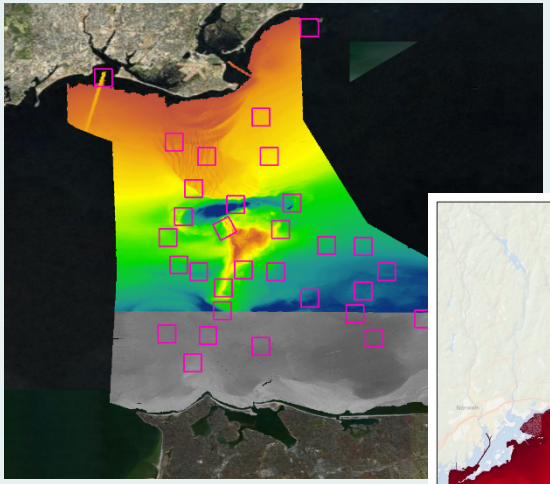
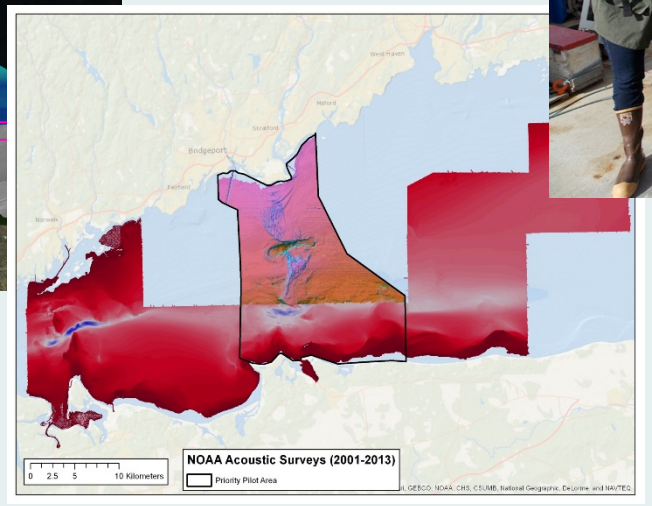
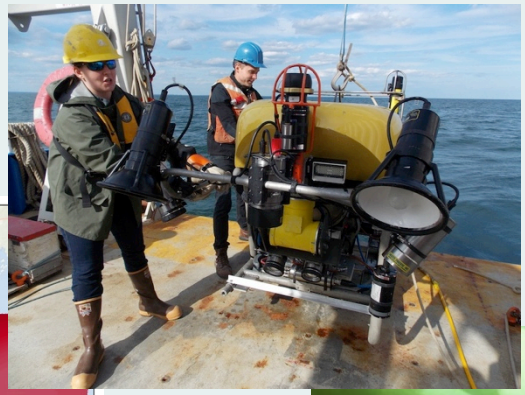
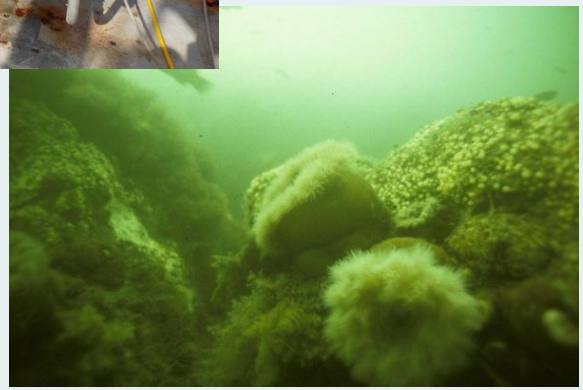








LIS Seafloor Mapping Initiative

5/13/2016

Kevin O'Brien, CT DEEP, Office of Long Island Sound Programs
Ivar Babb, University of Connecticut

2016 Long Island Sound Research Conference

CT Department of Energy and Environmental Protection

UCONN
UNIVERSITY OF CONNECTICUT

CT Coastal Management

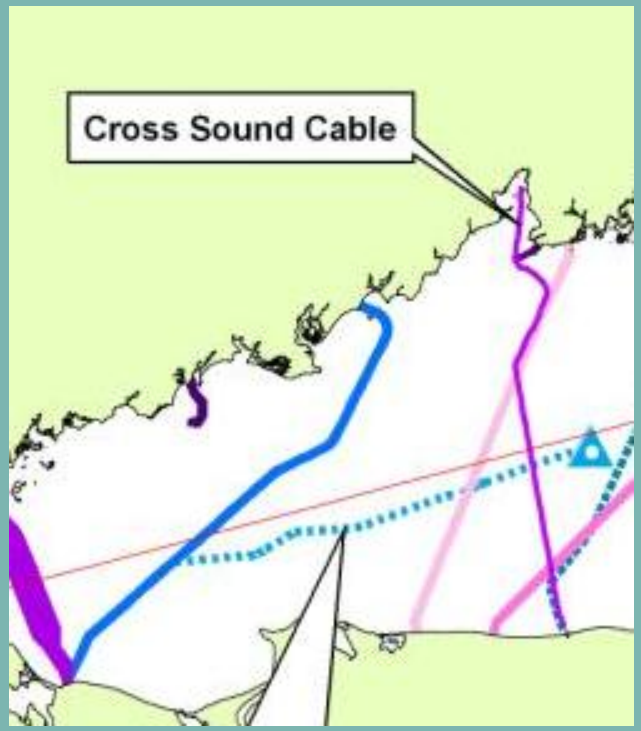
- Operating Principle:
  - Balance human uses/needs with protection, preservation & restoration of the natural functions & benefits of coastal environments.

Connecticut Department of Energy and Environmental Protection

UCONN
UNIVERSITY OF CONNECTICUT

CT Coastal Management - Context

- Cross Sound Cable:
  - Electrical transmission line
  - Information provided failed to adequately identify submerged bedrock.
    - **Result**: Permittee unable to comply with conditions requiring cable to be buried at a suitable depth.



CT Coastal Management - Context

- Islander East Pipeline:
  - Proposed natural gas pipeline
  - Detailed benthic information provided, but only for proposed route.
  - Passed through areas of sensitive resources (e.g., shellfishing)

  - **Result**: CT DEEP unable to determine if route was better or worse than adjacent or alternative options.

CT Coastal Management - Context

- Key Point:
  - Resource Managers need accurate, relevant information (scope & extent) to enable the best possible decision-making.
  - If not, then decisions are prone to be:
    - Reactionary on a project-by-project basis
    - Missing the key or greatest possible context

LIS Seafloor Mapping Initiative

- LIS Cross Sound Cable Settlement Agreement:
  - Compliance issues with 2 CT cable permits in LIS created $6M fund for research/restoration projects;
  - Led by bi-state, multi-agency Steering Committee
    - CTDEEP, NYDEC, EPA LISS, CT & NY SeaGrants, NYDOS
    - *Priority Goal: provide data products for resource management & infrastructure siting in LIS*
  - 2004 - 2009; (asst'd discussions/workshops)
  - 2009 - now (implementation planning & execution)

LIS Seafloor Mapping Initiative

- Milestone: Collaborative Partners Identified (2010)

UCONN UNIVERSITY OF CONNECTICUT

UNIVERSITY OF NEW HAVEN

UNIVERSITY OF RHODE ISLAND HOPE 1892

USGS science for a changing world

National Centers for Coastal Ocean Science NCCOS

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

Office of Coast Survey OCS

LAMONT-DOHERTY EARTH OBSERVATORY THE EARTH INSTITUTE AT COLUMBIA UNIVERSITY

STONY BROOK STATE UNIVERSITY OF NEW YORK

QUEENS COLLEGE

WESLEYAN UNIVERSITY

LIS Seafloor Mapping Initiative

- Milestone: Identified Target Areas (2011)
  - Engage stakeholders to determine where in LIS to target mapping efforts and why;
  - Technique adapted/improved from earlier efforts in CA;
    - CT process subsequently used/improved in WA
  - Divided map of LIS into a grid & surveyed experts to:
    - Identify critical **areas**
    - Identify the dominant **issue** & provide supporting **details**
    - Assign a **priority**

LIS Seafloor Mapping Initiative

- Milestone: Identified Target Areas (2011)

Highest Priority Areas for Benthic Mapping in LIS

Connecticut Department of Energy and Environmental Protection

UCONN
UNIVERSITY OF CONNECTICUT

LIS Seafloor Mapping Initiative

- Milestone: Identified Target Areas (2011)
  - Share core issues of:
    - Planning, Regulatory, Resource Management
  - Details supporting issues are:
    - Have Knowledge Gaps
    - Represent Significant Natural Areas
    - Relevant to Infrastructure
    - Have High Use/Potential for Use Conflicts
  - Timeframe to address:
    - Need for data soon (1-2 years)

LIS Seafloor Mapping Initiative

- Milestone: Pilot Area Mapping Goals (2012 – 2015)
  - Define and implement technical components for a mapping program focusing on:

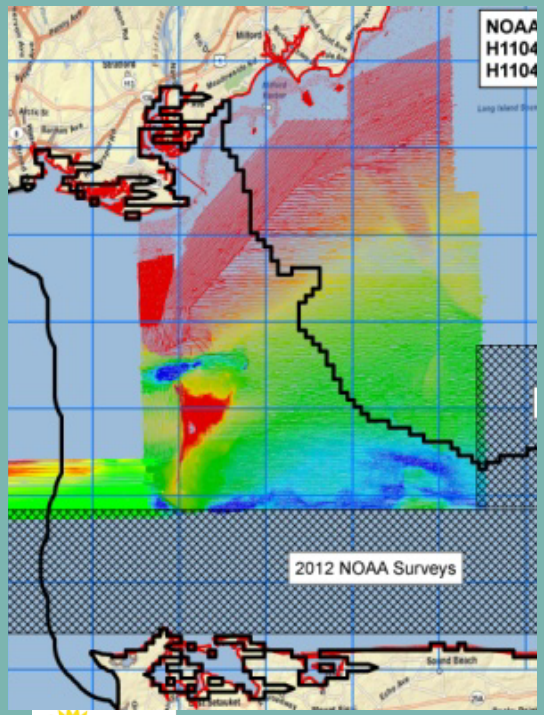
Acoustic Intensity / Seafloor Topography	Benthic Habitats & Ecology
Sediment Texture & Grain Size	Physical Environments
Sedimentary Environments	Data Management System

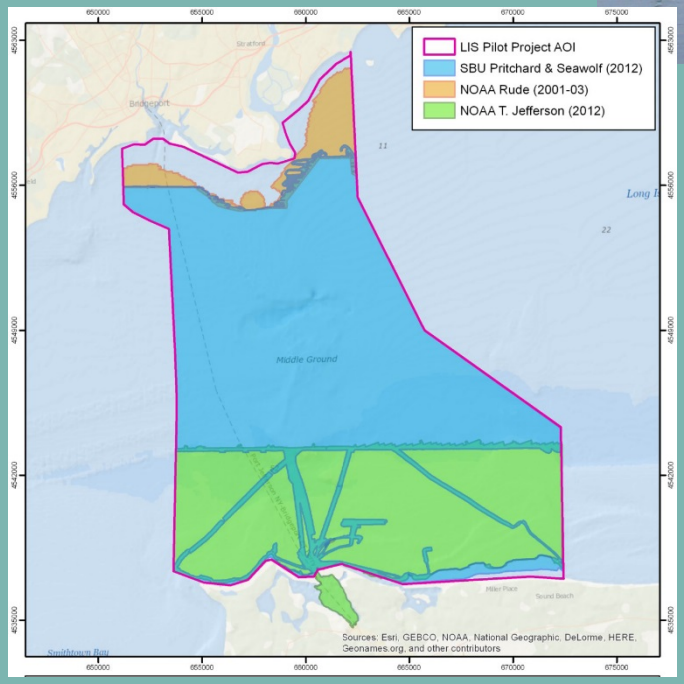
  - Assess implementation strategies
  - Report on methods, analysis, results and conclusions/ recommendations

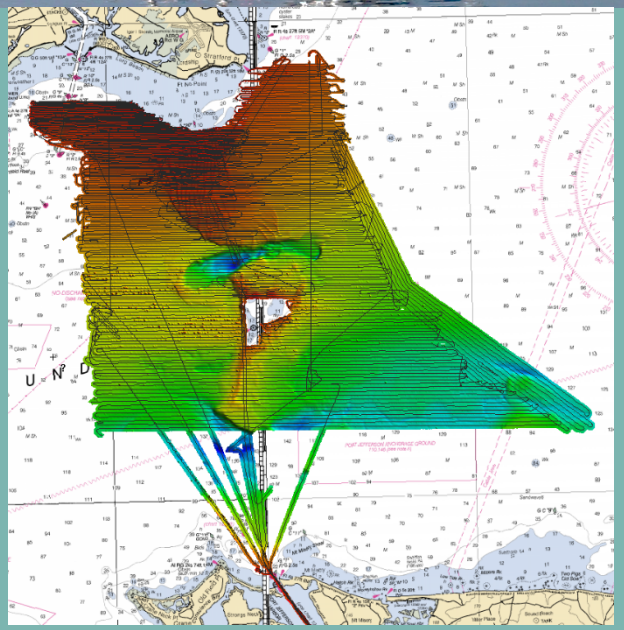
LIS Seafloor Mapping Initiative

Acoustic Data:

- Compilation of previous NOAA data & new NOAA & Stony Brook surveys







Connecticut Department of Energy and Environmental Protection

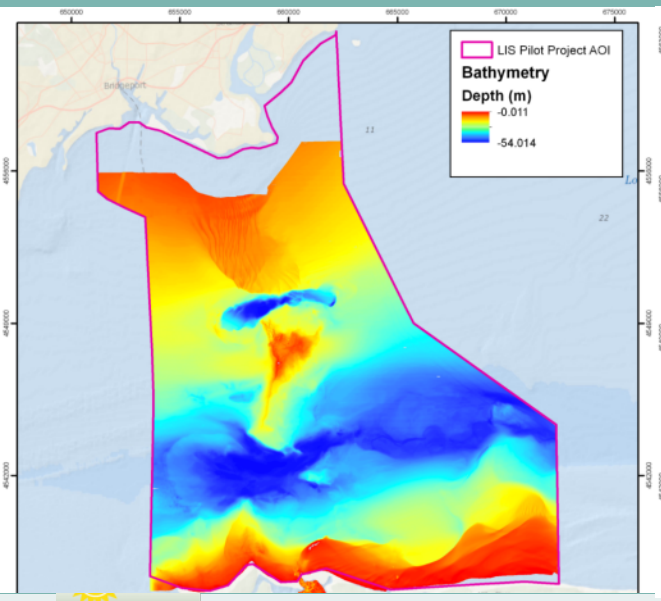
UCONN
UNIVERSITY OF CONNECTICUT

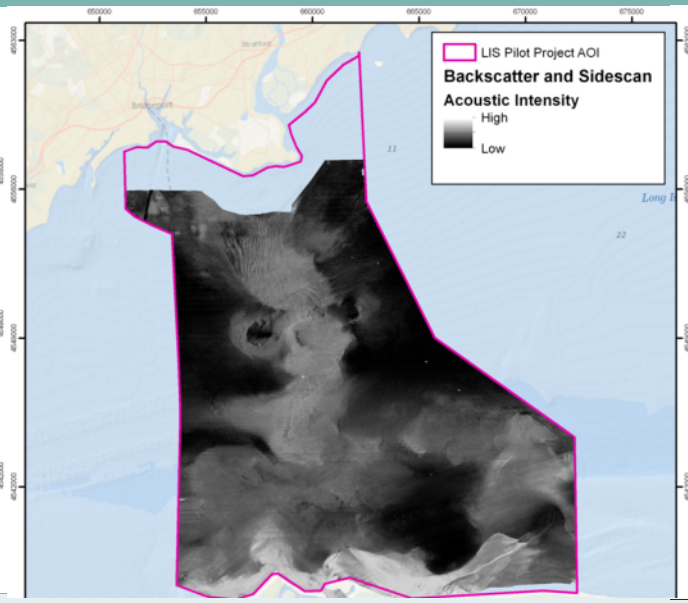
LIS Seafloor Mapping Initiative

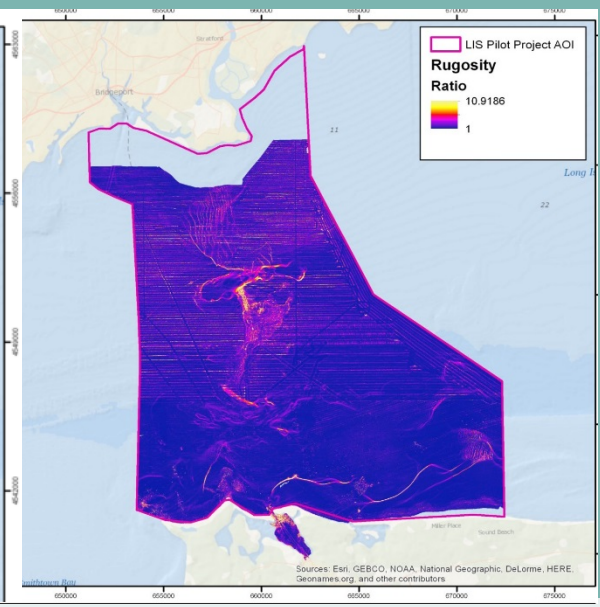
Acoustic Data:

- Provides depth & backscatter data
- Derived products – TRI, slope, rugosity
- Most of the remaining data products directly or indirectly depends on this

NOAA Survey Vessel
Thomas Jefferson





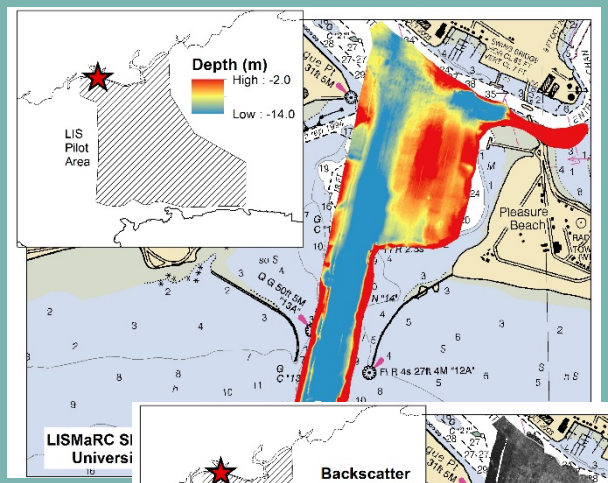


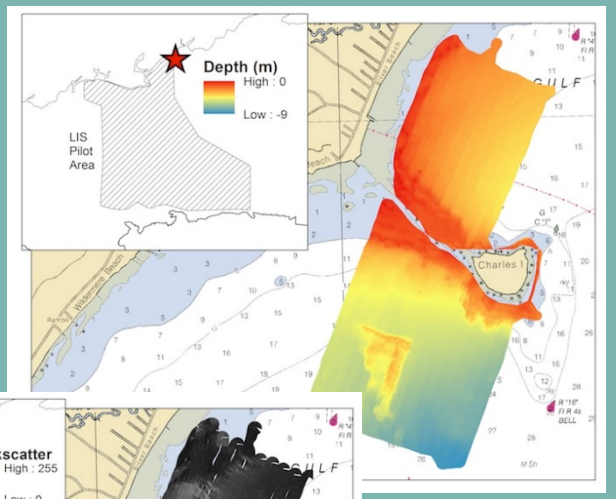
Connecticut Department of Energy and Environmental Protection

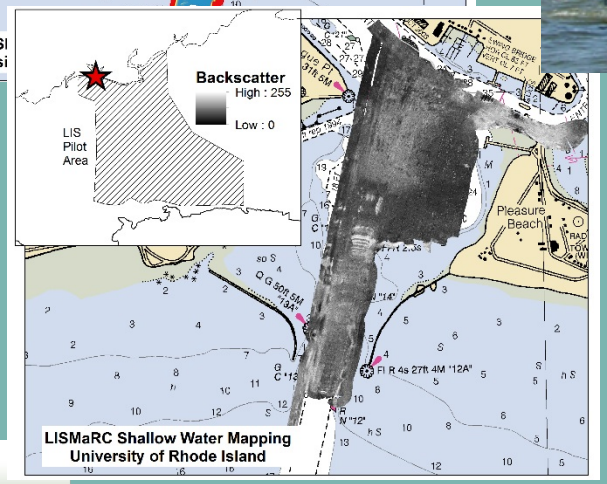
UCONN
UNIVERSITY OF CONNECTICUT

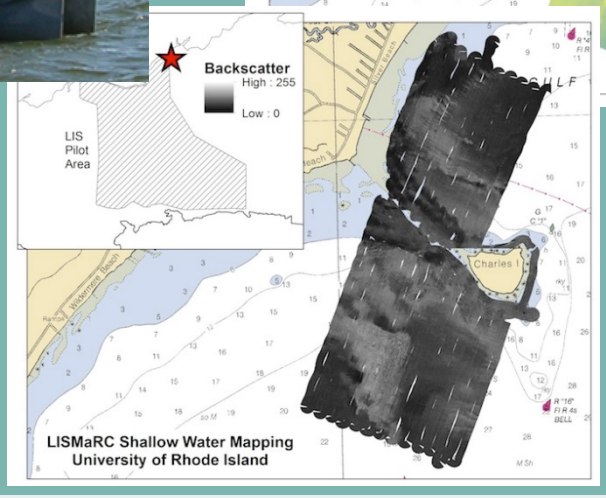
LIS Seafloor Mapping Initiative

Acoustic Data: Shallow water mapping was also conducted by URI using an interferometric (vs beam forming) sonar









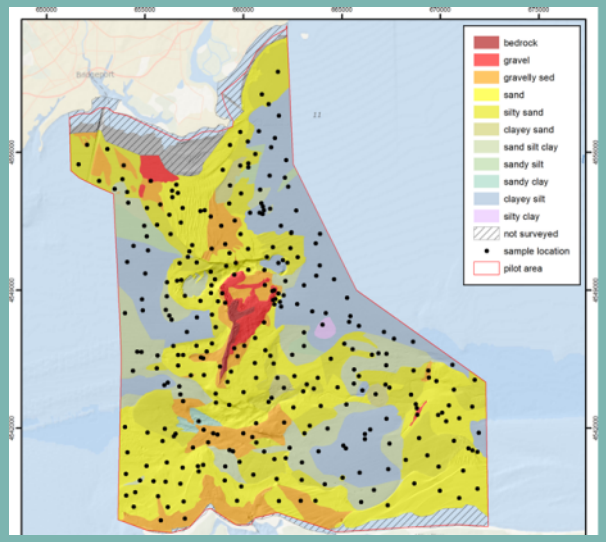
Connecticut Department of Energy and Environmental Protection

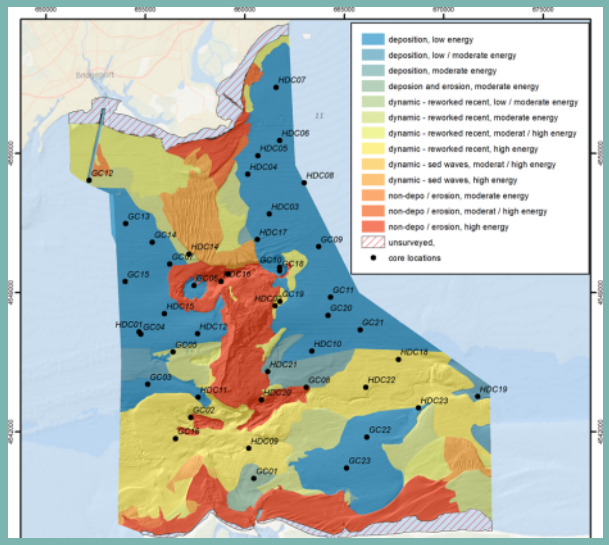
UCONN
UNIVERSITY OF CONNECTICUT

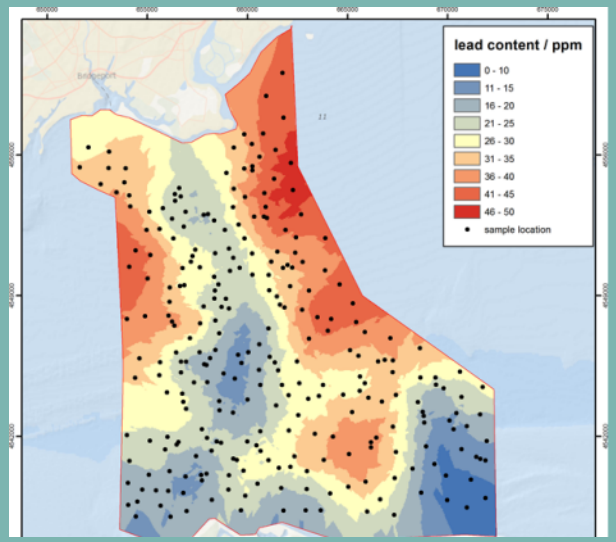
LIS Seafloor Mapping Initiative

Sediment Texture & Environments:

- Provides detailed bottom composition description (e.g., gravel, sand, mud, silt, etc.) and dynamics (e.g., erosion, deposition, etc.)
- Also provided rapid sediment chemistry (TOC, N, Pb, Zn, Cu)







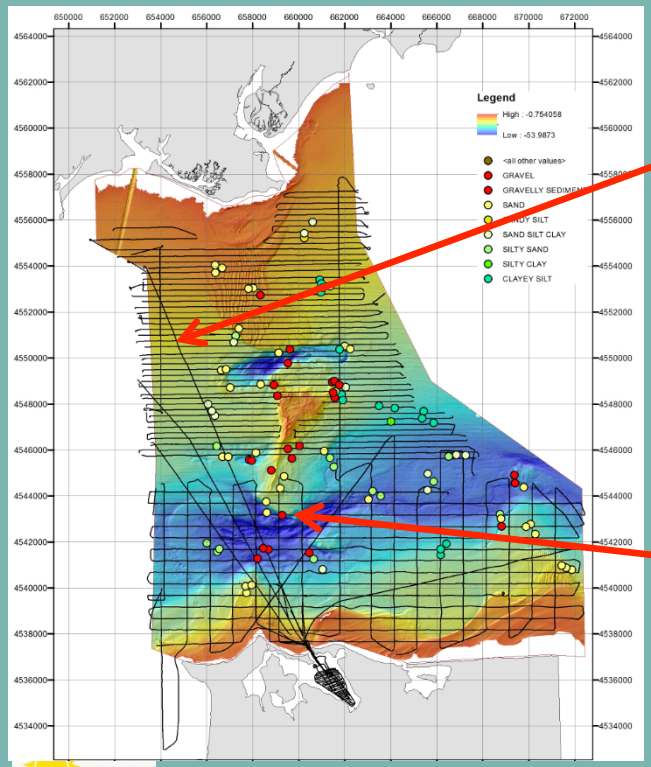
Connecticut Department of Energy and Environmental Protection

UCONN
UNIVERSITY OF CONNECTICUT

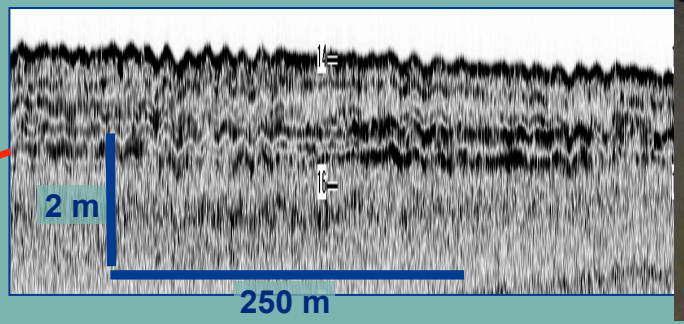
LIS Seafloor Mapping Initiative

Sediment Texture & Environments:

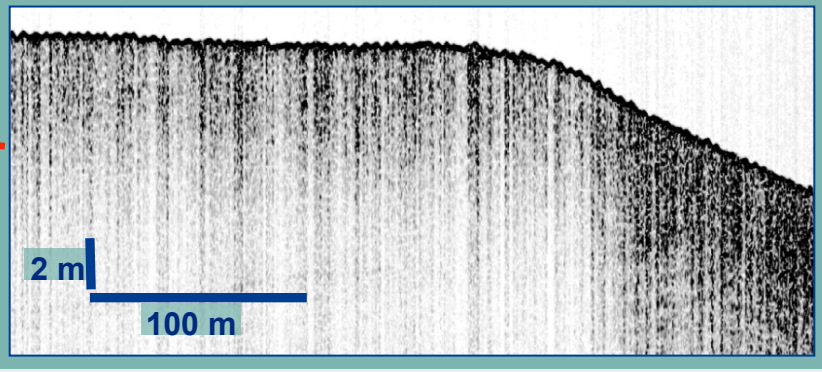
– Sub-bottom profiling used to develop sediment environments



Example – depositional layers



Example – non-deposition/erosion



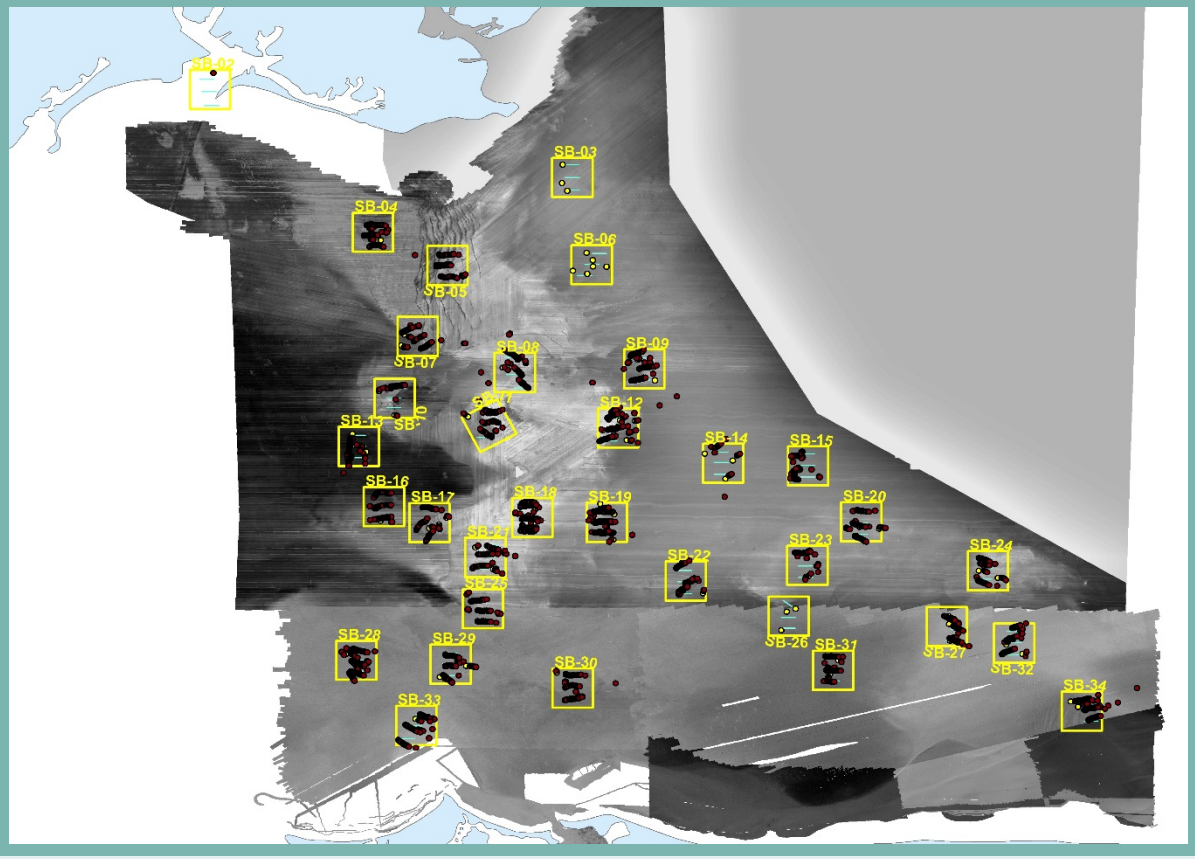
Connecticut Department of Energy and Environmental Protection

UCONN
UNIVERSITY OF CONNECTICUT

LIS Seafloor Mapping Initiative

Ecological Characterization:

- Backscatter data utilized for sample site selection



Connecticut Department of Energy and Environmental Protection

UCONN
UNIVERSITY OF CONNECTICUT

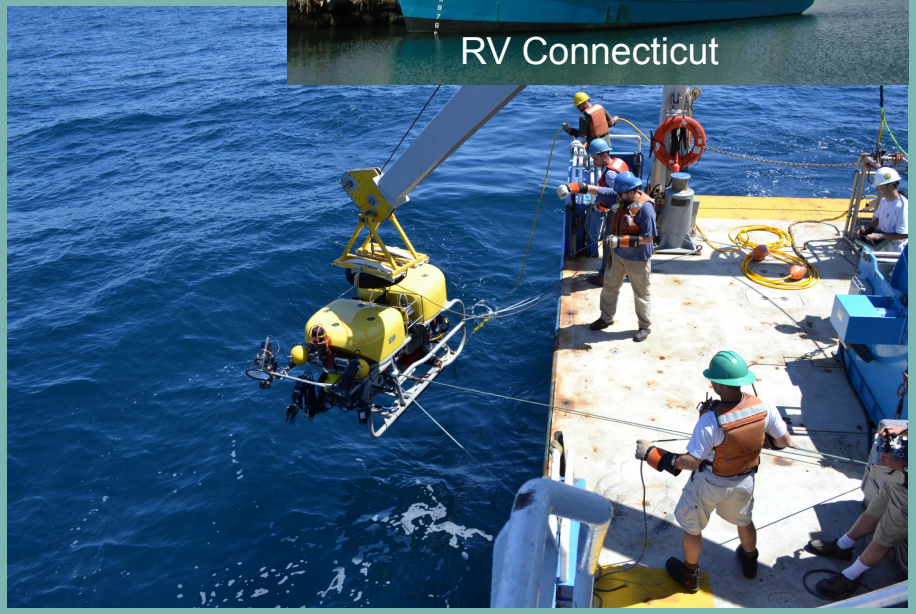
LIS Seafloor Mapping Initiative

Ecological Characterization:

- Characterized benthic habitats for infauna and epifauna using the SEABOSS and Kraken2

RV Connecticut

SEABOSS


Kraken2 ROV

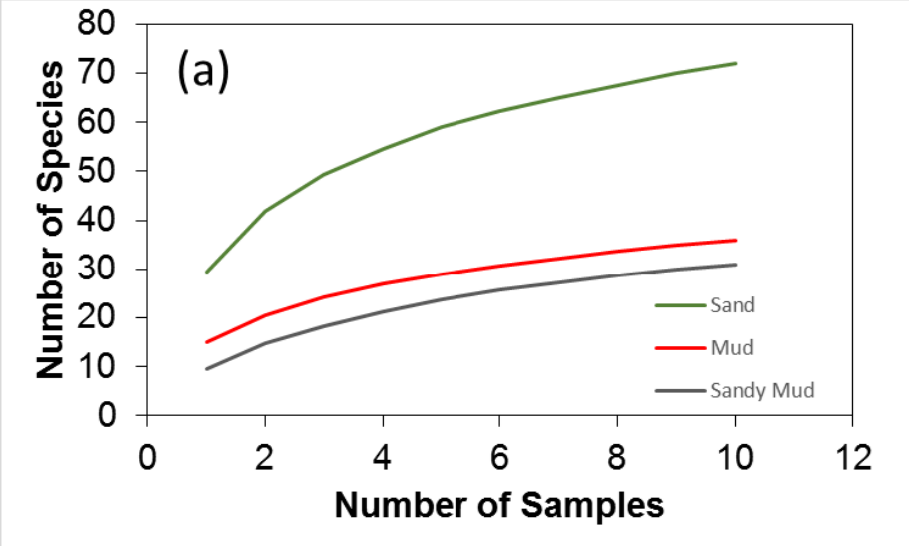
Connecticut Department of Energy and Environmental Protection

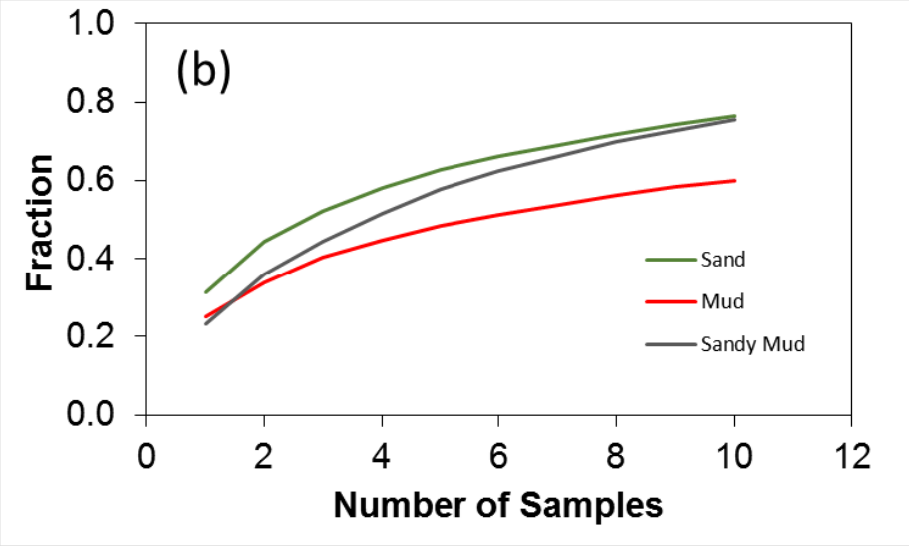
UCONN
UNIVERSITY OF CONNECTICUT

LIS Seafloor Mapping Initiative

Ecological Analysis:

- Stony Brook University focused sampling assessment





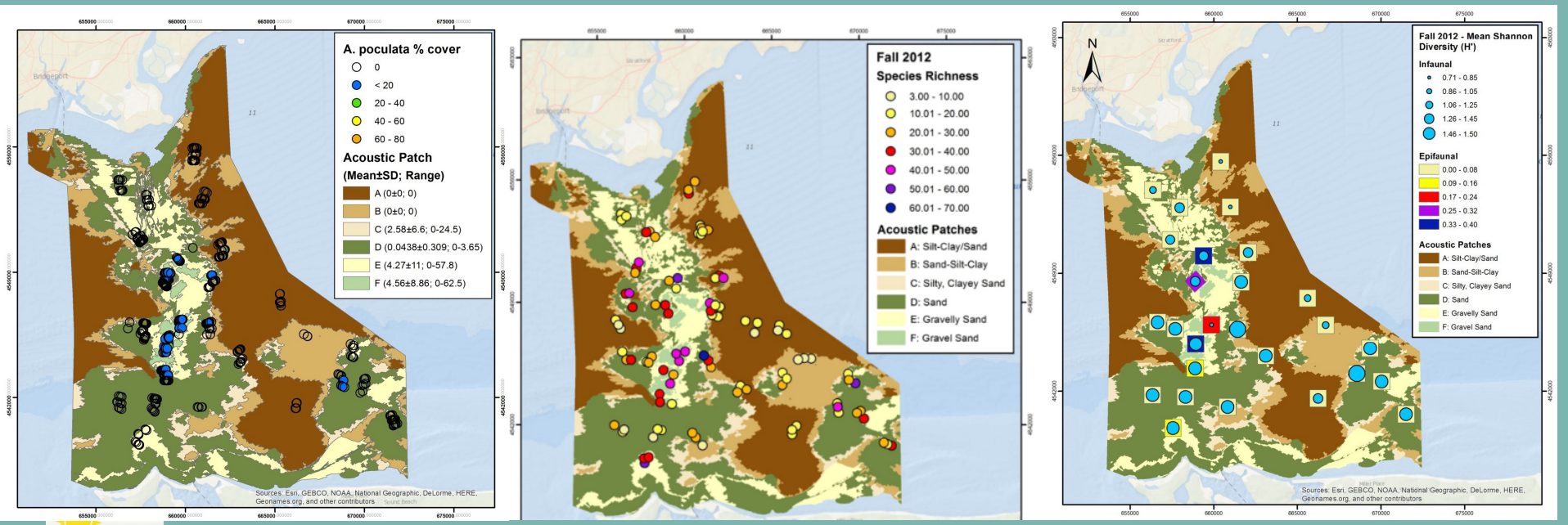
Connecticut Department of Energy and Environmental Protection

UCONN
UNIVERSITY OF CONNECTICUT

LIS Seafloor Mapping Initiative

Seafloor Classification & Ecological Analysis:

- Generated numerous data products including individual species distribution, biogenic features, species richness and diversity maps.



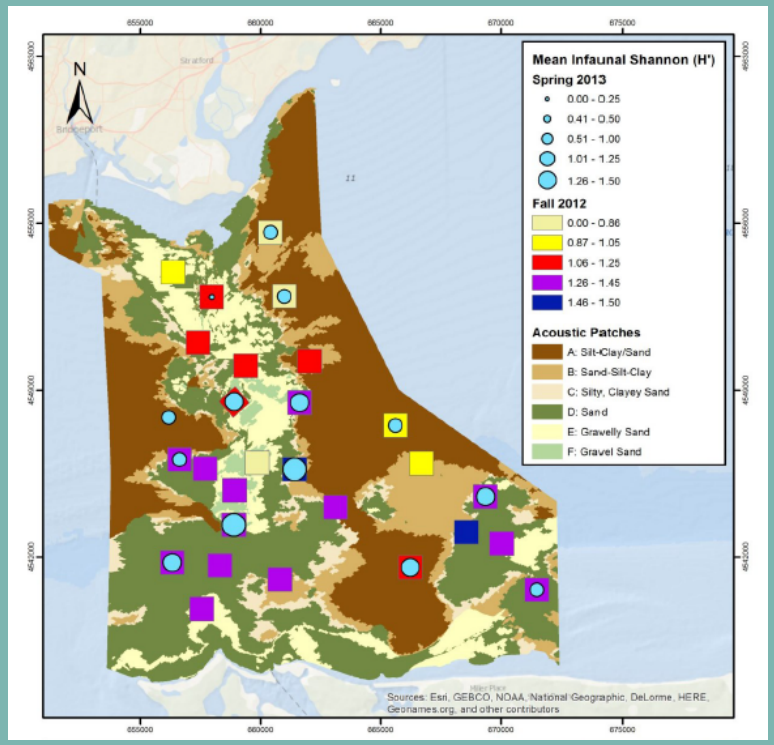
Connecticut Department of Energy and Environmental Protection

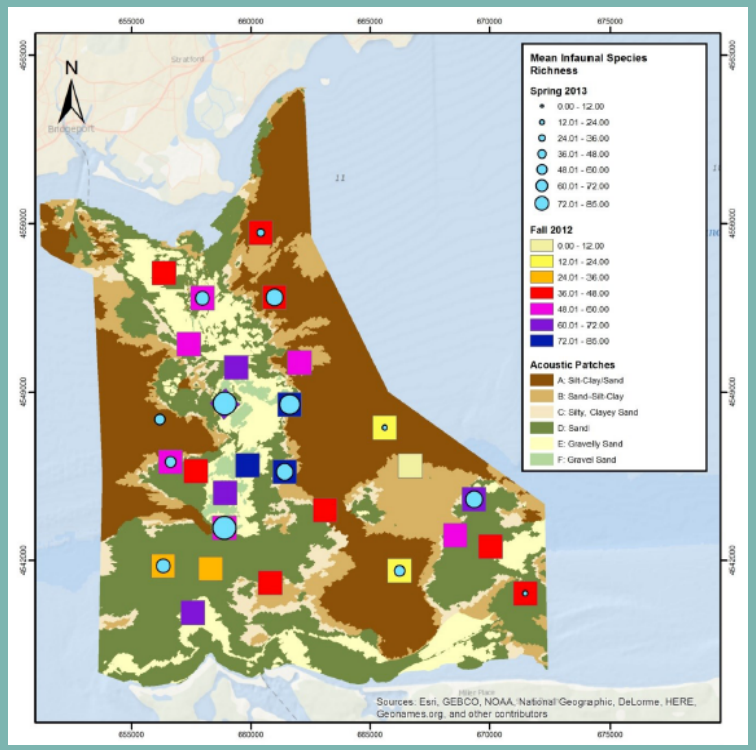
UCONN
UNIVERSITY OF CONNECTICUT

LIS Seafloor Mapping Initiative

Ecological Analysis:

- Seasonal analyses showed areas with ecological stability and others with seasonal change





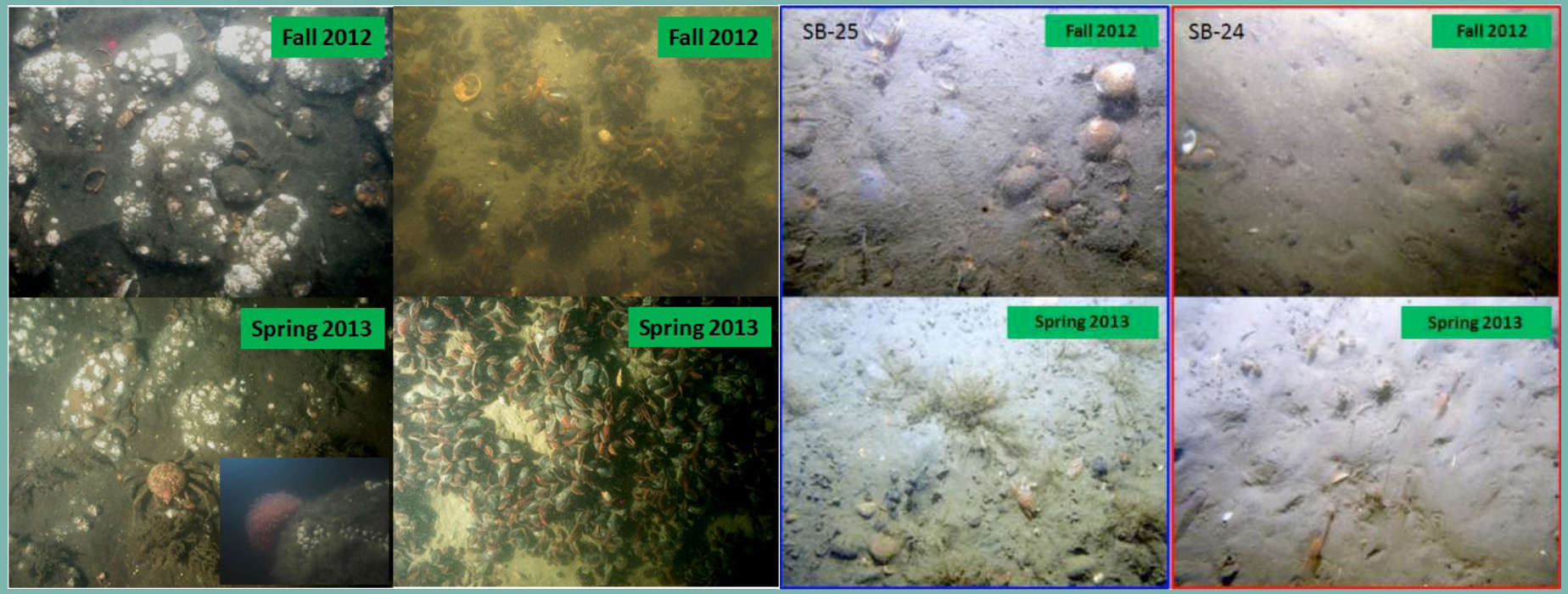
Connecticut Department of Energy and Environmental Protection

UCONN
UNIVERSITY OF CONNECTICUT

LIS Seafloor Mapping Initiative

Ecological Analysis:

- Seasonal analyses showed ecological stability and change



Stable hard substrates

Seasonally variable soft substrates

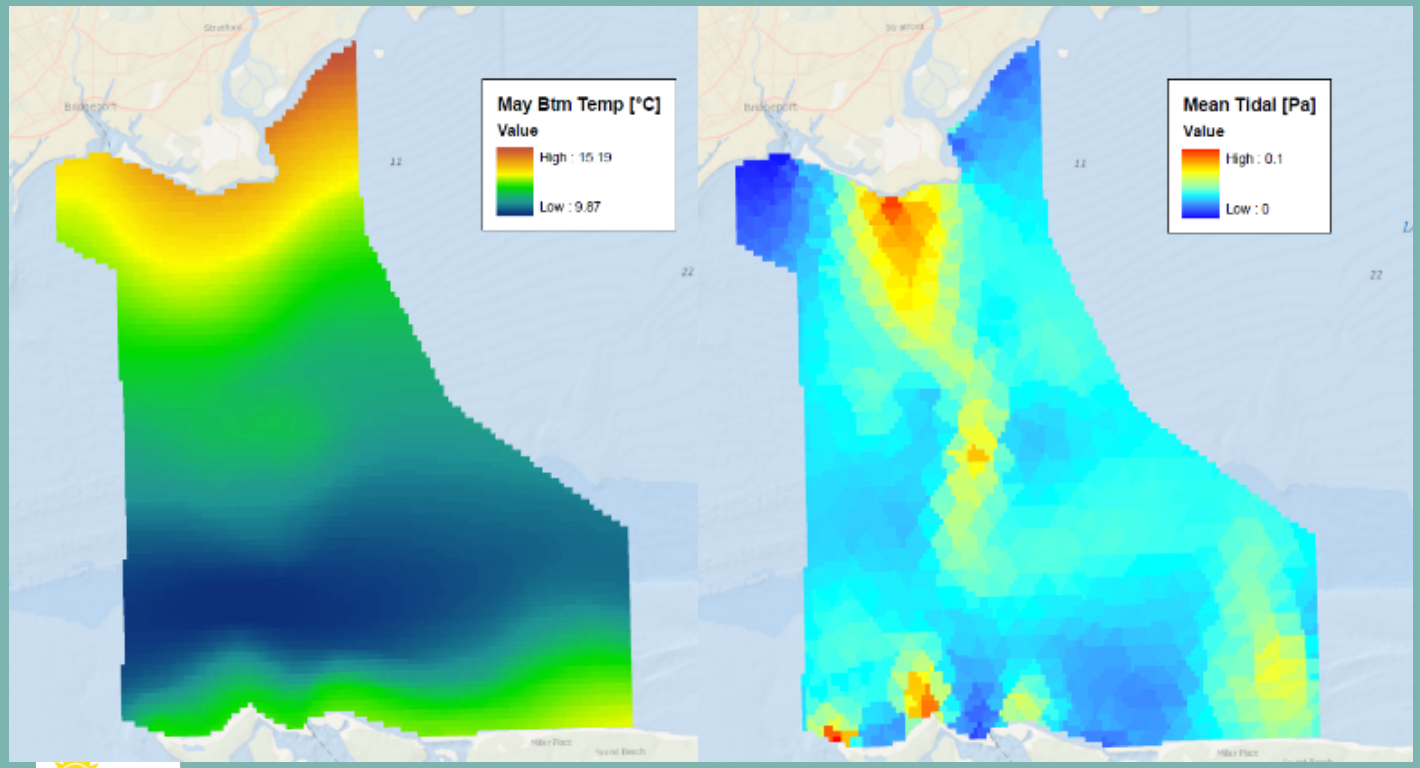
Connecticut Department of Energy and Environmental Protection

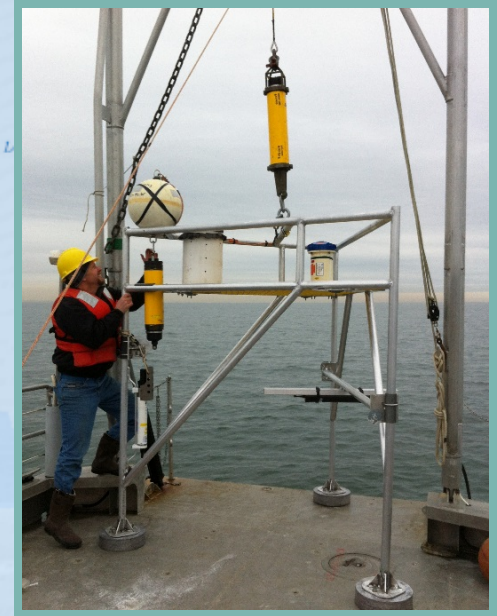
UCONN
UNIVERSITY OF CONNECTICUT

LIS Seafloor Mapping Initiative

Physical Oceanography:

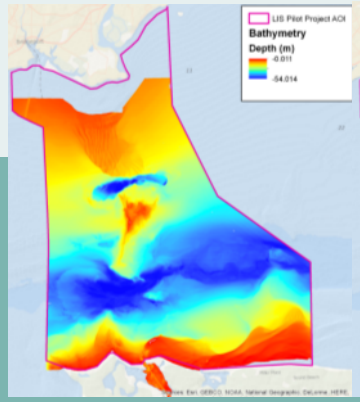
- Data on temperature, salinity, currents, bottom stress, etc., based on observations and modeling.

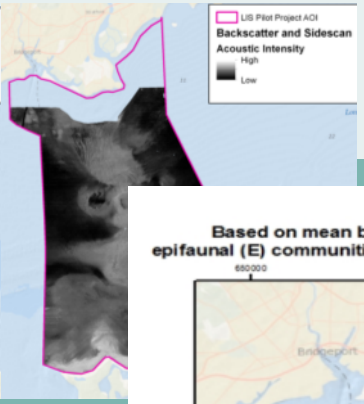


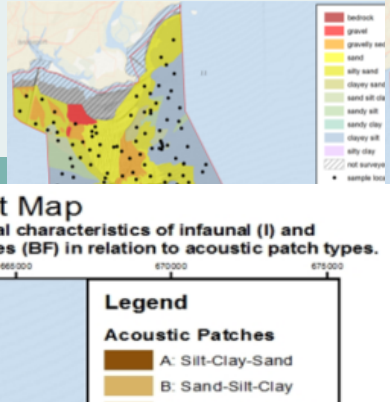


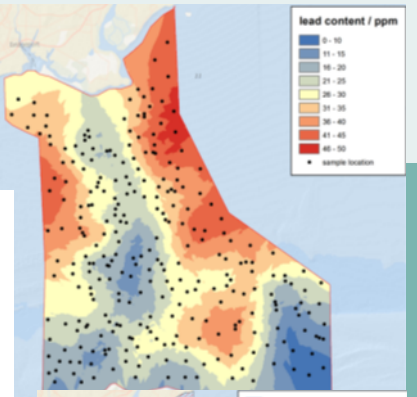
Connecticut Department of Energy and Environmental Protection

UCONN
UNIVERSITY OF CONNECTICUT



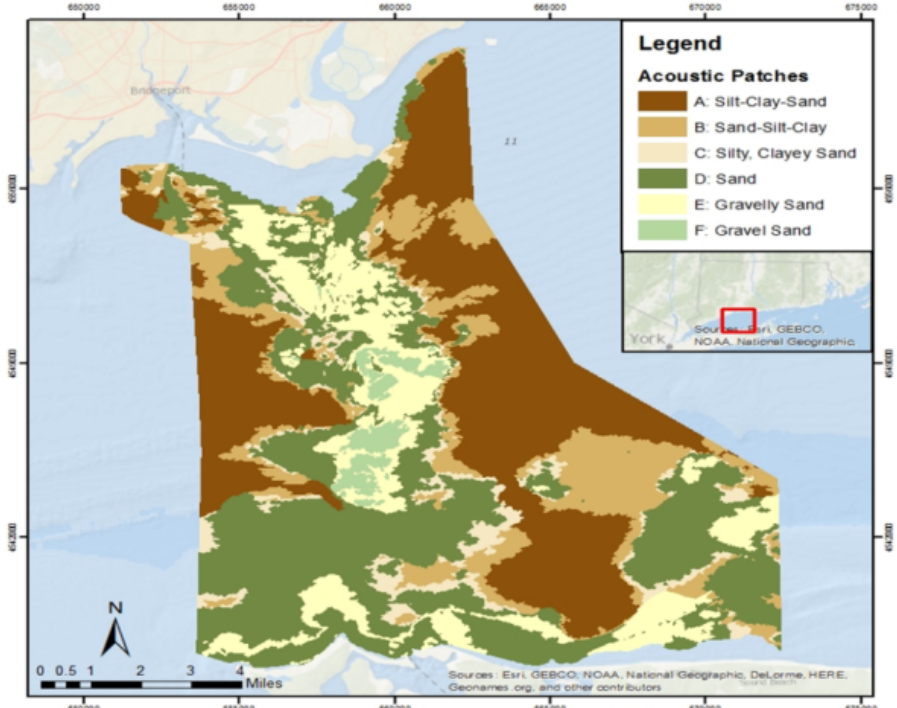






Integrated Habitat Map

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.



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

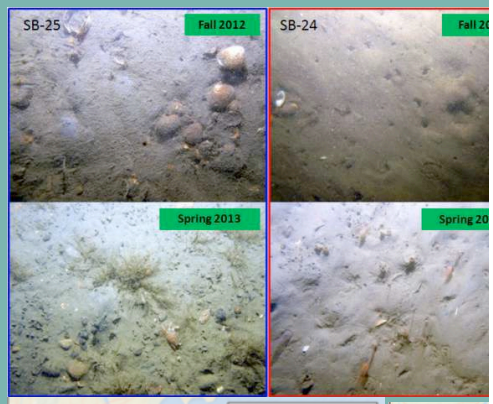
Patch type B: low-high stress
I: Tubiculous taxa, motile surface feeders
E: Bivalve, *Corymorpha*, solitary ascidian
BF: Shell

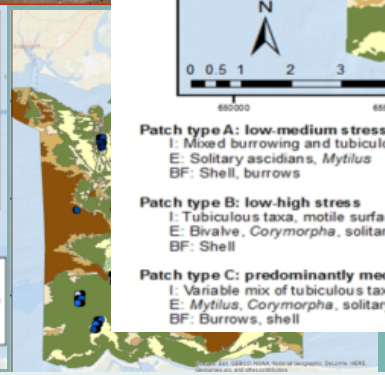
Patch type C: predominantly medium stress
I: Variable mix of tubiculous taxa and burrowers
E: *Mytilus*, *Corymorpha*, solitary ascidian
BF: Burrows, shell

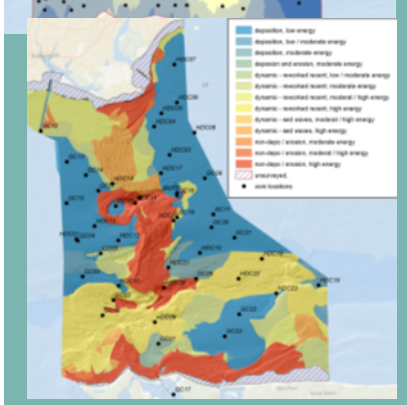
Patch type D: high-medium stress
I: Small tubiculous taxa (polychaetes and amphipods); High density of bivalves
E: Hydroids, *Mytilus*, barnacle
BF: High coverage of shell patches and burrows

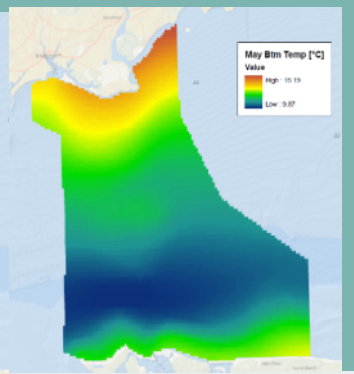
Patch type E: predominantly high stress
I: Oligochaetes and archiannelids, small tubiculous taxa, deep burrowing taxa
E: Hydroids, *Mytilus*, *Astrangia*
BF: High coverage of shell patches

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









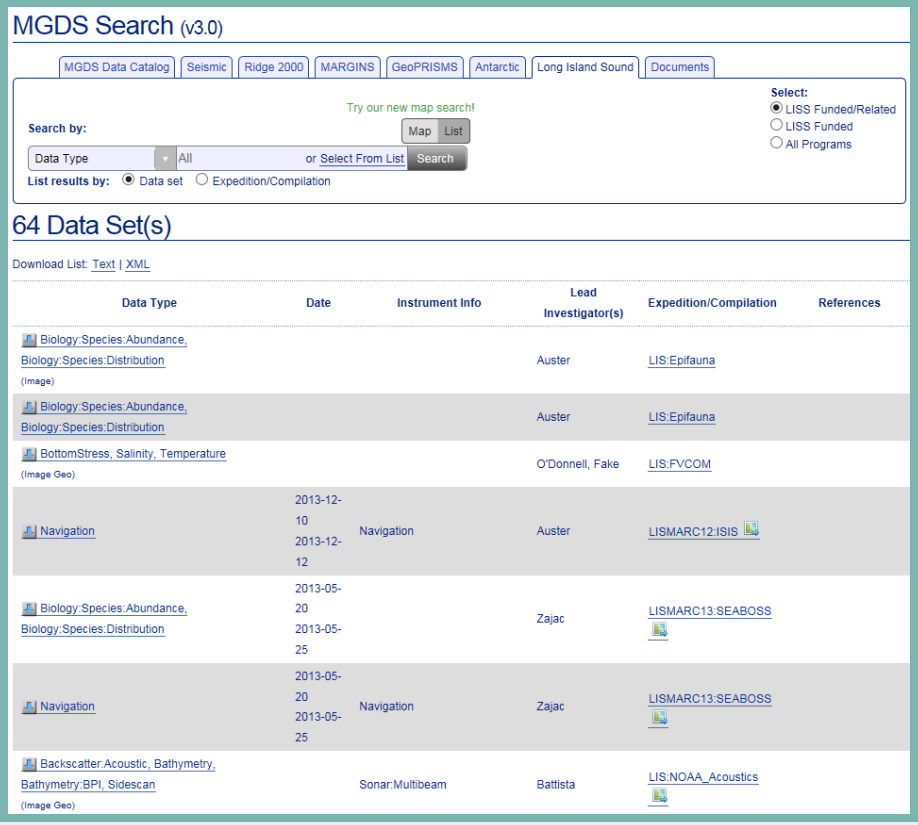
Connecticut Department of Energy and Environmental Protection

UCONN
UNIVERSITY OF CONNECTICUT

LIS Seafloor Mapping Initiative

Data Management:

- Leveraged an existing NSF funded system at LDEO to store and share results: http://www.marine-geo.org/portals/lis/



Connecticut Department of Energy and Environmental Protection

UCONN
UNIVERSITY OF CONNECTICUT

LIS Seafloor Mapping Initiative

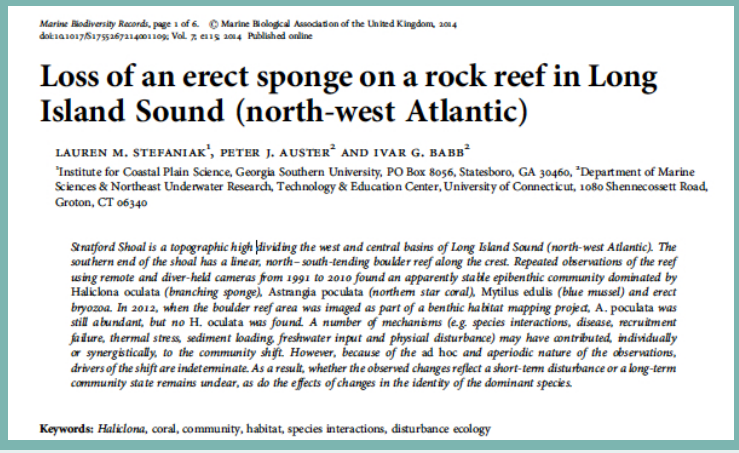
- Post Pilot:
  - Fall/Winter 2014 - 2016:
    - SC evaluated processes/deliverables with input from outside reviewers;
    - SC & teams made adjustments to both implementation strategies and data products;
    - Notable exception – acoustic data collection in ELIS area by NOAA in Fall 2015 to fill in large gap areas from earlier surveys
  - 2016 going forward:
    - Developing work plans for Phase II eastern LIS area
    - Initiate (or continue) data collection/analysis activities

LIS Seafloor Mapping Initiative

- Outcomes:
  - Overall, SC feels pilot was successful
    - Generated useful data and examples of how data can be visualized and synthesized
    - Demonstrated that teaming approach can be an effective way to approach a complex, large scale effort
  - Areas for improvement
    - Better definition and application of data standards
    - Improved coordination and communication (between teams as well as between teams and SC)

LIS Seafloor Mapping Initiative

- Outcomes:
  - Report and Appendices:
    - http://tinyurl.com/LISCableFundPilotReport
    - http://tinyurl.com/LISCableFundPilotReportApps
  - YouTube Video from ROV Dives:
    - https://www.youtube.com/watch?v=tz_QX4R2hg0
  - Stefaniak et al. 2014:



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)

LAUREN M. STEFANIAK[1], PETER J. AUSTER[2] AND IVAR G. BABB[2]

[1]Institute for Coastal Plain Science, Georgia Southern University, PO Box 8056, Statesboro, GA 30460, [2]Department of Marine Sciences & Northeast Underwater Research, Technology & Education Center, University of Connecticut, 1080 Shennecossett Road, Groton, CT 06340

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 undear, as do the effects of changes in the identity of the dominant species.*

Keywords: *Haliclona*, coral, community, habitat, species interactions, disturbance ecology


Questions?
Kevin O'Brien: 860-424-3432 or kevin.obrien@ct.gov
Ivar Babb: 860-405-9121 or ivar.babb@uconn.edu