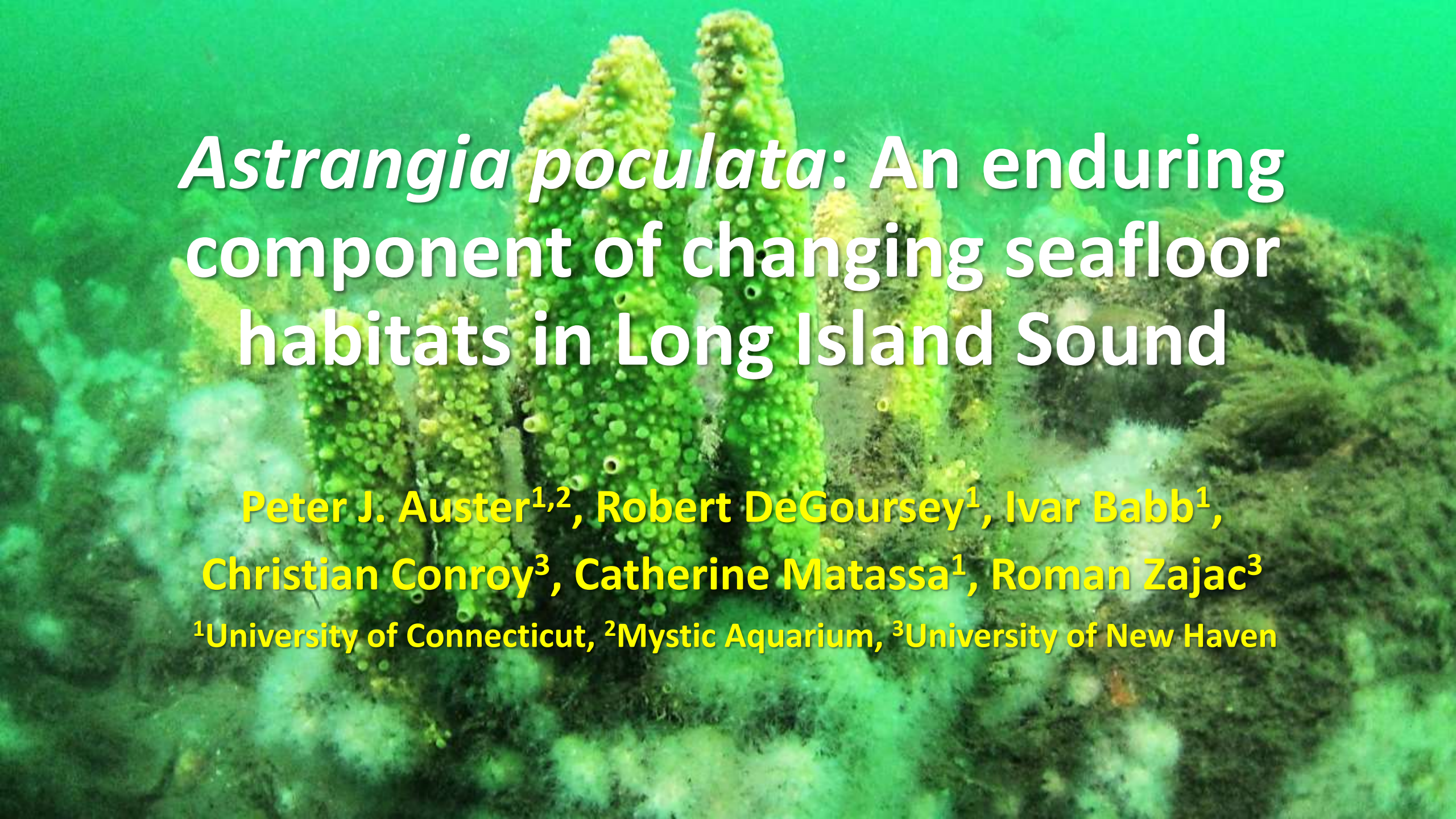


Astrangia poculata: An enduring component of changing seafloor habitats in Long Island Sound

Peter J. Auster[1,2], Robert DeGoursey[1], Ivar Babb[1],
Christian Conroy[3], Catherine Matassa[1], Roman Zajac[3]

[1]University of Connecticut, [2]Mystic Aquarium, [3]University of New Haven

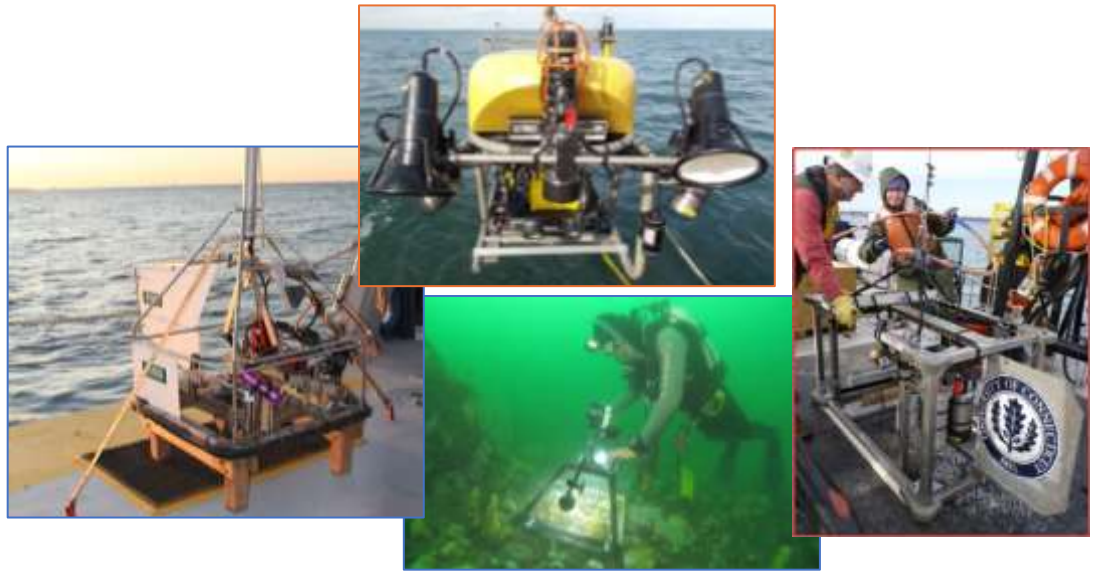
12 minutes
2 short stories!

- One about space
- One about time
- All through the eyes of the main character:

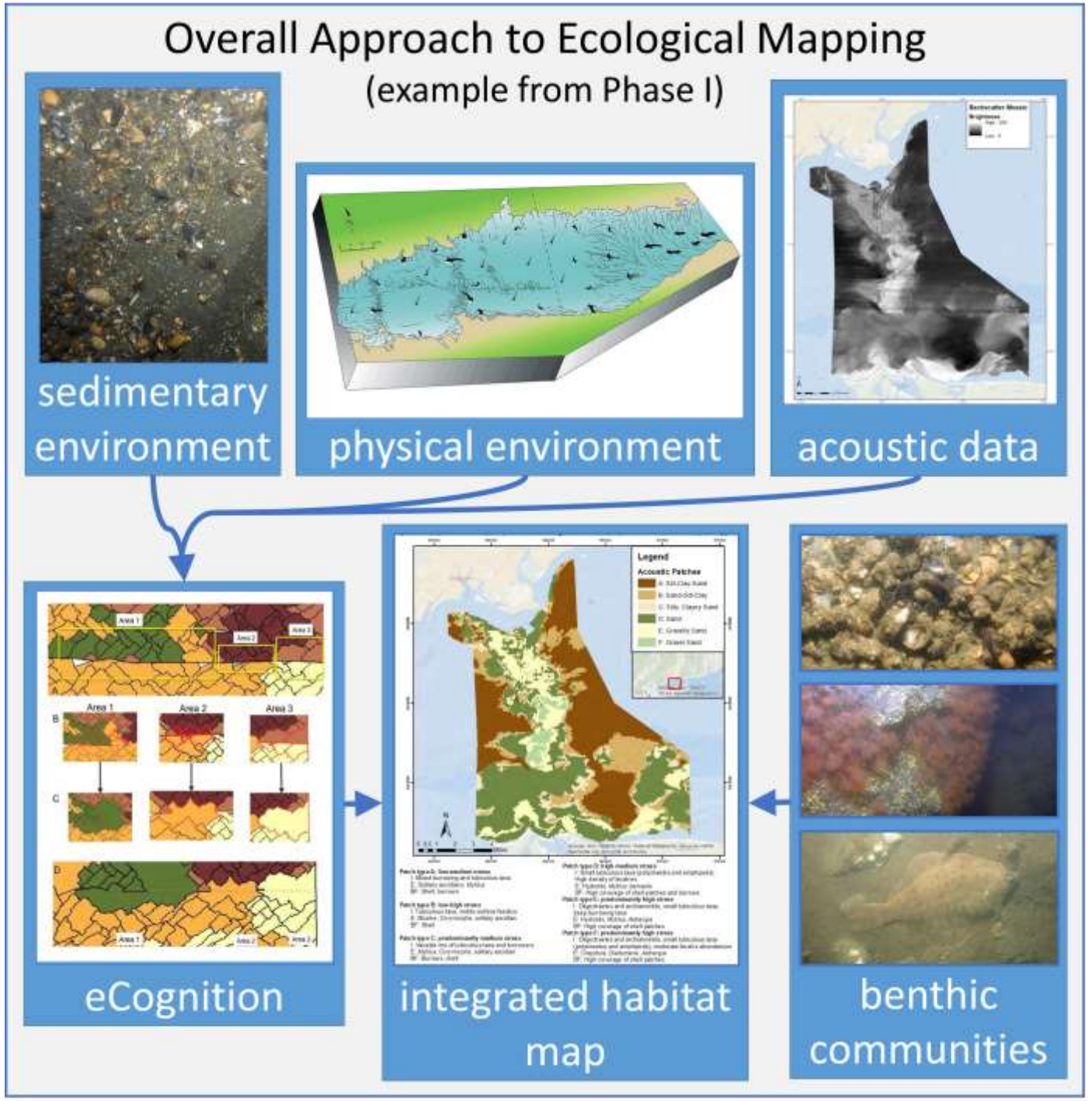
Astrangia poculata

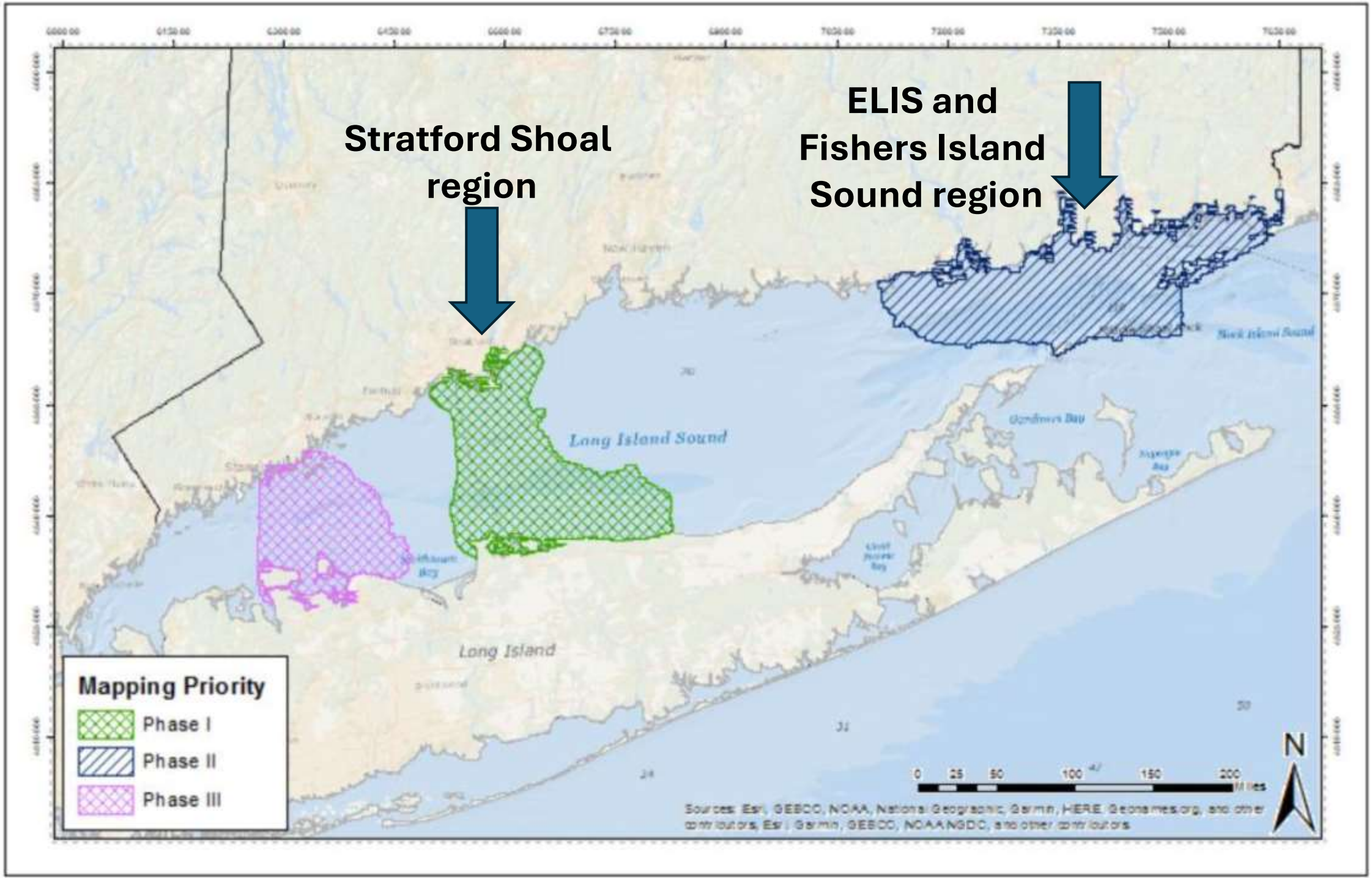
The Space Story: LIS Habitat Mapping

Ecological characterization of seafloor habitats to inform policy and management

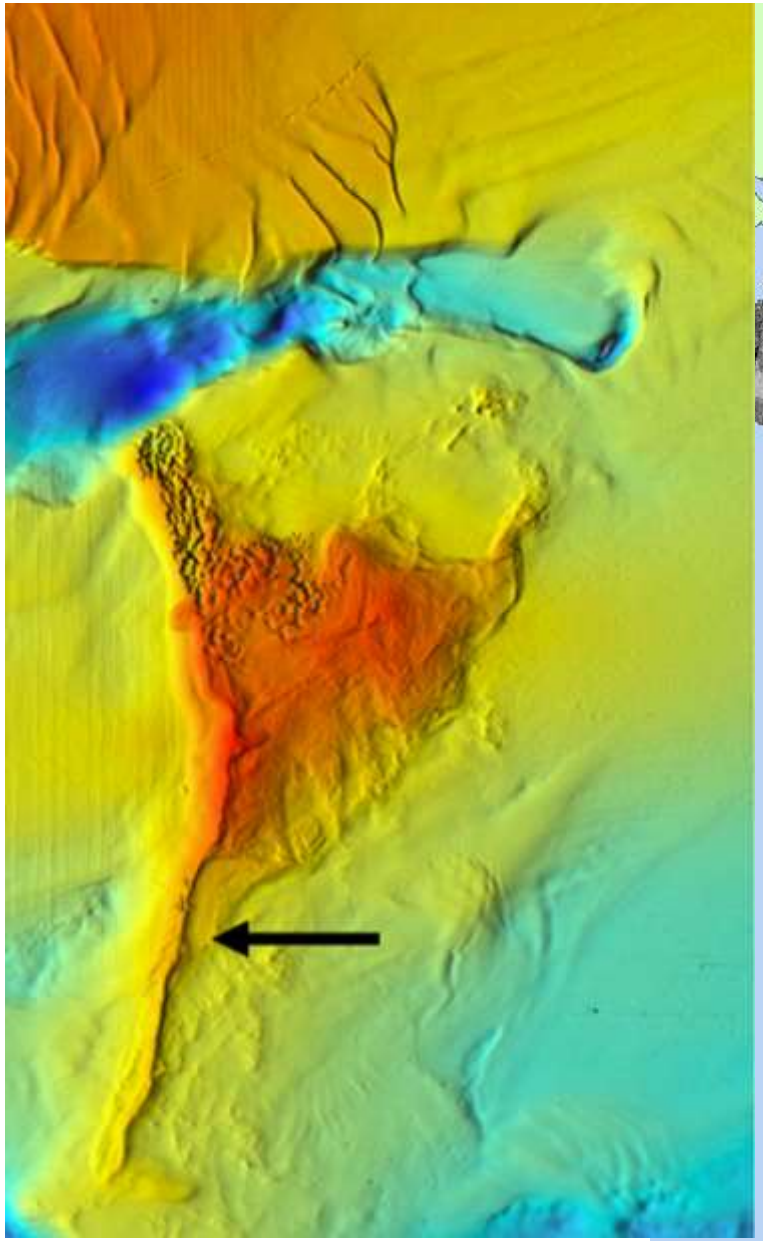


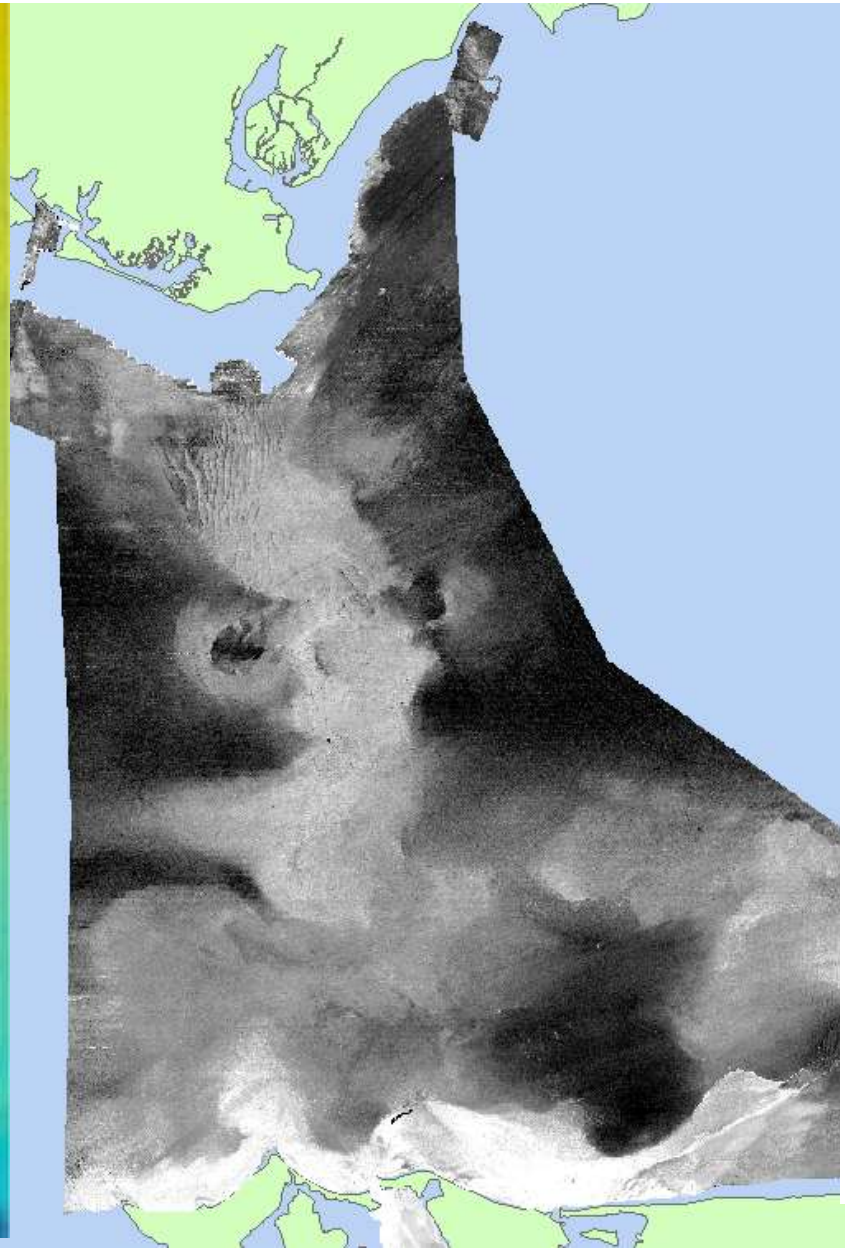
https://lismap.uconn.edu/

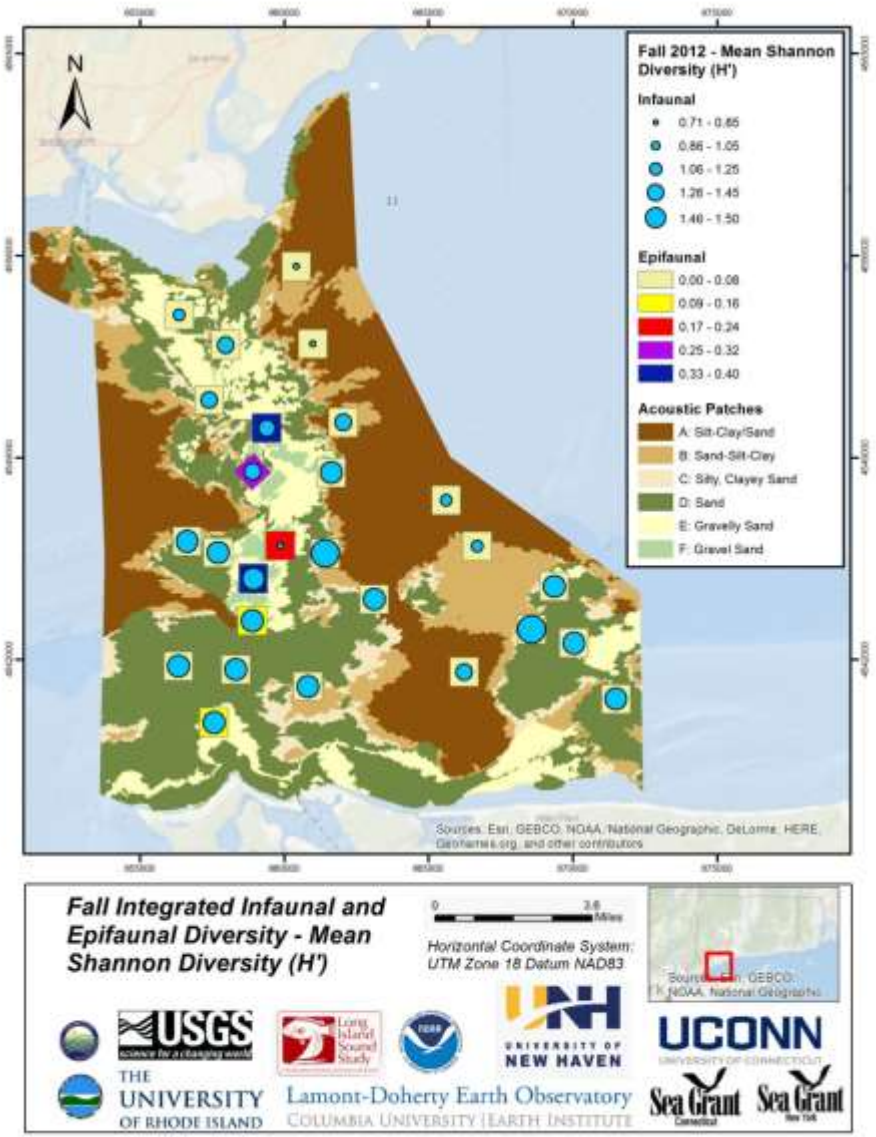



Stratford Shoal region
ELIS and Fishers Island Sound region
Long Island Sound
Long Island
Gardiners Bay
Block Island Sound
Mapping Priority
Phase I
Phase II
Phase III
0 25 50 100 150 200
Miles
N

Stratford Shoal region

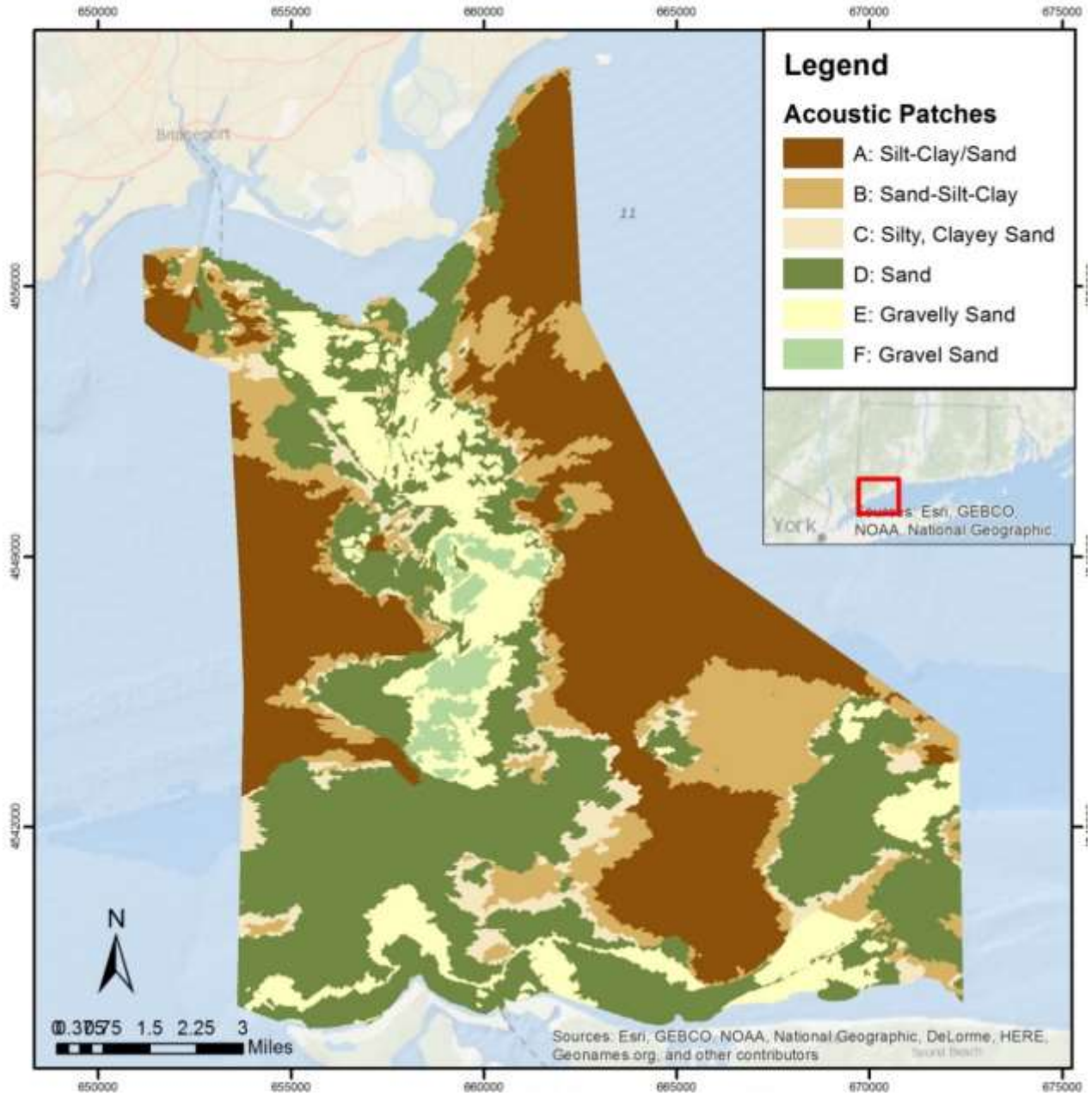






Integrated Habitat Map

based on mean bottom tidal stress, defining ecological characteristics of infaunal (I) and epifaunal (E) communities, and predominant biogenic features (BF).



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

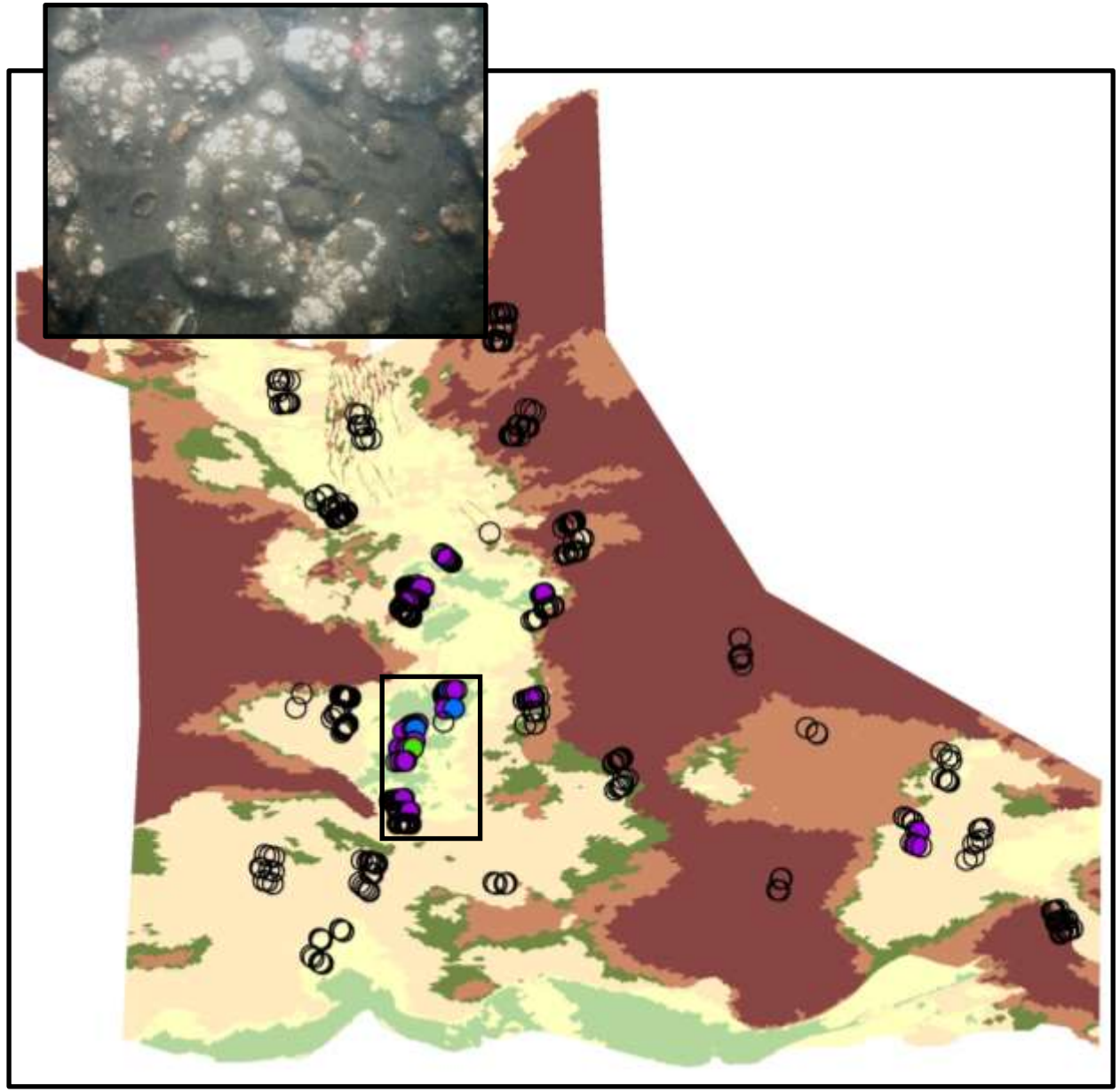
Patch type C: predominantly medium stress
- I: Variable mix of tubiculous taxa and burrowers
- E: *Mytilus*, *Corymorpha*, solitary ascidian
- BF: Burrows, shell

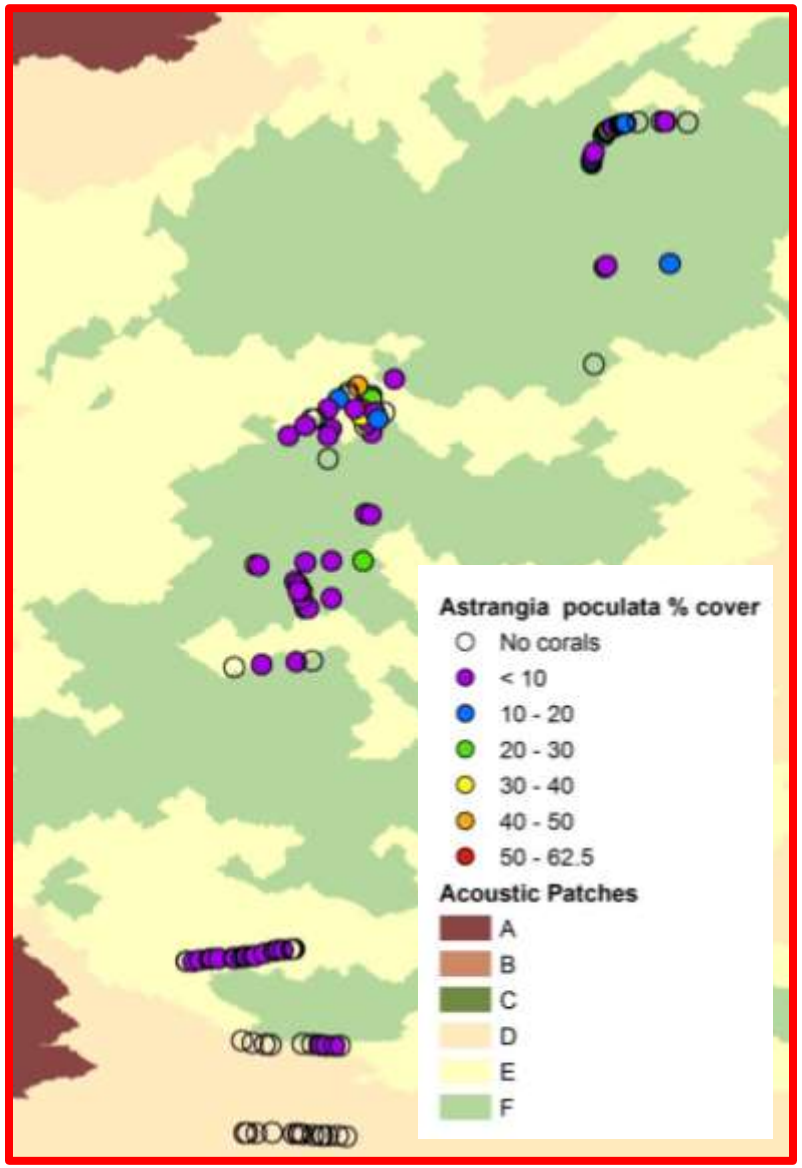
Patch type D: high-medium stress
- I: Small tubiculous taxa (polychaetes and amphipods); High density of bivalves
- E: Hydroids, *Mytilus*, barnacle
- BF: High coverage of shell patches and burrows

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

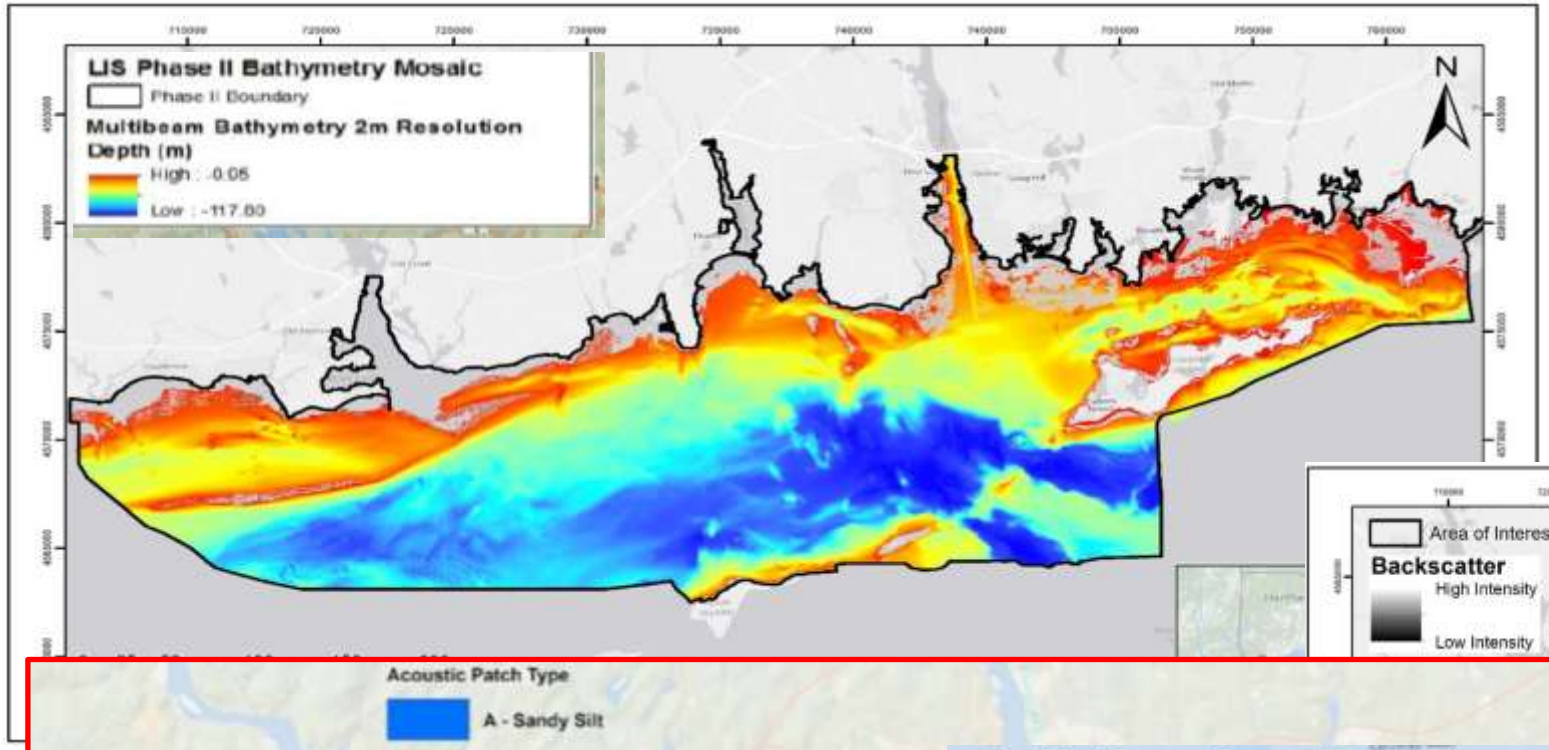
Patch type F: predominantly high stress
- I: Oligochaetes and archiannelids, small tubiculous taxa (polychaetes and amphipods), moderate bivalve abundances
- E: *Crepidula*, *Diadumene*, *Astrangia*
- BF: High coverage of shell patches

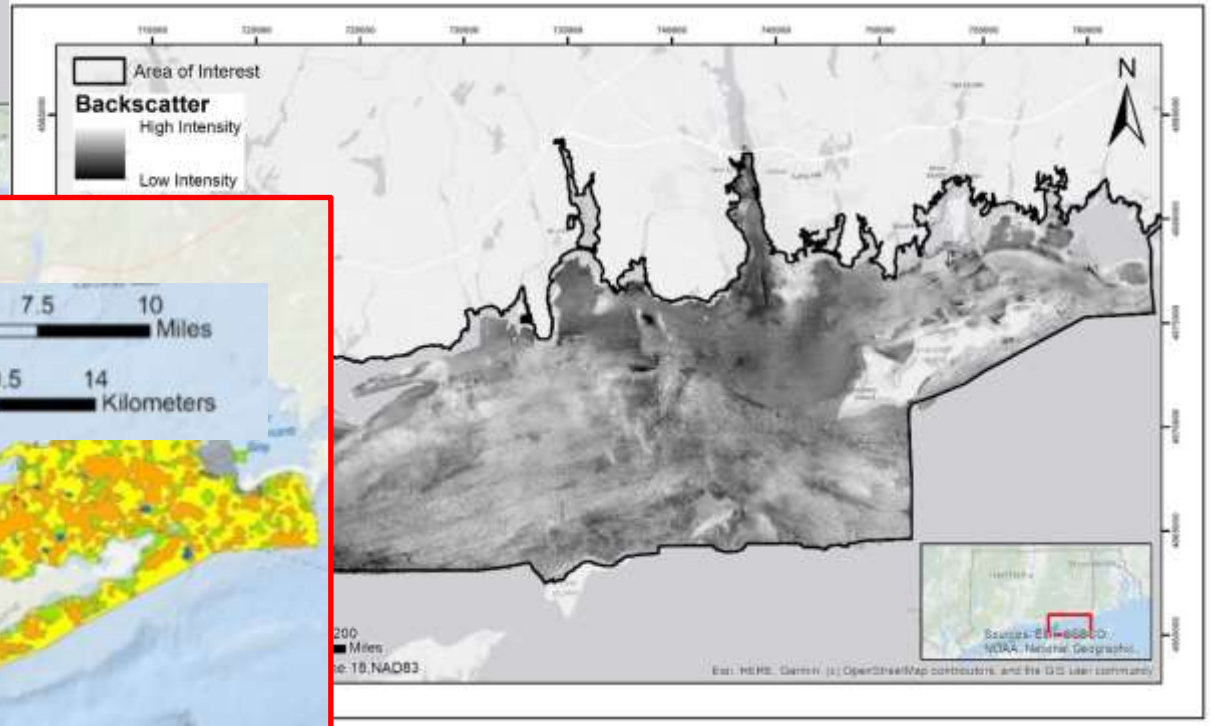
Broad scale distribution: *Stratford Shoal*

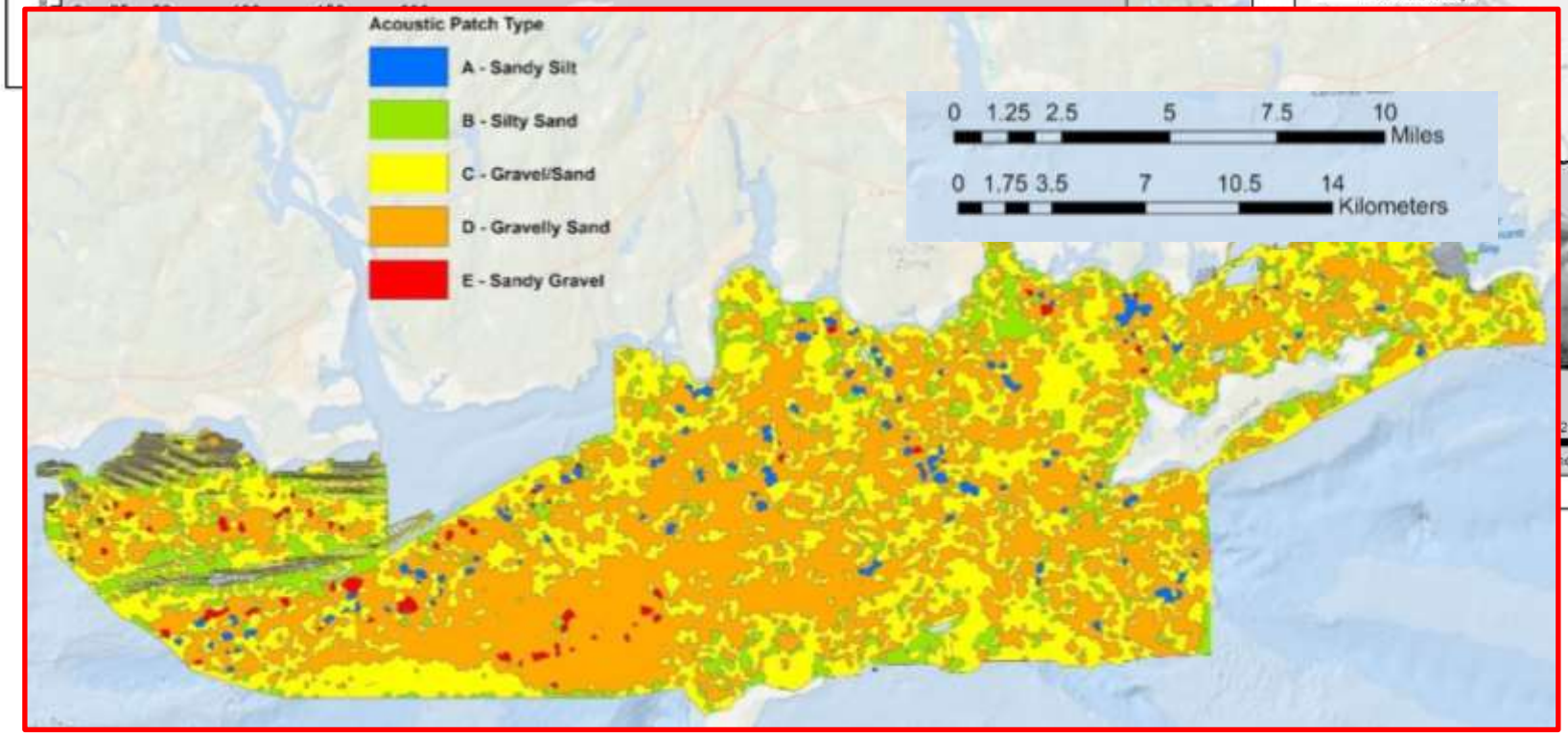




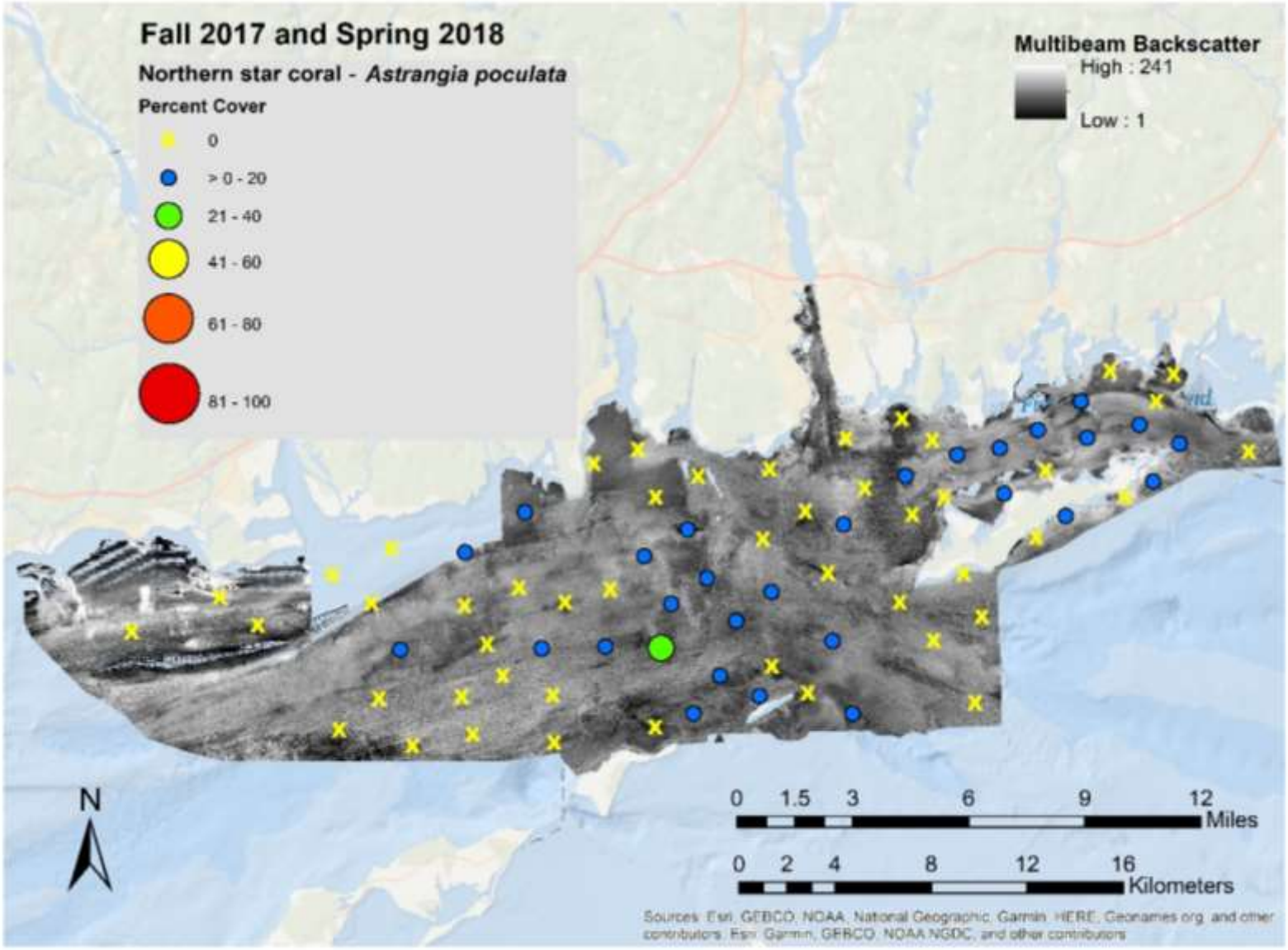
ELIS and Fishers Island Sound region

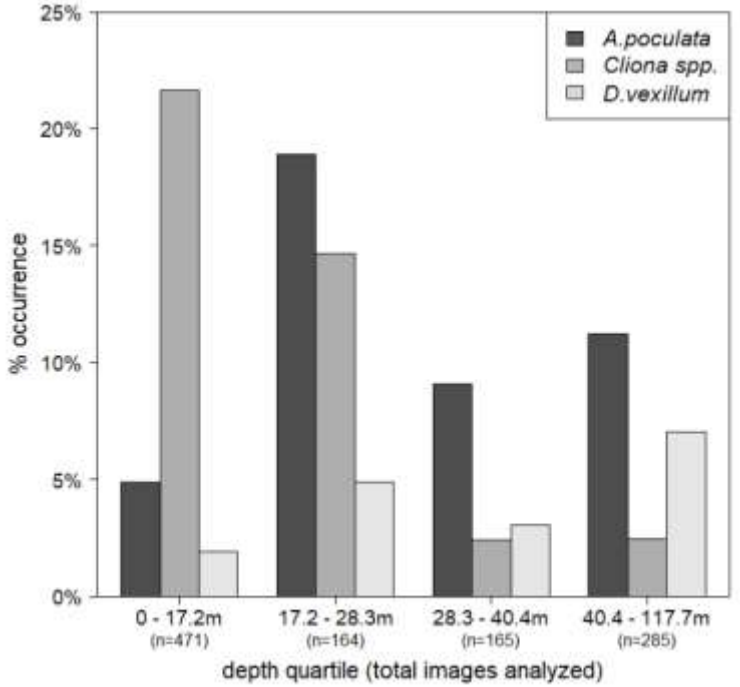


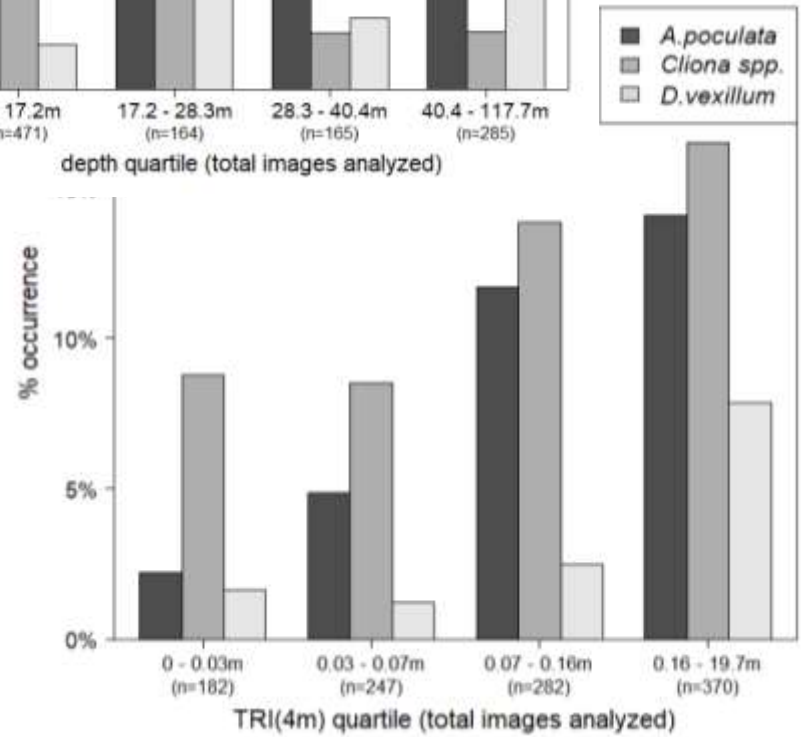


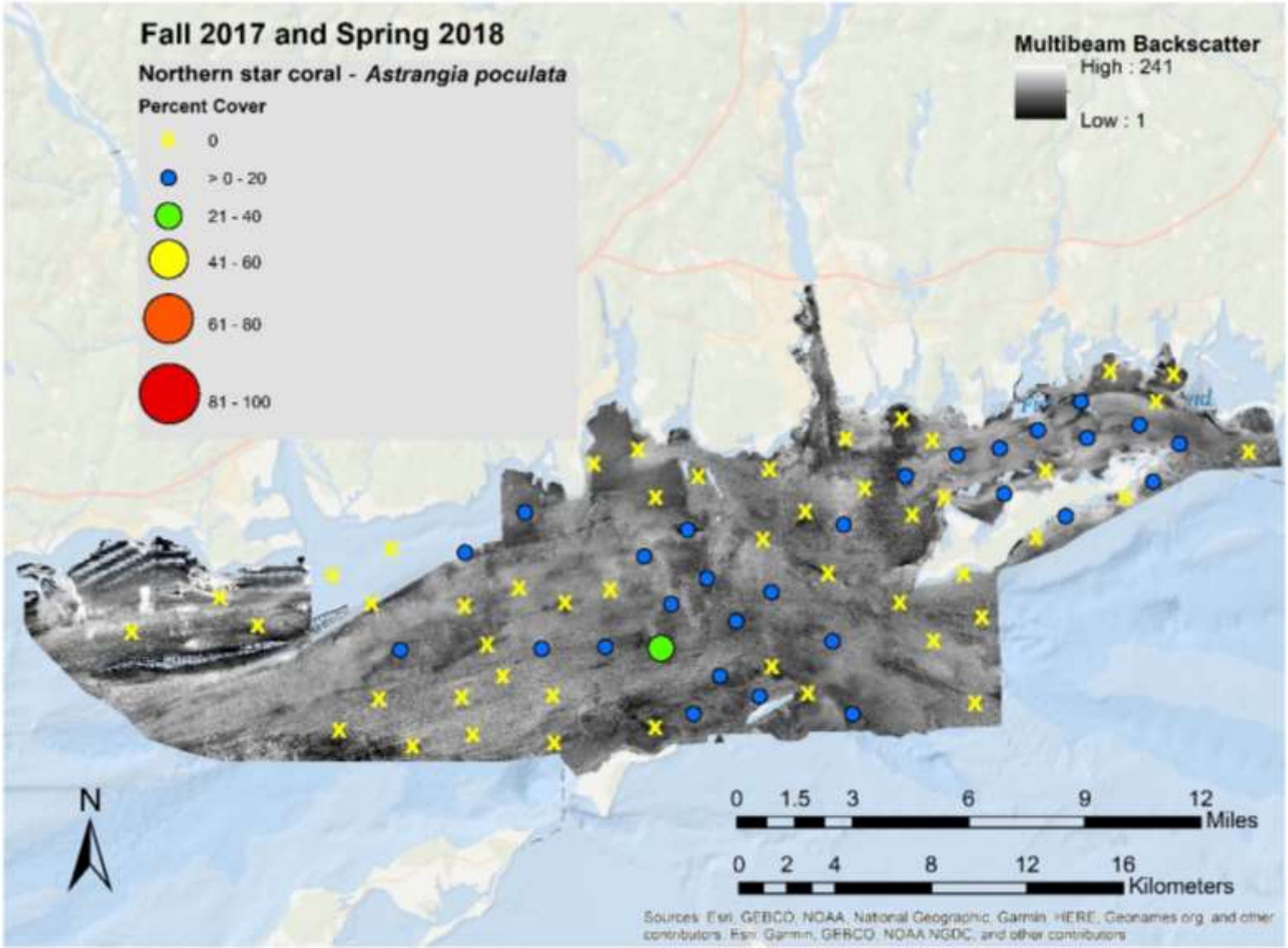


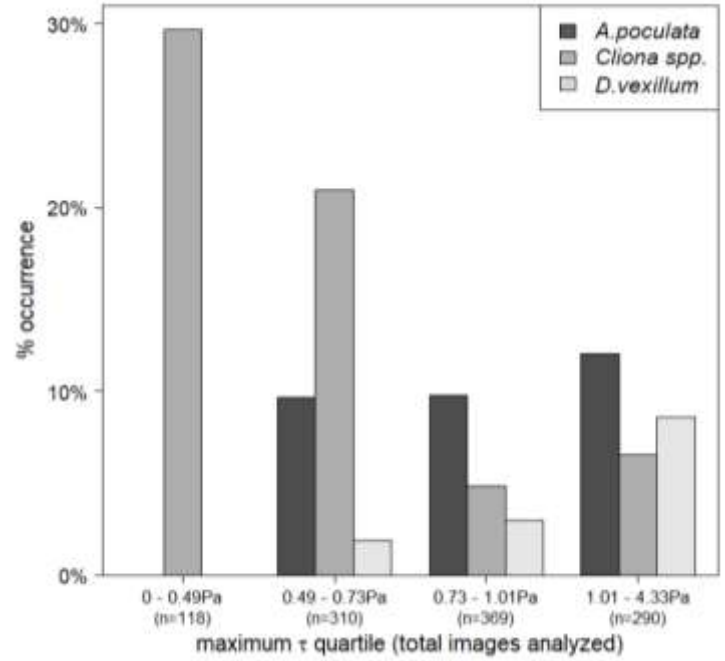
Broad scale distribution: *ELIS and FIS*

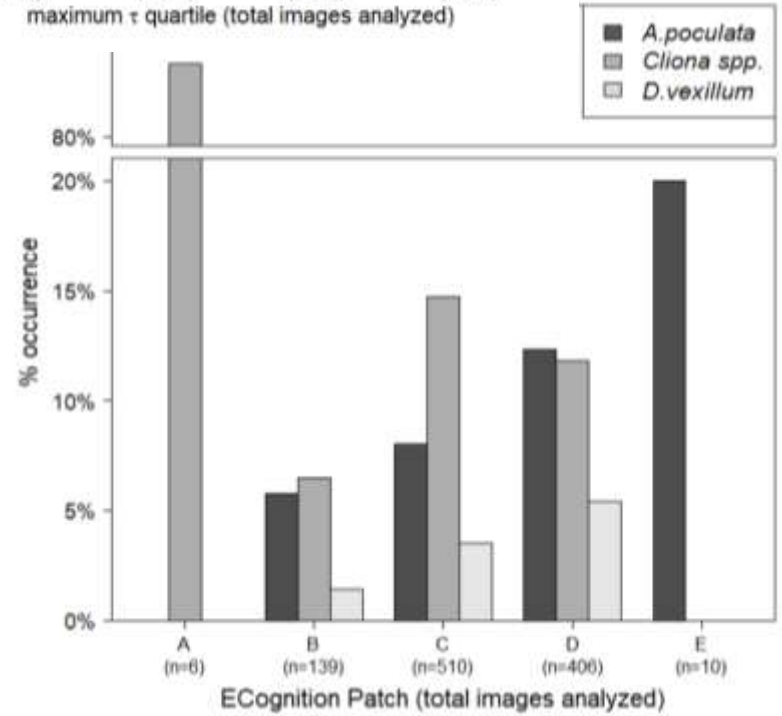


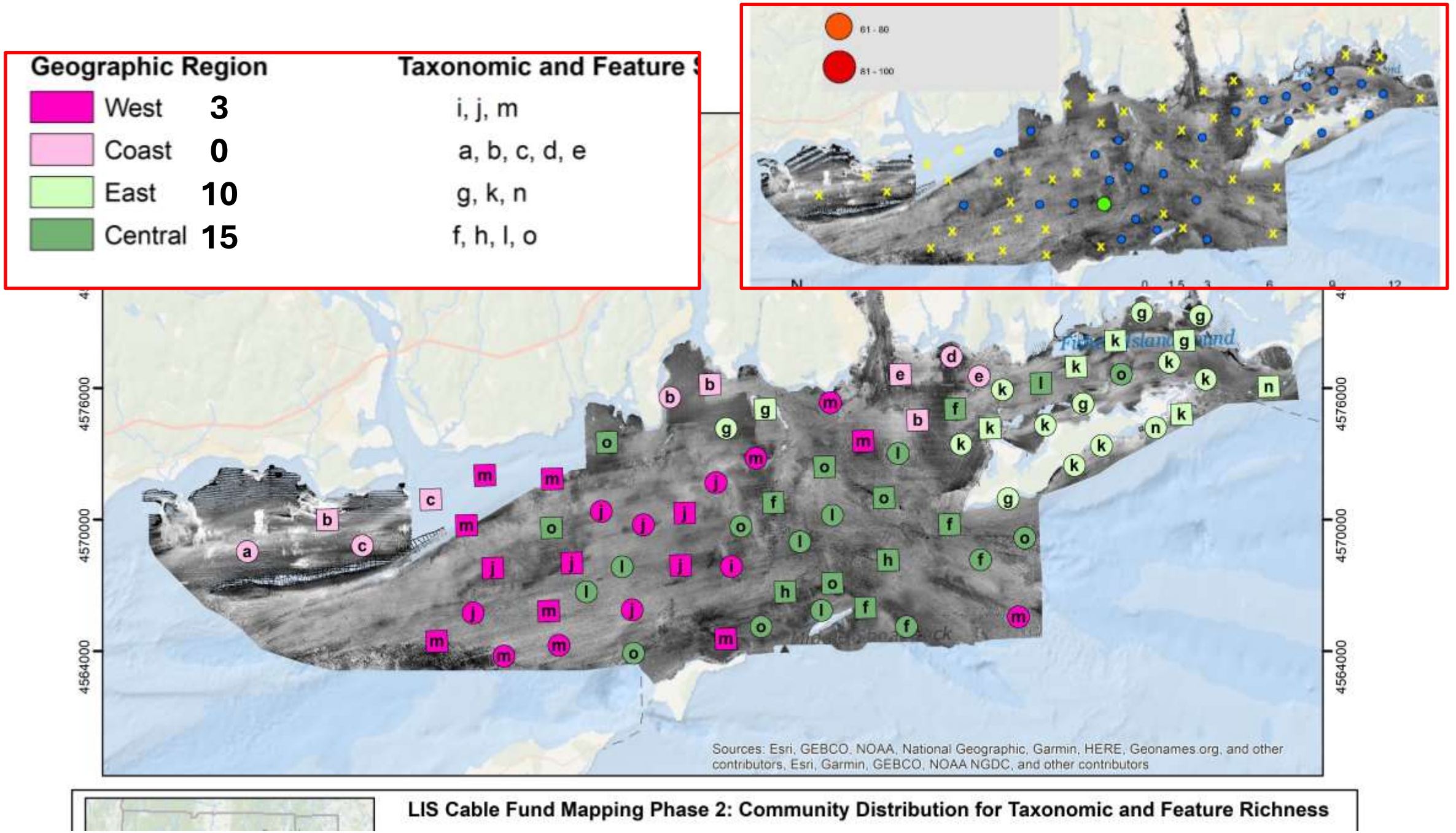





Fall 2017 and Spring 2018
Northern star coral - Astrangia poculata
Percent Cover
0
> 0 - 20
21 - 40
41 - 60
61 - 80
81 - 100
Multibeam Backscatter
High : 241
Low : 1
N
0 1.5 3 6 9 12
Miles
0 2 4 8 12 16
Kilometers
Sources: Esri, GEBCO, NOAA, National Geographic, Garmin, HERE, Geonames.org, and other contributors. Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

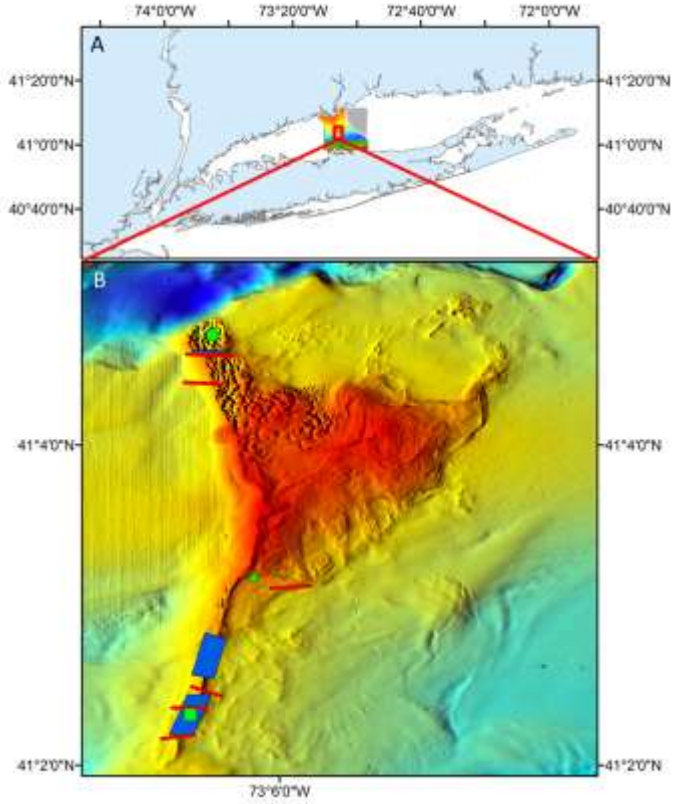

A.poculata
Cliona spp.
D.vexillum
30%
20%
10%
0%
% occurrence
0 - 0.49Pa (n=118)
0.49 - 0.73Pa (n=310)
0.73 - 1.01Pa (n=369)
1.01 - 4.33Pa (n=290)
maximum τ quartile (total images analyzed)


A.poculata
Cliona spp.
D.vexillum
80%
20%
15%
10%
5%
0%
% occurrence
A (n=6)
B (n=139)
C (n=510)
D (n=406)
E (n=10)
ECognition Patch (total images analyzed)

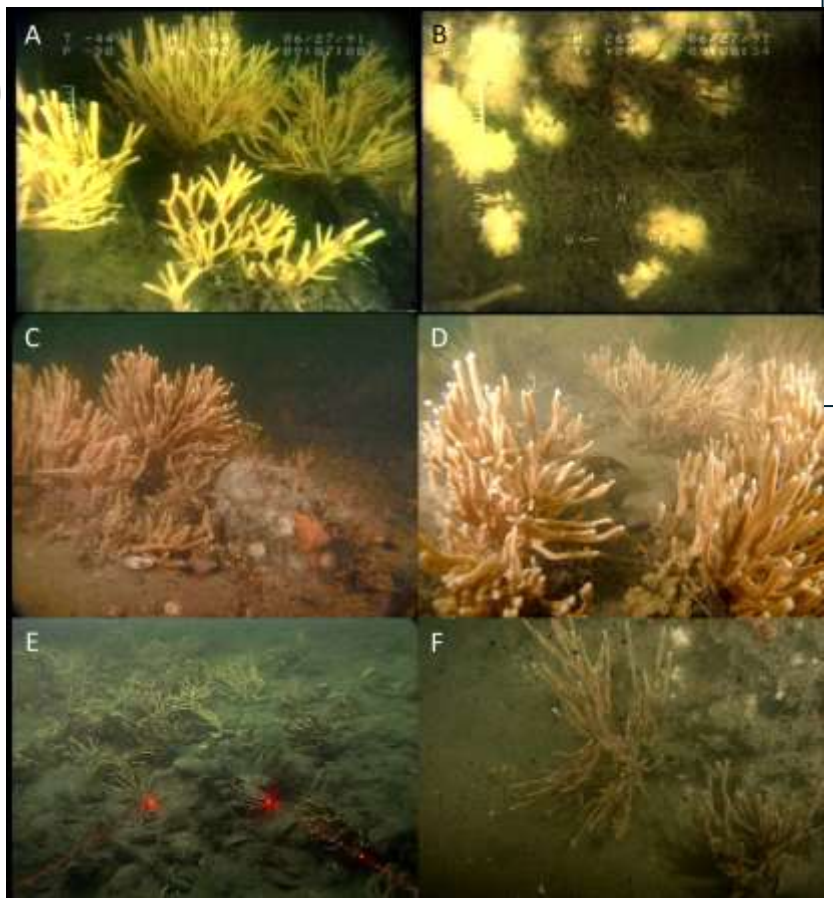


LIS Cable Fund Mapping Phase 2: Community Distribution for Taxonomic and Feature Richness

The Time Story: Decadal-scale studies of complex habitats are rare …



1991-2010



Marine Biodiversity Records, page 1 of 6. © Marine Biological Association of the United Kingdom, 2014
doi:10.1017/S1755267214001109; Vol. 7; e115; 2014 Published online

Loss of an erect sponge on a rock reef in Long Island Sound (north-west Atlantic)

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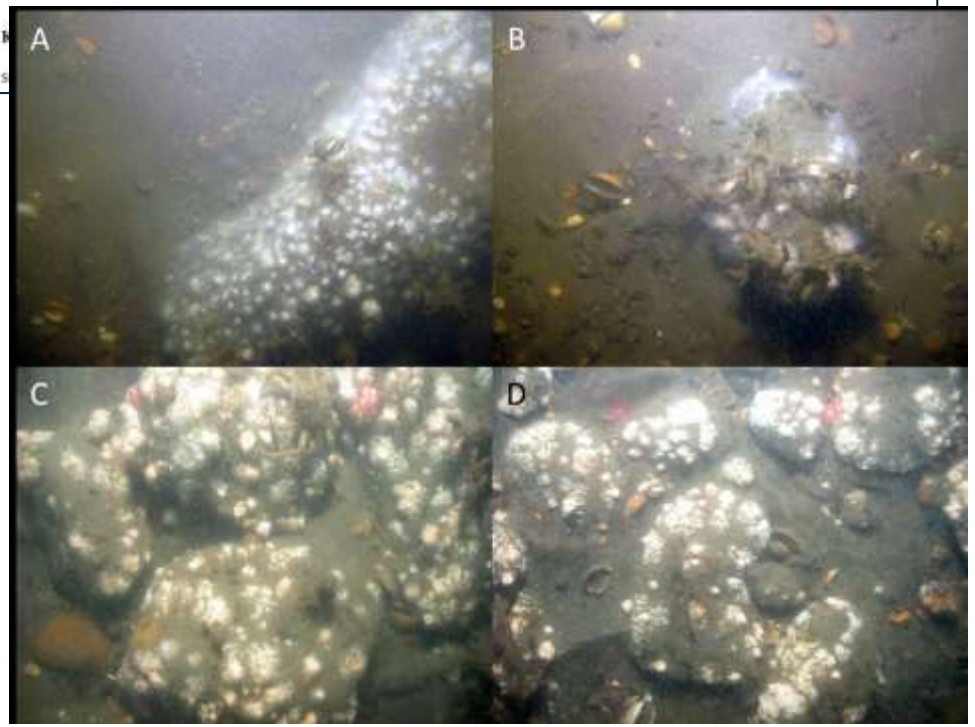
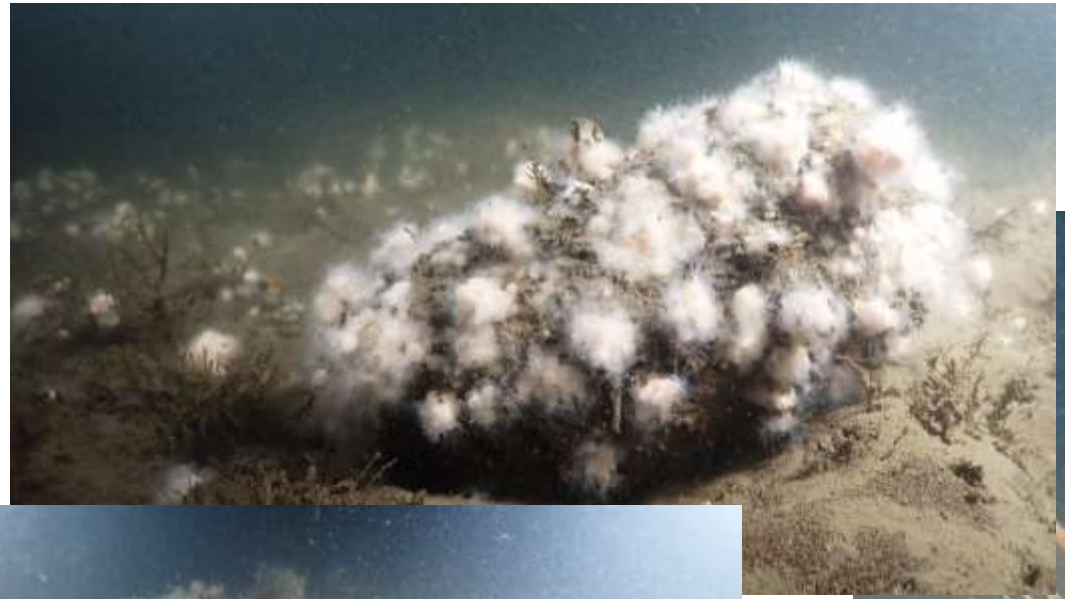
Stratford Shoal is a topographic high dividing the west and central basins of Long Island Sound (north-west Atlantic). The southern end of the shoal has a linear, north–south-tending boulder reef along the crest. Repeated observations of the reef using remote and diver-held cameras from 1991 to 2010 found an apparently stable epibenthic community dominated by Haliclona oculata *(branching sponge),* Astrangia poculata *(northern star coral),* Mytilus edulis *(blue mussel) and erect bryozoa. In 2012, when the boulder reef area was imaged as part of a benthic habitat mapping project,* A. poculata *was still abundant, but no* H. oculata *was found. A number of mechanisms (e.g. species interactions, disease, recruitment failure, thermal stress, sediment loading, freshwater input and physical disturbance) may have contributed, individually or synergistically, to the community shift. However, because of the* ad hoc *and aperiodic nature of the observations, drivers of the shift are indeterminate. As a result, whether the observed changes reflect a short-term disturbance or a long-term community state remains unclear, as do the effects of changes in the identity of the dominant species.*

2012



Summer 2023 – What process/model applies?

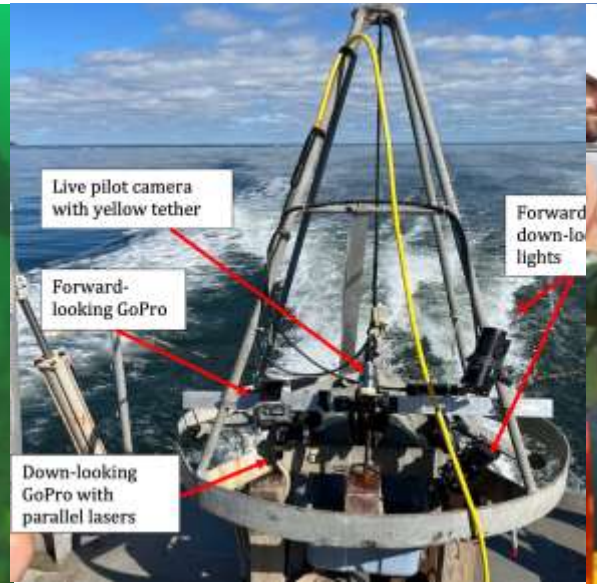
Recovery, resilience, tipping points in LIS complex habitats?

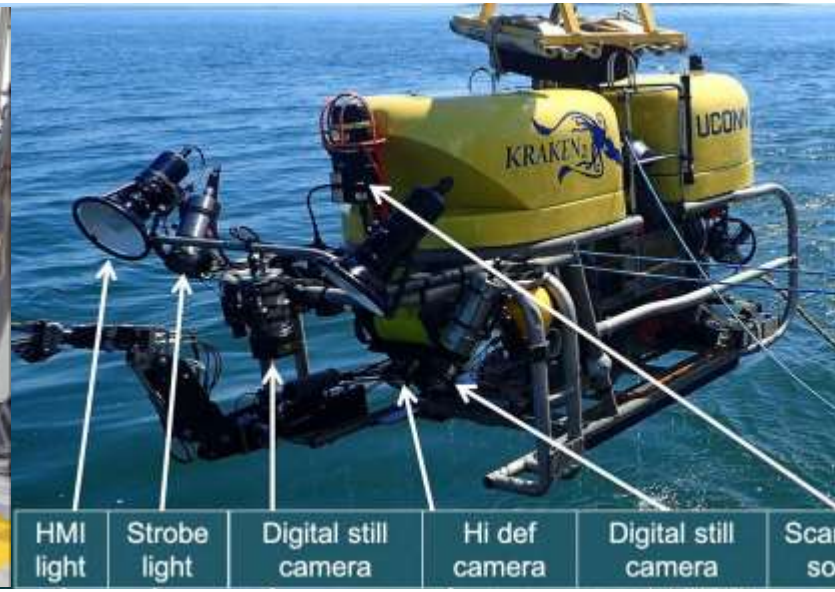


	1991-2010	2012-13	2022-23
Astrangia	↑	↑	+
Haliclona	↑	0	↑
Mytilus	↑	0	0
Crepidula	0	↑	↑
Bryo-Hydro	↑	↑	↑

Look what I found behind the file cabinets!

- 35mm color transparency film (primarily Kodachrome and Ektachrome) were identified from years 1975 to 2013
- Scanned images examined as digital jpeg files n = 271
- Field logbooks from 57 dives at select sites with images
- NURTEC archive of ROV video – 13 dives 1989-2006
- Recent LISMaRC surveys using wet diving (quadrapod, oblique stills), SEABoSS, K2 ROV, PISSAH





Places that old people remember (images, logbooks, video, and paper copies of unpublished reports)

https://www.bsac.com/news-and-blog/anatomy-of-a-diver-the-bones/

Ellis Reef

1983-1988

2017-2018

2023

Cliona ↑

Astrangia ↑

Metridium 0

Asterias 0

Crepidula ↑

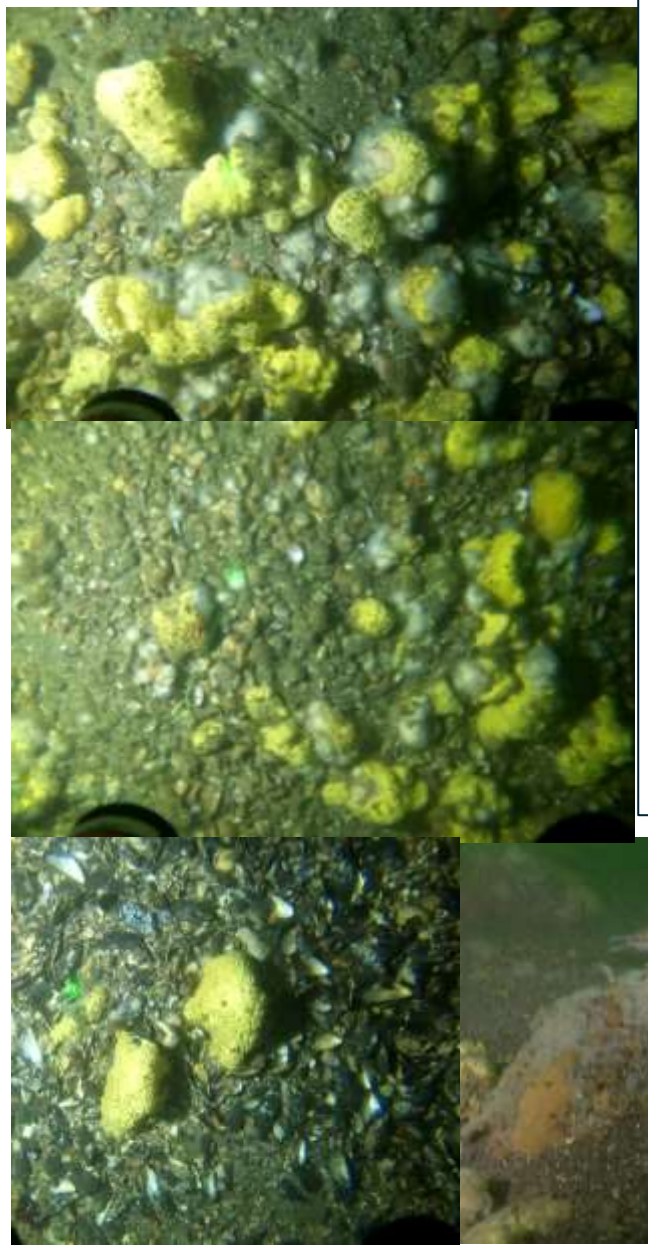
Homarus/ Cancer ↓

Deep Hole East of Latimer Reef

1987-1993

2006

2022-2023



Astrangia

Mytilus

Crepidula

Asterias

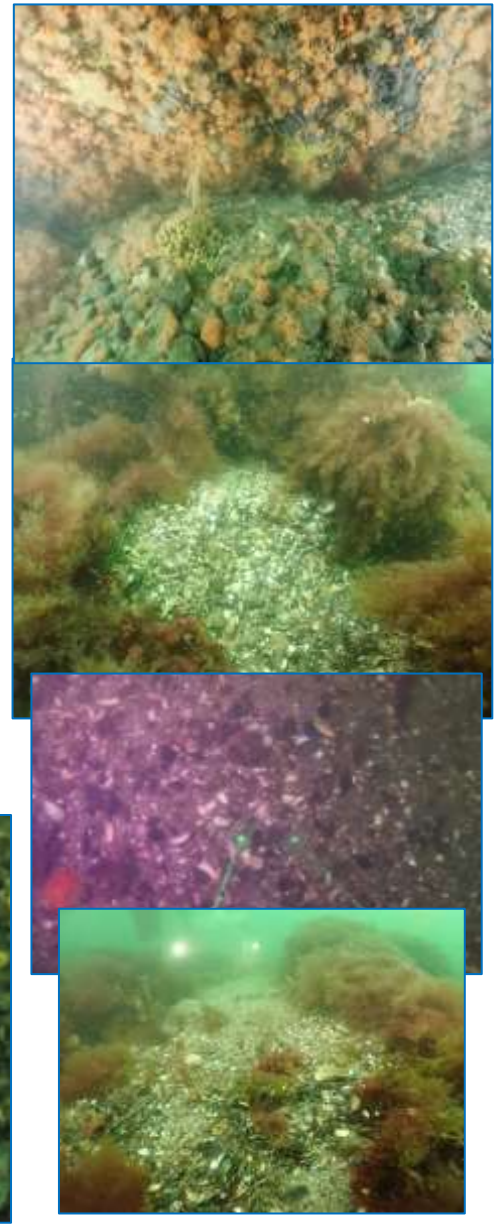
Arbacia

Ram Island Reef

1982-1986

2017

2022-2023

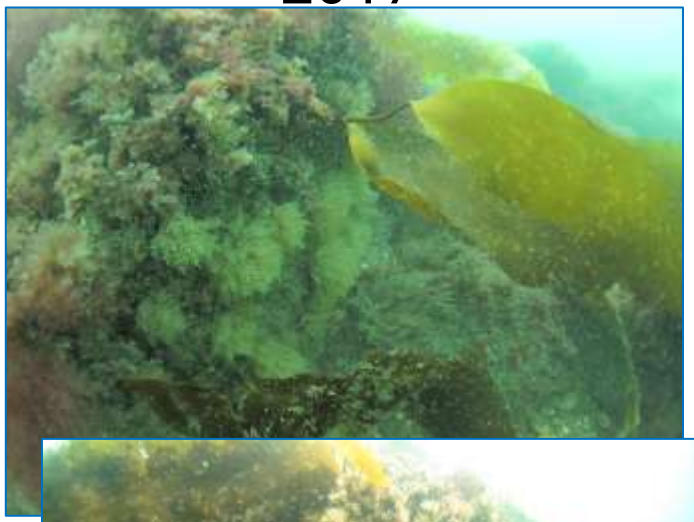


Mytilus	0
Crepidula	↕
Kelp	0
Asterias	0
Homarus/ Cancer	0

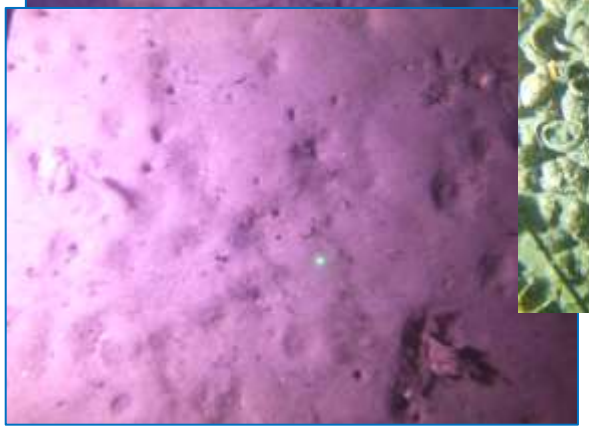
North Dumpling

1975

2017



2022



Mytilus	0
Crepidula	↕
Kelp	0
Asterias	0
Homarus/ Cancer	0

Patterns and inference?
What role of *Astrangia*?

Role as structure forming species

- Stability over decades in *Cliona-Astrangia* community
- *Astrangia* distribution dynamic
- Reduced kelp habitat
- Decline in *Mytilus* - increase *Crepidula* dominated communities

Interactions with predators

- Apparent *Asterias* decline
- Apparent *Metridium* decline
- Decline in *Homarus*/*Cancer*
- Decline in *Tautogolabrus*, increase in *Centropristis*

Drivers

- Climate
- Competition space-food resources
- Predation
- Shifts in cyclical recruitment/mortality
- Overlaid on temp driven increases

Processes (pops/community)

- Where are tipping points?
- What does recovery look like?
- Recovery without resilience?

The Future

- Research=Confirm–monitor–drivers?
- Policy=Focused on disturbance?
- Management=ABM?

Acknowledgements

Support for this work comes from:

- The Long Island Sound Seafloor Mapping Fund administered cooperatively by the EPA Long Island Sound Study and the CT Department of Energy and Environmental Protection
- Mystic Aquarium
- CT National Estuarine Research Reserve
- CT Sea Grant
- USGS Woods Hole Coastal and Marine Science Center
- UConn Marine Sciences Vessel Operations, Diving Program, and NURTEC ROV Group


Questions?