original data archive and download

UConn: https://lismap.uconn.edu/

- NEW - Project resources, multi-media, info, story maps

Coming soon – Phase 2 data added to the NY Geographic Information Gateway: http://opdgig.dos.ny.gov/#/home

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