

Using continuous environmental monitoring data to inform biological changes in a rapidly warming Gulf of Maine:

NOAA's System Wide Monitoring Program

Gulf of Maine Monitoring Symposium
April 8th, 2025



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National Estuarine Research Reserve System (NERRS)



New CT Reserve
2022!

LIST OF RESERVES

Great Lakes

1. Lake Superior, Wisconsin
2. Old Woman Creek, Ohio

Northeast

3. Wells, Maine
4. Great Bay, New Hampshire
5. Waquoit Bay, Massachusetts
6. Narragansett Bay, Rhode Island

Mid-Atlantic

7. Hudson River, New York
8. Jacques Cousteau, New Jersey
9. Delaware
10. Chesapeake Bay, Maryland
11. Chesapeake Bay, Virginia

Southeast

12. North Carolina
13. North Inlet-Winyah Bay, South Carolina
14. ACE Basin, South Carolina
15. Sapelo Island, Georgia
16. Guana Tolomato Matanzas, Florida

Gulf of Mexico

17. Rookery Bay, Florida
18. Apalachicola, Florida
19. Weeks Bay, Alabama
20. Grand Bay, Mississippi
21. Mission Aransas, Texas

West

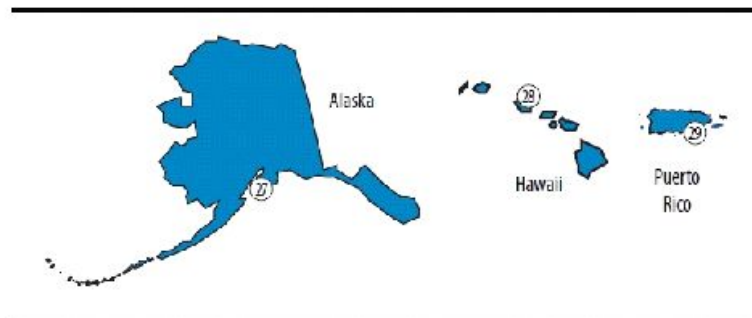
22. Tijuana River, California
23. Elkhorn Slough, California
24. San Francisco Bay, California
25. South Slough, Oregon
26. Padilla Bay, Washington
27. Kachemak Bay, Alaska

Pacific

28. He'eia, Hawaii

Caribbean

29. Jobos Bay, Puerto Rico

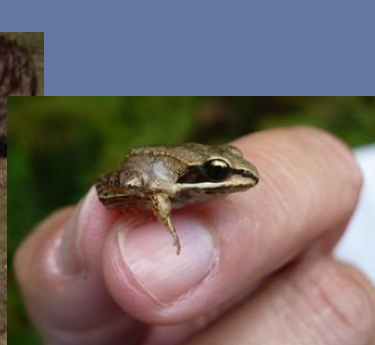




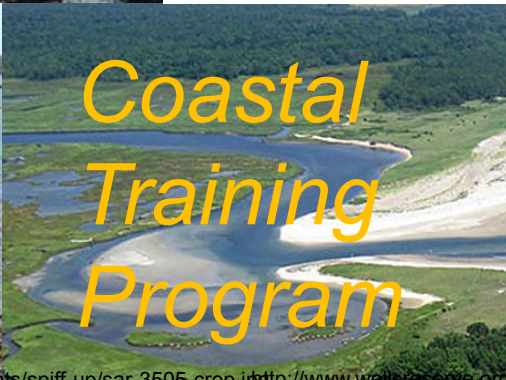
Education



Research



Stewardship



Coastal Training Program

The Maine Coastal Ecology Center

- Fisheries- habitat-monitoring
- Ocean and coastal climate change (SWMP)
- Hypothesis-driven research
- Science that informs!



Ernest F.
Hollings Scholars



Interns & Students

- Undergraduates
- Graduates
- Post-doctoral
- NOAA 5-Colleges
- NOAA Hollings Scholars
- Volunteers

Dr. Jason Goldstein: Research Director



Long-term monitoring and research efforts

- System Wide Monitoring Program (SMWP) 1995-present
 - Zooplankton monitoring (larval fish and crustacea) 2008-present
 - Invasive species (MIMIC) 2008-present
 - Others (OA, eDNA, crabs, etc.)



System-Wide Monitoring Program (SWMP)

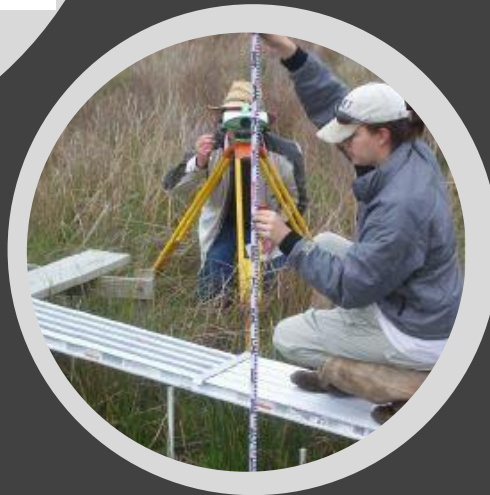


• Abiotic Monitoring

- 15 min Water quality
- Monthly nutrients
- 15 min Meteorological
- Marsh elevation/SETs

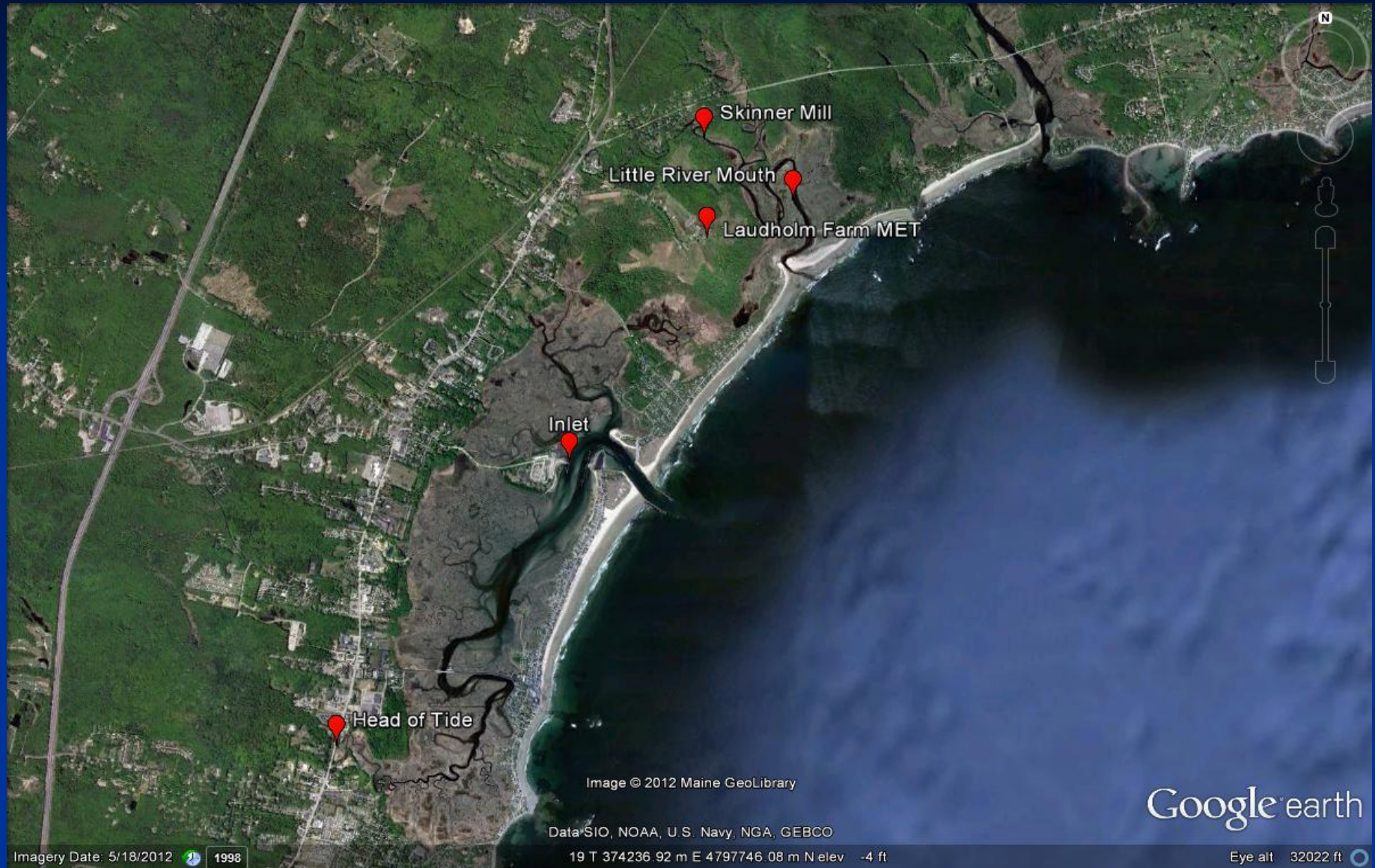
• Biological Monitoring

- Habitat change (veg transects/SAV)
- Biodiversity (fish/plants/crustacea)
 - Invasive species
 - Crabs
 - Larval fish
 - Veg transects



MISSION: Identify and track short-term variability and long-term changes in the integrity and biodiversity of estuarine ecosystems.

Collection of Data (Abiotic)



“Impacted site”



**Webhannet
River
Estuary**

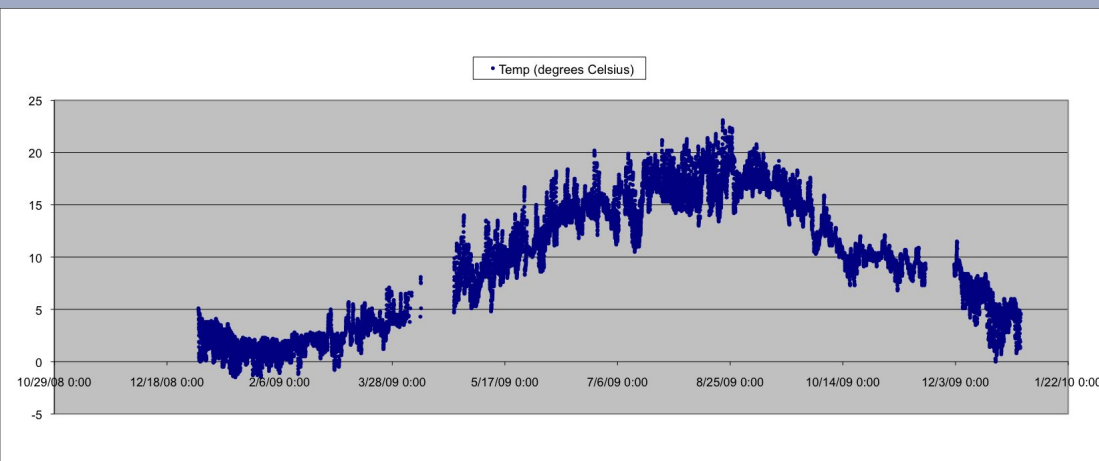


System Wide Monitoring Program: A case for time-series!

- ❑ Innovations in monitoring equipment and data telemetry have made the collection of time-series data much more accurate and reliable.
- ❑ Extended deployment systems with anti-fouling accessories and wiped sensors, improving data quality.
- ❑ Data Telemetry options have improved which help in data collection, dissemination, and quality



<http://www.ysi.com/media/products/6600V2-sensor>
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Key factors and considerations

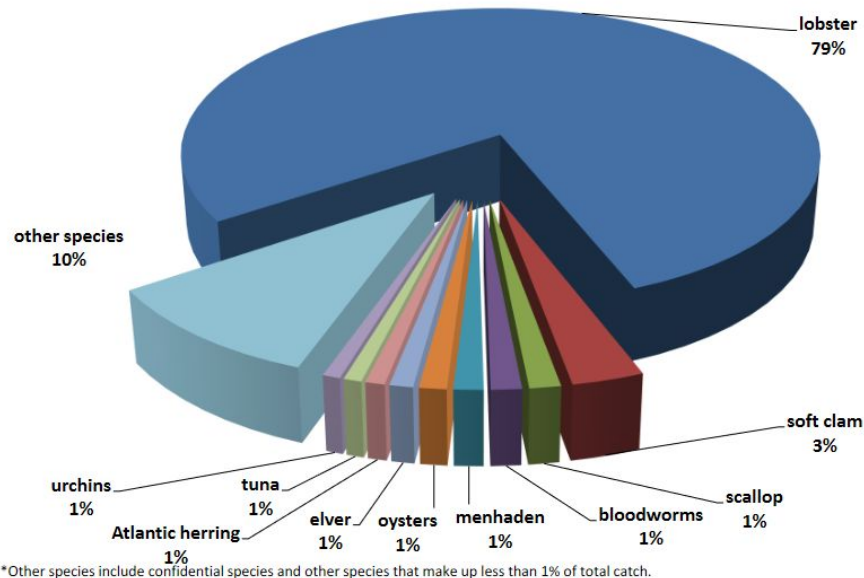
- Long-term continuous data collection at fixed locations
- Standardized methodology (reliability/repeatability)
- Data Management and QA/QC
- Funding....



Coastal and Ocean Acidification (COA) in Maine:

A new suite of parameters in response to our changing coasts

Preliminary 2020 Commercial Maine Landings By Ex-vessel Value
Total: \$516,796,611 as of 3/15/2021



- Adapting monitoring programs to accept new parameters
- Finding **funding** for equipment
- Techniques for gathering “complimentary” data on carbonate chemistry
- **Working with others to improve upon regional observations/trends and leverage support (NECAN, OPAL, etc)**

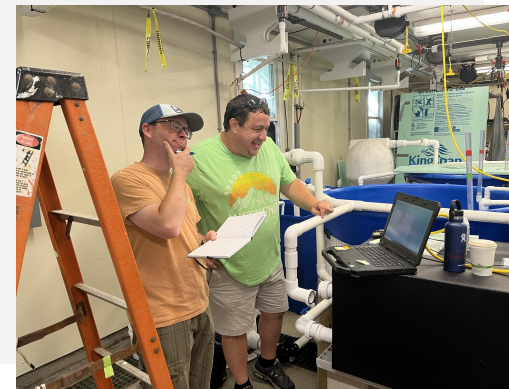
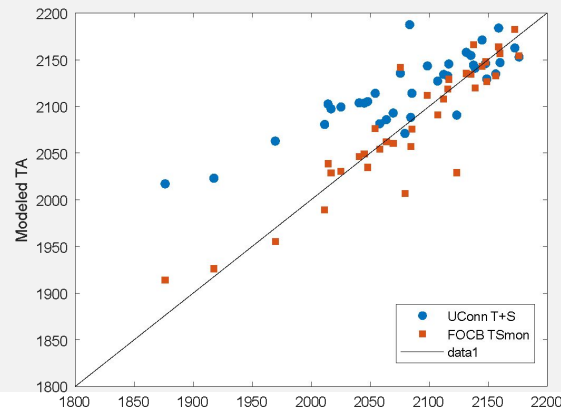
Shellfish species, which comprise more than 70% of the commercial fisheries in the Gulf of Maine, may be at exceptional risk.



“Sensor Squad” Updates: COA Monitoring

Activities:

1. pH sensor intercomparison
 - independent calibration checks
 - seawater reference buffer test
 - combination of discrete samples and reference sensors
2. MLR TA model
 - site-specific model
 - combinations of input parameters
 - discrete TA samples and YSI environmental data



University of
New Hampshire



Friends of Casco Bay
CASCO BAYKEEPER



Wells Reserve
at Leachholm
Wells National Estuarine
Research Reserve

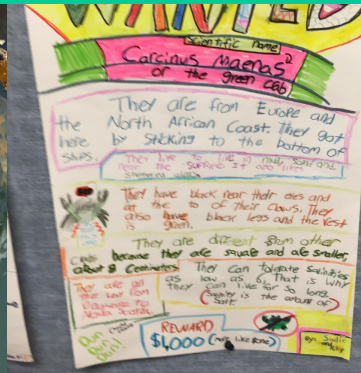
Biological monitoring and biodiversity: challenges and solutions



Collaborations and Citizen Scientist at Work! (MIMIC)



Community
members doing real
science!





One Crab, Two Crab, Green Crab... BLUE CRAB?!?



Green Crab (*C. meanas*)

Quickly adapting to arrival of new species/range expansions

Climate change/warming waters, impacts to native species, etc.

Blue Crabs (*Callinectes sapidus*) caught in the Webhannet River Marsh, Wells, ME. Summer 2020. (below)



Working together

Monitoring Blue Crab Range Expansion



Trapping
(Population
Dynamics)



Acoustic
Telemetry
(Movement)



Zooplankton
Surveys
(Larval
Recruitment)



Interaction
Trials with
Green Crabs

- GoM Blue Crab Network
- Sharing protocols
- Expanding trapping
- And more...



Environmental DNA (eDNA)



Dr. Jason Goldstein
& Laura Crane –
Wells NERR

Dr. Allison Watts –
UNH

LETTER

“Sight-unseen” detection of rare aquatic species using environmental DNA

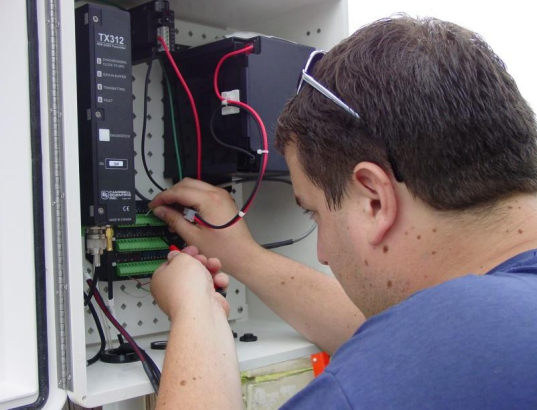
Christopher L. Jerde¹, Andrew R. Mahon¹, W. Lindsay Chadderton², & David M. Lodge¹

- Detection rates 80-96%
- Faster & cheaper sampling (< 30 min, <\$30/sample)
- **A new tool/technique for monitoring?**



To wrap up....

- Lots of “types” of monitoring
 - Different approaches for each...
- Set and understand program goals
 - Understand limitations of program
- Utilize volunteers/citizen scientists!
- Data QA/QC and management
- Keep up on new technologies/equip/etc.
- NETWORK and COLLABORATE!



Thank you!!

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