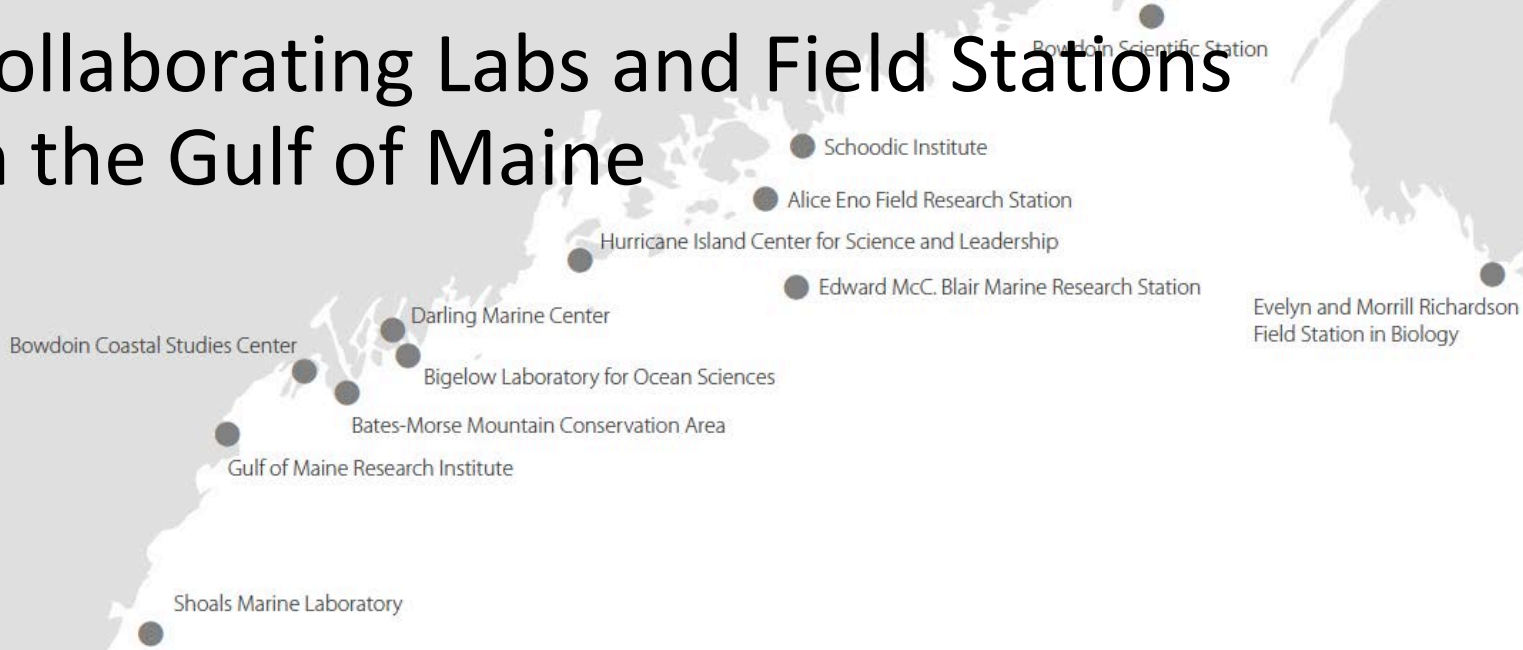
NeCSA

Northeastern Coastal Stations Alliance

Hannah Webber
Schoodic Institute at Acadia National Park

Beaches Conference
Kittery, Maine
June 14, 2019

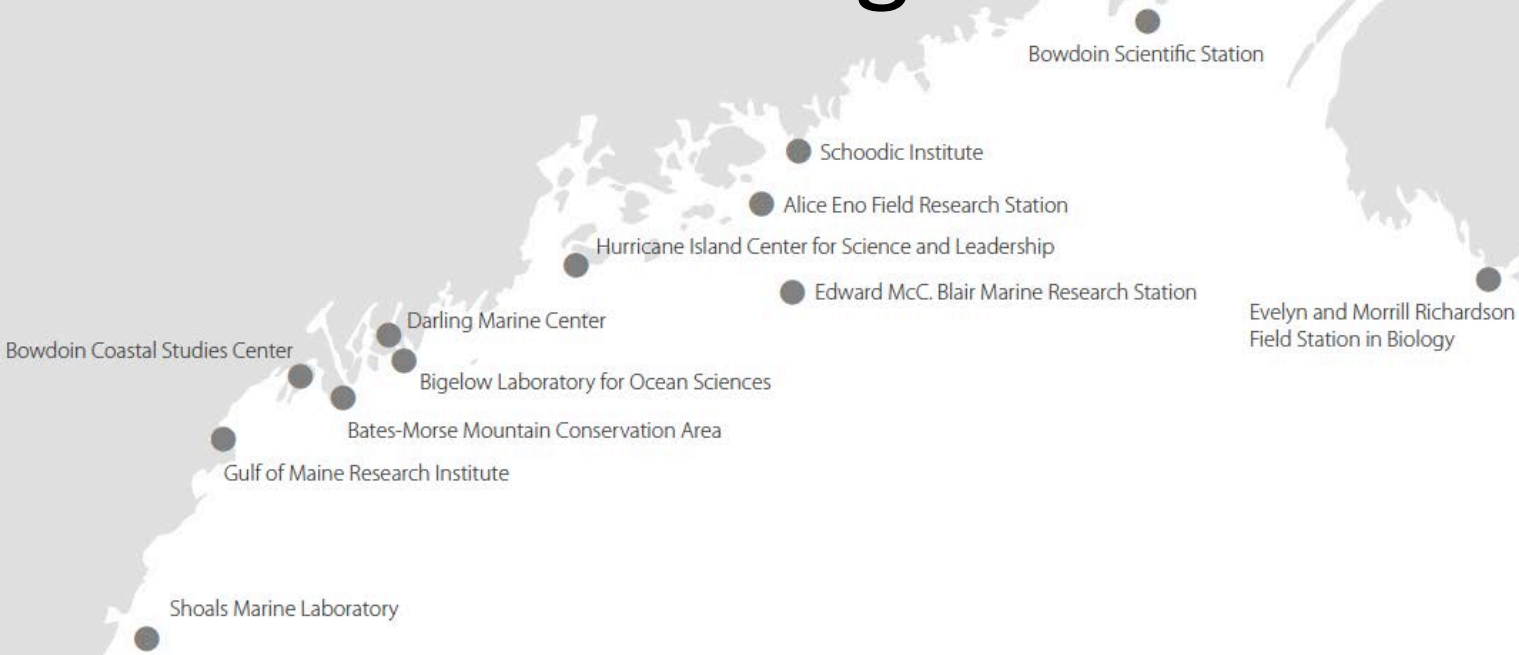
NeCSA -
Northeastern Coastal Stations Alliance
Collaborating Labs and Field Stations in the Gulf of Maine



Who We Are

Member stations of the Northeastern Coastal Stations Alliance (NeCSA) span the Gulf of Maine from Appledore Island, ME to Bon Portage Island, Nova Scotia, Canada. These facilities support field-based research and are committed to collecting long-term environmental data, and to training students of all ages. We are working to integrate our efforts with others in New England, and to effectively communicate scientific findings to the communities in which we are embedded. We care deeply about the Gulf of Maine and are aware of climate-change impacts affecting both fundamental ecosystem processes and coastal communities.

How did we get here?



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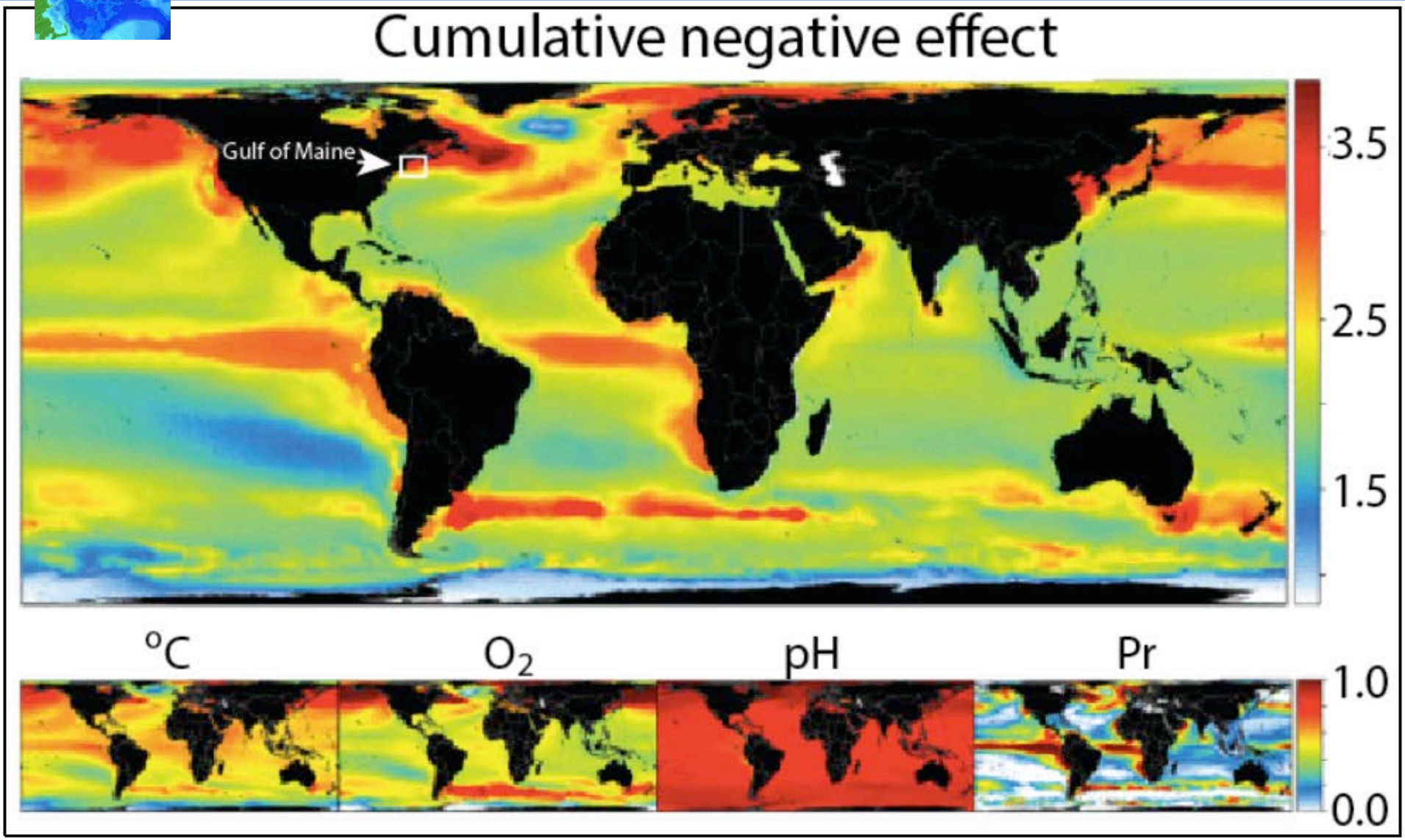
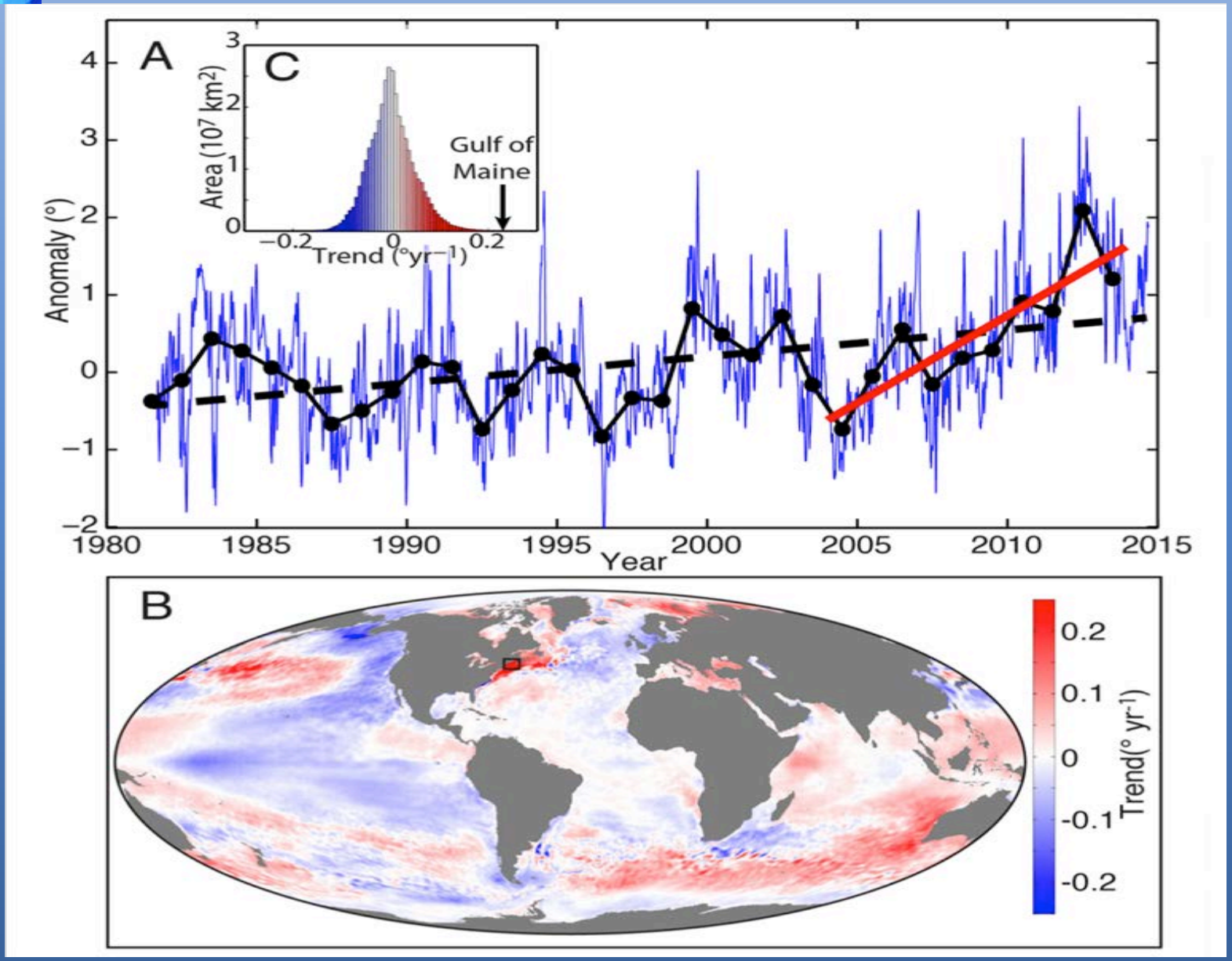
Predictions - 2100



Mora, C., C. -L. Wei, A. Rollo, T. Amaro, et al. 2013. Biotic and Human Vulnerability to Projected Changes in Ocean Biogeochemistry over the 21st Century. PLoS biology **11:** e1001682.

Environmental change in Gulf of Maine



Climate change is re-organizing the Gulf of Maine Ecosystem

American Lobster
Homarus americanus

European green crab
Carcinus maenus

Black Sea Bass
Centropristis striata

Colonial tunicate
Didemnum vexillum, Asia

Natives

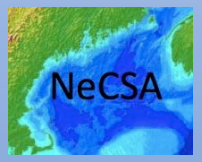
Aliens

2014 Workshop at Bowdoin College

Damon Gannon, Former Director, Kent Island Scientific Station

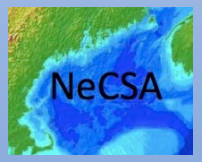
Bowdoin College, March 2014 Workshop

- Brought together representatives of small labs and field stations
- What can we do to harness our geographic scope, existing facilities, and people-power?
- ***Sentinel variables*** – Critical ecosystem variables effected by climate change



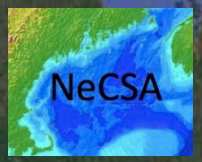
Reasons to collaborate

- *Increase* intellectual capital
- *Attract* intellectual capital- esp. other disciplines
- Pool resources
- Coordinate research



More reasons to collaborate

- Attract money
- Increase value & profile of all
- Make research & education scale = ecological scale
- Data! (who doesn't love data?)



Existing Monitoring Networks - The Northeastern Regional Association of Coastal Ocean Observing System (NERACOOS)

- NERACOOS - Offshore Buoys focused on physical and biological variables
- NeCSA – Inshore, complimentary, year round capabilities

2015 NSF FSML Planning Grant

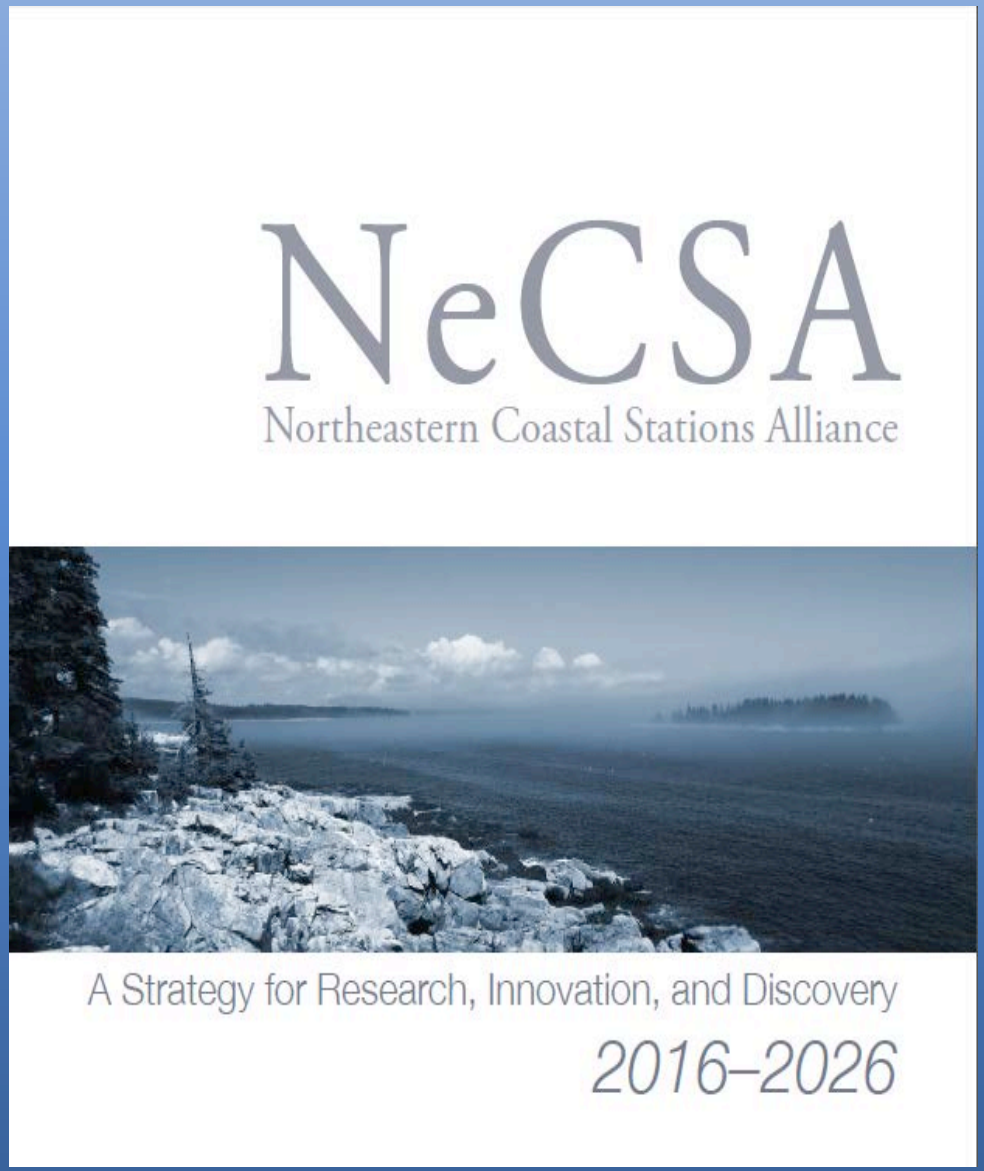
Laura Sewall - Bates College
Caitlin Cleaver - Hurricane Island Foundation

Hurricane Island
Summer 2015

Identifying gaps & synergies

Developing the community

Making a plan



Vision:
Research, innovation, and discovery enhanced by collaboration across the Gulf of Maine.

Mission:
To interpret near shore environmental change and foster transformative understanding of the Gulf of Maine.

NeCSA Strategic Plan

GOAL 1. Coordinated monitoring and research to document and discover patterns of environmental change in the Gulf of Maine.

Coordinated monitoring and research across the spatial extent of our member institutions provides opportunities for integrating place-based data sets, developing broad and systemic perspectives, and conducting innovative research.

Need for monitoring

Integrated Sentinel Monitoring for the Northeast Region: Gap Assessment

J. Runge[1], M. Coté, Jr.[2], B. Thompson[3], J. R. Morrison[4], D. Anderson[5], I. Cetinić[6], B. Cowie-Haskell[7], S. Gallager[8], J. Hare[9], C. Johnson[10], J. Salisbury[11], R. Steneck[12], R. Young Morse[13]

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[2]U.S. Environmental Protection Agency, Boston, USA, email: cote.mel@epamail.epa.gov
[3]Connecticut Department of Environmental Protection. Hartford, USA, email: brian.thompson@ct.gov
[4]NERACOOS, Rye, USA, email: ru.morrison@neracoos.org
[5,8] Woods Hole Oceanographic Institution, Woods Hole, USA, emails: danderson@whoi.edu;sgallager@whoi.edu
[6,12]University of Maine/ Orono, USA, emails: ivona.cetinic@maine.edu; steneck@maine.edu
[7]Stellwagen Bank National Marine Sanctuary, Scituate, USA, email: ben.haskell@noaa.gov
[9]National Marine Fisheries Service, Narragansett, USA, email: jon.hare@noaa.gov
[10]Bedford Institute of Oceanography, Dartmouth, Canada, email: catherine.johnson@dfo-mpo.gc.ca
[11]University of New Hampshire, Durham, USA, email: joe.salisbury@unh.edu
[13]Gulf of Maine Research Institute, Portland, USA, email: rmorse@gmri.org

ABSTRACT

We address gaps in the Northeast Region's capability to observe key biotic and abiotic ecosystem variables that are likely impacted by climate forcing. The need to observe effects of shorter-term and longer term climate and ocean variability on coastal ecosystems is especially acute in the Northeast, where water column temperatures have been rising at the rate of 0.1- 0.3°C yr^{-1} over the past decade. First, there is a need for coordination of sentinel monitoring for pelagic and benthic properties that makes use of regional capacity for data management and distribution, quality control and integrated analysis. The broad definition of a sentinel is a critical ecosystem variable (whether an abiotic factor, process, species or community index) that is measureable and likely to be affected by climate change. At present, a sentinel monitoring program has been initiated in parts of the Northeast Region, for Long Island Sound and adjacent Canadian waters, but there is no organized sentinel monitoring of other regional coastal ecosystems, for example in the Gulf of Maine. The NERACOOS Strategic Plan calls for development of an integrated sentinel monitoring program across the Northeast; here we discuss steps to make that happen. Second, there is a need for information about critical variables not presently sampled by the existing observing systems. We explore strategies for collection of data on sentinel variables that either cannot be measured autonomously with existing instrumentation or require validation with samples collected in the field. These strategies include establishment of sentinel, fixed time series stations and eventual introduction of new measurement technologies. We outline the way forward involving consultation with federal and non-federal users and experts to create a science and implementation plan and a vision for integration of data into physical-ecosystem models and dissemination of information to the user communities.

Key words: sentinel monitoring, climate change, benthic and water column properties, time series stations, modeling tools

1. INTRODUCTION AND HISTORY

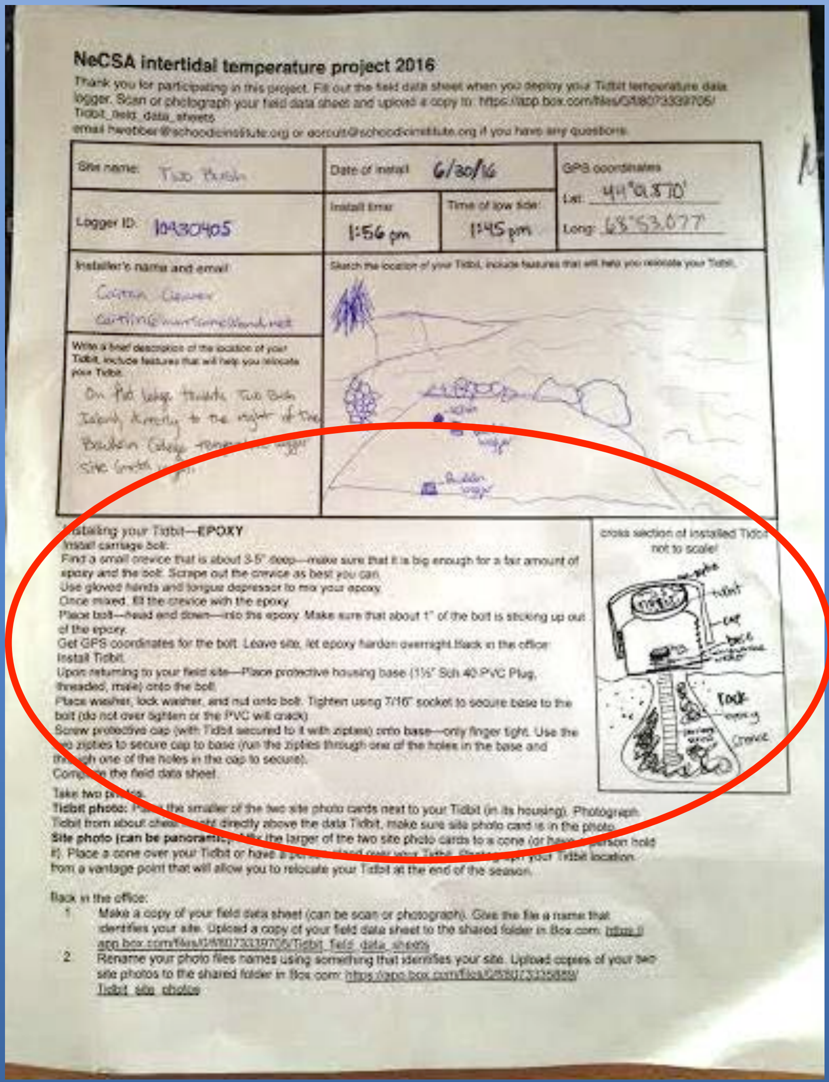
This White Paper addresses gaps in observi system capabilities to detect, assess and interpret effe of climate and ocean change on the health of coast ecosystems in the Northeast Region. This theme particularly relevant to the Northeast Region, which i experiencing rapid change in water column temperature on the order of 0.1-0.3°C yr^{-1} since 2001[1]. Surface water temperatures in summer, 2012, are 2-4°C warmer than normal in the region. These recent warming trends are affecting regional coastal ecosystems. For example, the molt cycle of the American lobster, New England's most valuable marine resource, is 2-4 months earlier in 2012, the likely consequence of exceptionally warm temperature of its bottom habitat. The early molting contributed to an unexpected glut of lobsters on the market, creating an economic crisis in Maine's coastal fisheries. The warming is undoubtedly impacting the coastal ecosystem in other significant ways, but the Northeast Region does not have an organized regional plan in place to observe these changes.

The gap assessment we provide here is likely also applicable to other regions under pressure from climate forcing. First, there is a need for a region-wide sentinel monitoring program for water column and benthic properties that takes advantage of regional capacity for integrated analysis and data management. Second, it is clear that a number of critical variables that may be changing cannot be observed by present capabilities in remote sensing and autonomous, in situ sampling platforms. The measurement of these variables will require collection and analysis of samples involving shipboard sampling where appropriate. Technological advances may allow autonomous measurement of some of these variables in the future, and resources may be well spent to develop this capability, but in the meantime "human-assisted" measurements at a limited number of shore or ship stations are needed to build essential time series.

…but in the meantime "human assisted" measurements at a limited number of shore or ship stations are needed to build essential time series.

Test capacities for coordinated research & monitoring

Testing while being aware of different capacities



NeCSA intertidal temperature project 2016

Thank you for participating in this project. Fill out the field data sheet when you deploy your Tidbit temperature data logger. Scan or photograph your field data sheet and upload a copy to: https://app.box.com/files/0/f/8073339705/Tidbit_field_data_sheets
email hwebber@schoodicinstitute.org or eorcutt@schoodicinstitute.org if you have any questions.

Site name: Two Bush	Date of install: 6/30/16		GPS coordinates Lat: 44°0.870' Long: 68°53.077'
Logger ID: 10930405	Install time: 1:56 pm	Time of low tide: 1:45 pm	

Installer's name and email:

Write a brief description of the location of your Tidbit, include features that will help you relocate your Tidbit.

Sketch the location of your Tidbit, include features that will help you relocate your Tidbit.

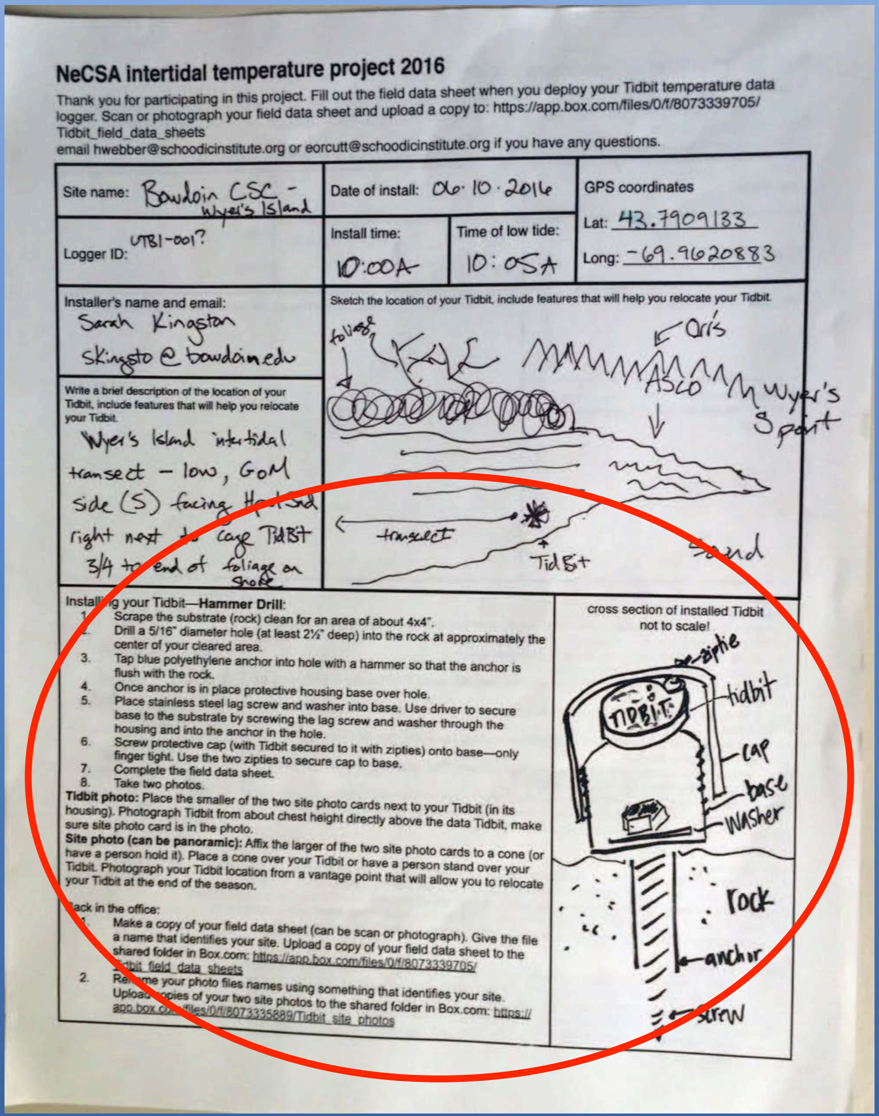
Installing your Tidbit—EPOXY

Install carriage bolt:
Find a small crevice that is about 3-5" deep—make sure that it is big enough for a fair amount of epoxy and the bolt. Scrape out the crevice as best you can.
Use gloved hands and tongue depressor to mix your epoxy.
Once mixed, fill the crevice with the epoxy.
Place bolt—head end down—into the epoxy. Make sure that about 1" of the bolt is sticking up out of the epoxy.
Get GPS coordinates for the bolt. Leave site, let epoxy harden overnight. Back in the office:
Install Tidbit:
Upon returning to your field site—Place protective housing base (1½" Sch 40 PVC Plug, threaded, male) onto the bolt.
Place washer, lock washer, and nut onto bolt. Tighten using 7/16" socket to secure base to the bolt (do not over tighten or the PVC will crack).
Screw protective cap (with Tidbit secured to it with zipties) onto base—only finger tight. Use the two zipties to secure cap to base (run the zipties through one of the holes in the base and through one of the holes in the cap to secure).
Complete the field data sheet.
Take two photos.

cross section of installed Tidbit not to scale!

Tidbit photo: Place the smaller of the two site photo cards next to your Tidbit (in its housing). Photograph Tidbit from about chest height directly above the data Tidbit, make sure site photo card is in the photo.
Site photo (can be panoramic): Affix the larger of the two site photo cards to a cone (or have a person hold it). Place a cone over your Tidbit or have a person stand over your Tidbit. Photograph your Tidbit location from a vantage point that will allow you to relocate your Tidbit at the end of the season.

Back in the office:
1. Make a copy of your field data sheet (can be scan or photograph). Give the file a name that identifies your site. Upload a copy of your field data sheet to the shared folder in Box.com: https://app.box.com/files/0/f/8073339705/Tidbit_field_data_sheets
2. Rename your photo files names using something that identifies your site. Upload copies of your two site photos to the shared folder in Box.com: https://app.box.com/files/0/f/8073335889/Tidbit_site_photos



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email hwebber@schoodicinstitute.org or eorcutt@schoodicinstitute.org if you have any questions.

Site name: Bowdoin CSC - Wyer's Island	Date of install: 06·10·2016		GPS coordinates Lat: 43.7909133 Long: -69.9620883
Logger ID: UTBI-001?	Install time: 10:00A	Time of low tide: 10:05A	

Installer's name and email: Sarah Kingston skingsto@bowdoin.edu

Write a brief description of the location of your Tidbit, include features that will help you relocate your Tidbit.
Wyer's Island intertidal transect – low, GoM side (S) facing Headland right next to cage TidBit 3/4 to end of foliage on shore

Sketch the location of your Tidbit, include features that will help you relocate your Tidbit.

Installing your Tidbit—**Hammer Drill**:
1. Scrape the substrate (rock) clean for an area of about 4x4".
2. Drill a 5/16" diameter hole (at least 2½" deep) into the rock at approximately the center of your cleared area.
3. Tap blue polyethylene anchor into hole with a hammer so that the anchor is flush with the rock.
4. Once anchor is in place protective housing base over hole.
5. Place stainless steel lag screw and washer into base. Use driver to secure base to the substrate by screwing the lag screw and washer through the housing and into the anchor in the hole.
6. Screw protective cap (with Tidbit secured to it with zipties) onto base—only finger tight. Use the two zipties to secure cap to base.
7. Complete the field data sheet.
8. Take two photos.

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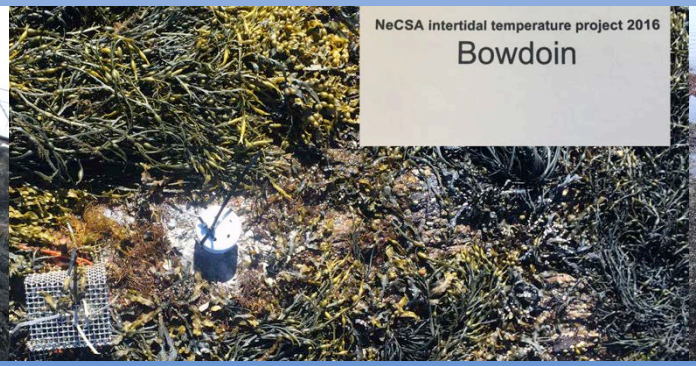
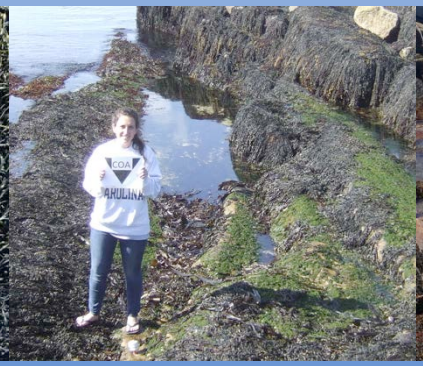
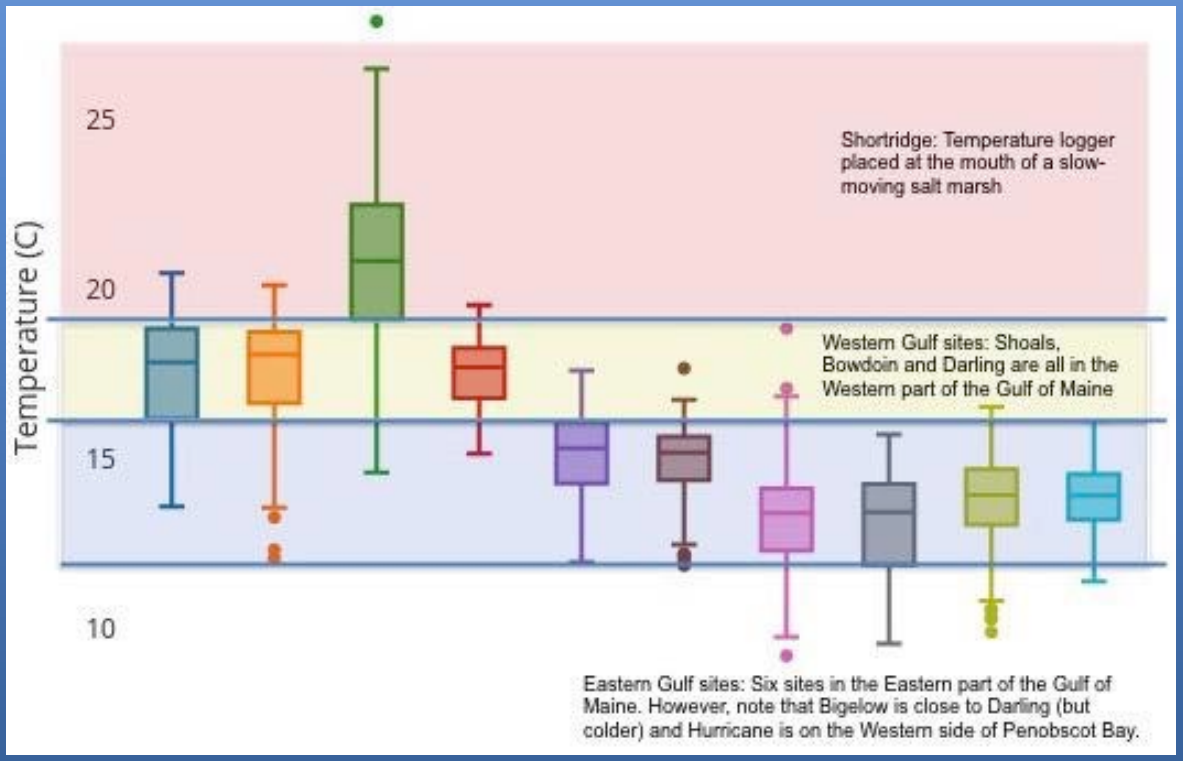
cross section of installed Tidbit not to scale!

We have success!

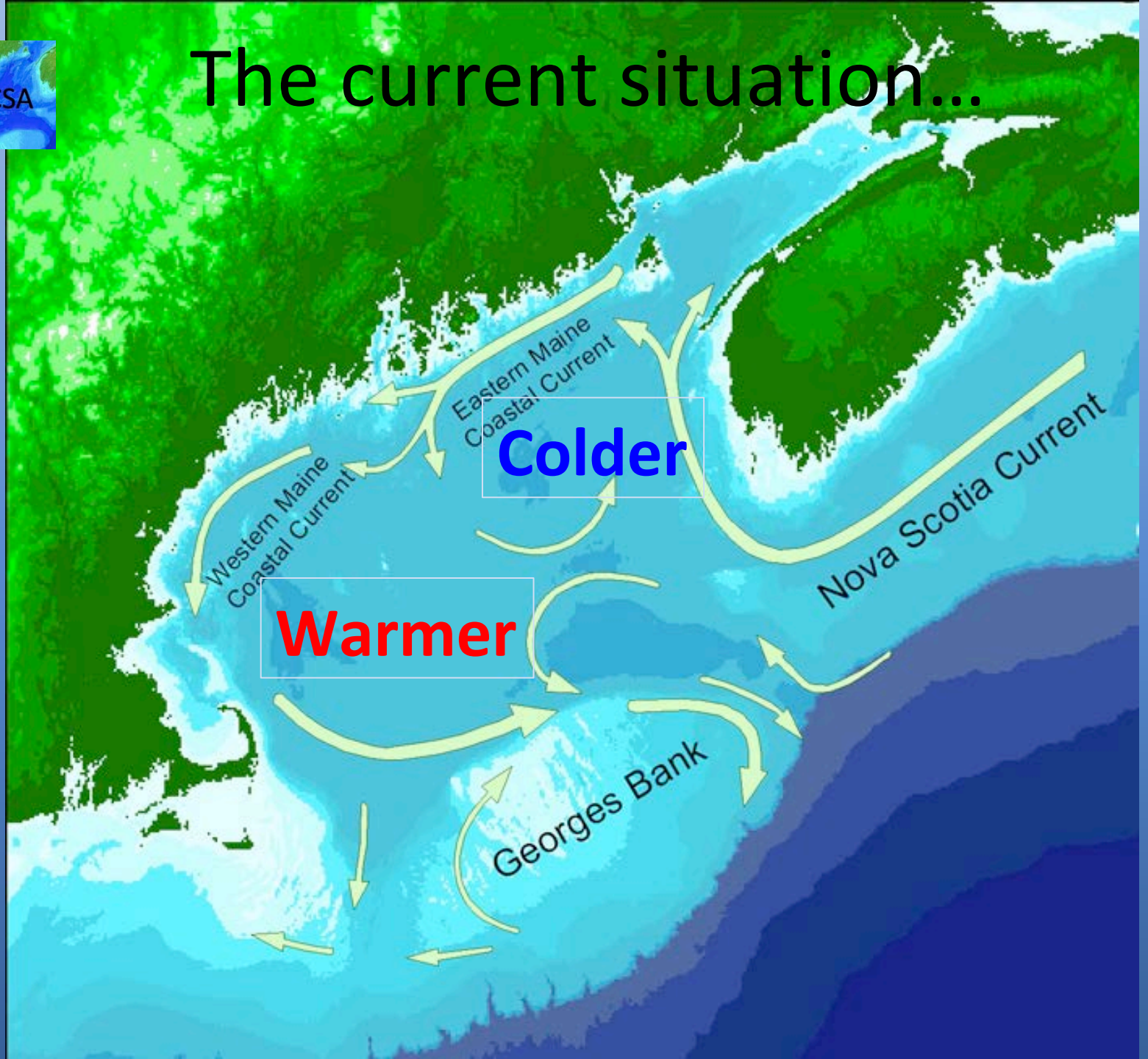




Variability in intertidal temperature (at high tide) at ten field stations in the Gulf of Maine



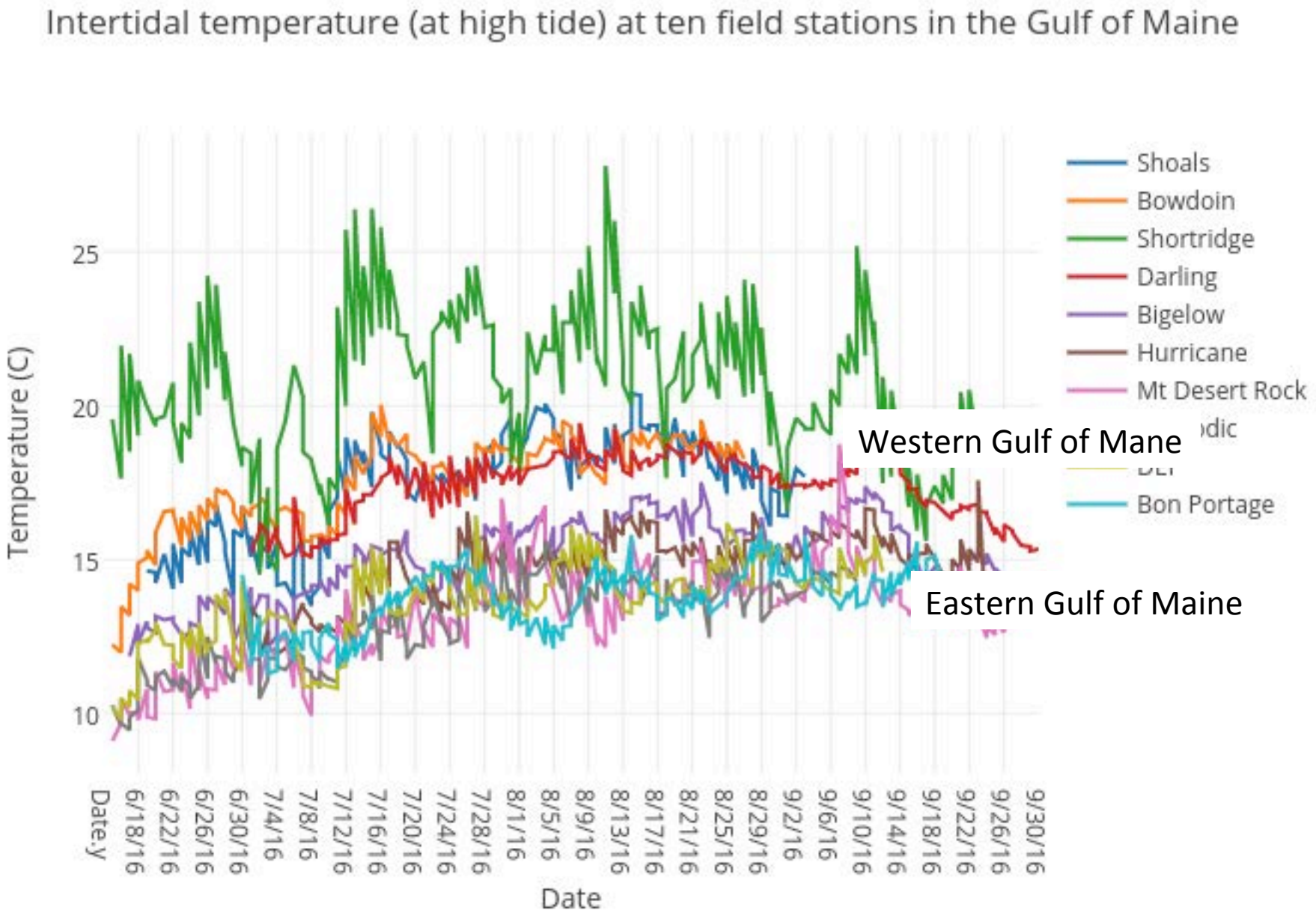
The current situation…



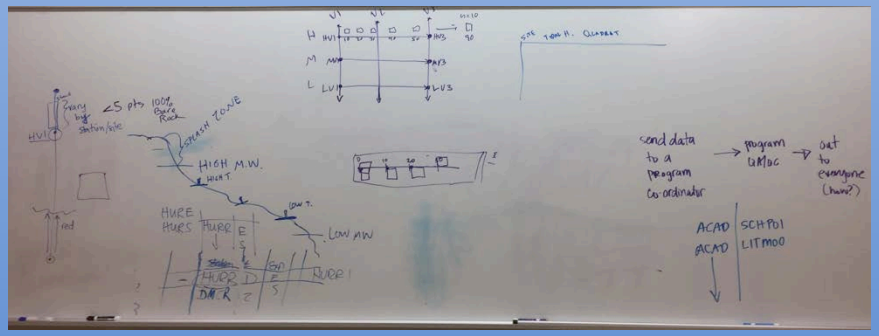
Temperature data – 2016
NERACOOS Buoys vs. Onshore Hobos

Buoy data | NeCSA | Buoy data | NeCSA

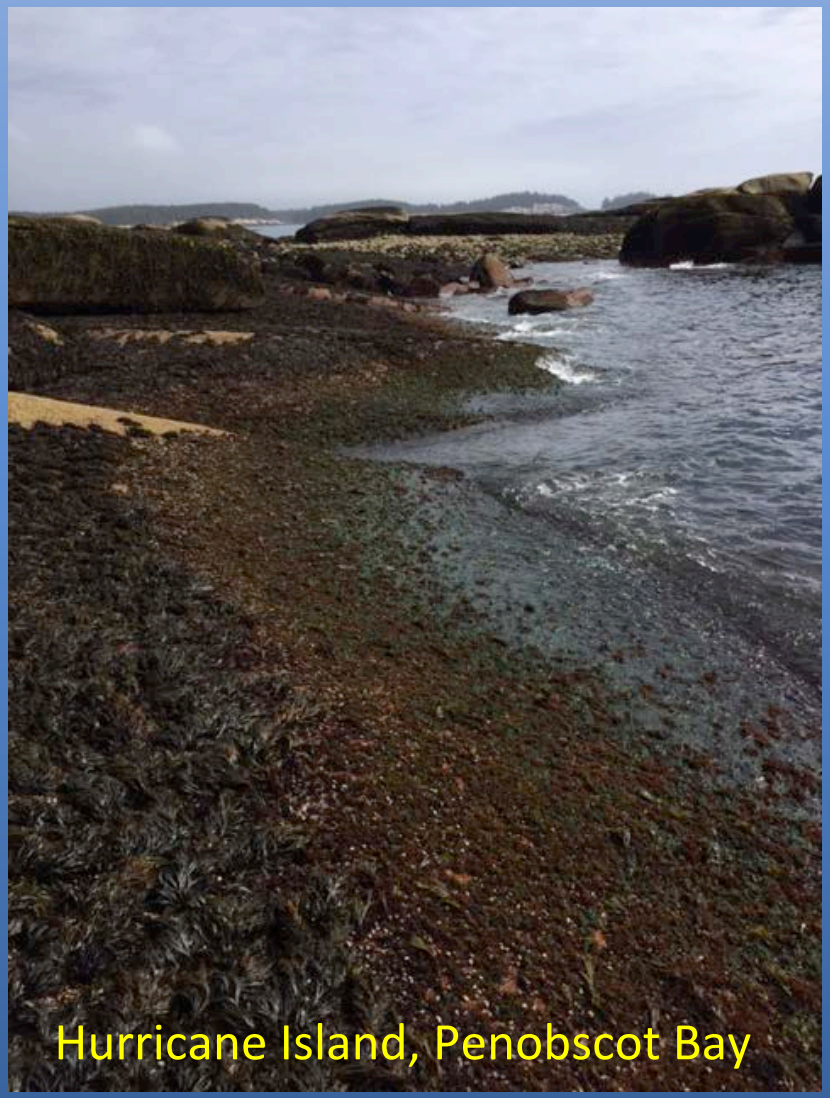
Western GOM | Eastern GOM


Intertidal temperature (at high tide) at ten field stations in the Gulf of Maine
Temperature (C)
25
20
15
10
Date.y
6/18/16
6/22/16
6/26/16
6/30/16
7/4/16
7/8/16
7/12/16
7/16/16
7/20/16
7/24/16
7/28/16
8/1/16
8/5/16
8/9/16
8/13/16
8/17/16
8/21/16
8/25/16
8/29/16
9/2/16
9/6/16
9/10/16
9/14/16
9/18/16
9/22/16
9/26/16
9/30/16
Date
Shoals
Bowdoin
Shortridge
Darling
Bigelow
Hurricane
Mt Desert Rock
Bon Portage
Western Gulf of Mane
Eastern Gulf of Maine

We build on the success & new friendships



Sentinel Variables – Rocky Intertidal

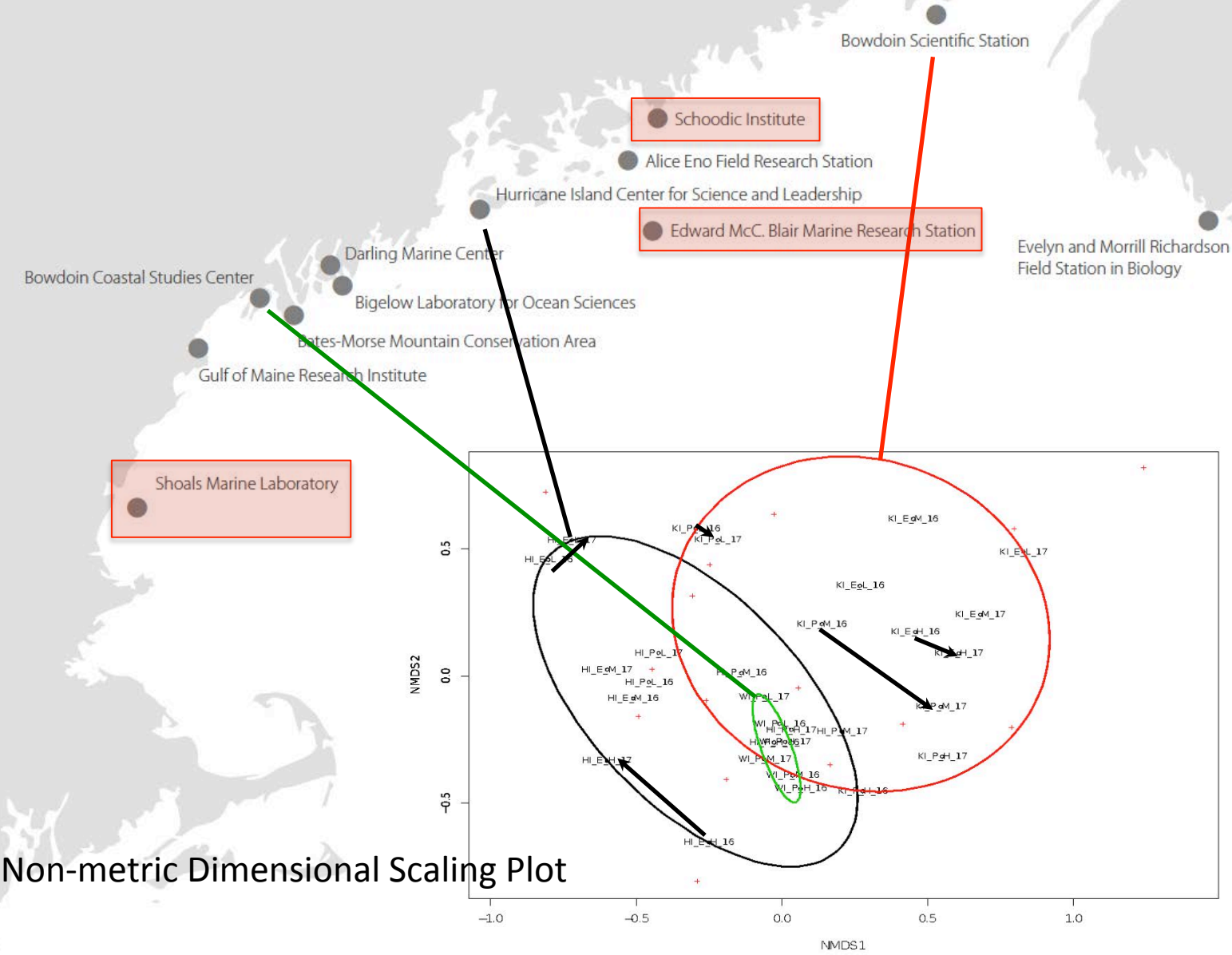

Hurricane Island, Penobscot Bay

- Accessible
- Well studied
- Forced by bottom up and top down processes
  - **Temperature** – Hobo data loggers
  - **Wave energy** - Dynamometers
  - **Intertidal community structure**
    - Macroalgae
    - Mobile consumers
    - % cover + abundance

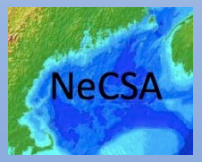
Rocky intertidal sampling

- 2 exposures/site
- 3 tidal heights
- Fixed transects parallel to shore
- Replicate 0.25 m^2 quadrats (n= 9) along transects

Intertidal Data – 2 years x 3 sites
Capturing variability in time and space

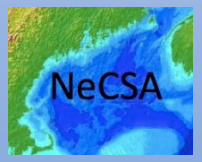


Non-metric Dimensional Scaling Plot



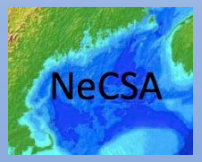
Lessons learned:

- Hire a facilitator for all major meetings
- Be flexible
  - Focus on the mission, the greater good
  - Remember the goals
- Anticipate and foster changes in leadership
  - Train as many as possible in relevant skills
- Follow the energy



Lessons learned:

- Working without dedicated staff
  - Value of relationships
  - Value to your existing programs/people
- Deciding what to do
  - common ground
  - resist shiny & new
- The trouble with standardization



Lessons learned:

- You can only play with people who show up
- Honor + support different capacities
- Iterate (to a point!)
- Jump in and do something (anything)

Honor & iterate!

Sarah Kingston
@scarletscience

Follow

#NeCSA intertidal monitoring in the golden hour with #BMSS2017 #Bowdoin #CoastalStudiesCenter

7:12 PM - Aug 23, 2017

2 9

regrets Inbox x

Dianne Tilton Aug 18

to me, Kyle, Jeff

Hi Hannah,
Thanks for giving DEI the opportunity to work with you on your latest monitoring program. We certainly value the thought and rigor you apply to your projects and are always pleased to take part, primarily because the information is important, but as a practical matter, implementation is generally straightforward and takes little time on our end.

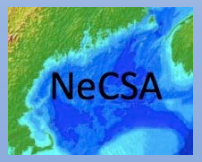
It's come to my attention, however, that this latest project is a bit different. My understanding is that because of the size of our tides, the experiment's design would mean we will be collecting thousands of measurements. No one you spoke with at DEI understood the extent of sampling that would be needed until recently.

At this time of year, our interns are wrapping up, and it would be Kyle or another research assistant doing the work. As much as Kyle is interested, feels he committed himself, and desires to continue working with you, I just can't allow this much of his time to be diverted from his primary duties.

We are all disappointed to have to decline to participate at this time, and since this was my decision, I apologize if it has caused great inconvenience for you. I do hope you can understand that we need to prioritize where our limited staff resources are spent, and that you won't hesitate to contact us for other projects in the future.

All the best to you Hannah, and thank you for understanding.

We are all disappointed to have to decline to participate at this time,



NeCSA Steering Committee

- Bates College
- Bowdoin College
- University of Maine - The Darling Marine Center
- University of New Hampshire - Shoals Marine Lab
- The Hurricane Island Center for Science and Leadership
- Schoodic Institute

BATES

BOWDOIN

DARLING MARINE CENTER University of Maine

Hurricane Island Center for Science and Leadership

SHOALS Marine Laboratory

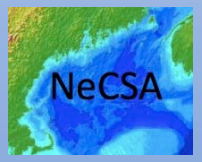
SCHOODIC INSTITUTE AT ACADIA NATIONAL PARK

Path Ahead

- Adding friends with sites and new sentinel variables
- Data
  - Quality
  - Curation
  - Accessibility
- Funding $$$

NeCSA

Northeastern Coastal Stations Alliance



Thanks and questions??

Collaborators:
Bates-Morse Mountain Conservation Area
Bowdoin Schiller Coastal Studies Center
Bigelow Lab for Ocean Science
Downeast Institute
Evelyn and Morrill Richardson Field Station in Biology
Hurricane Island Center for Science and Leadership
Schoodic Institute at Acadia National Park
Shoals Marine Laboratory
Edward McC. Blair Marine Research Station (College of the Atlantic)
Daring Marine Center (UMaine)
UMass/ Amherst Gloucester Field Station
Bon Portage Field Station (Acadia University)

Funders:
National Science Foundation
Maine SeaGrant
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