

COLLABORATIVE SCIENCE AT THE GTM NERR: Integrating graduate education, professional training, and long-term research



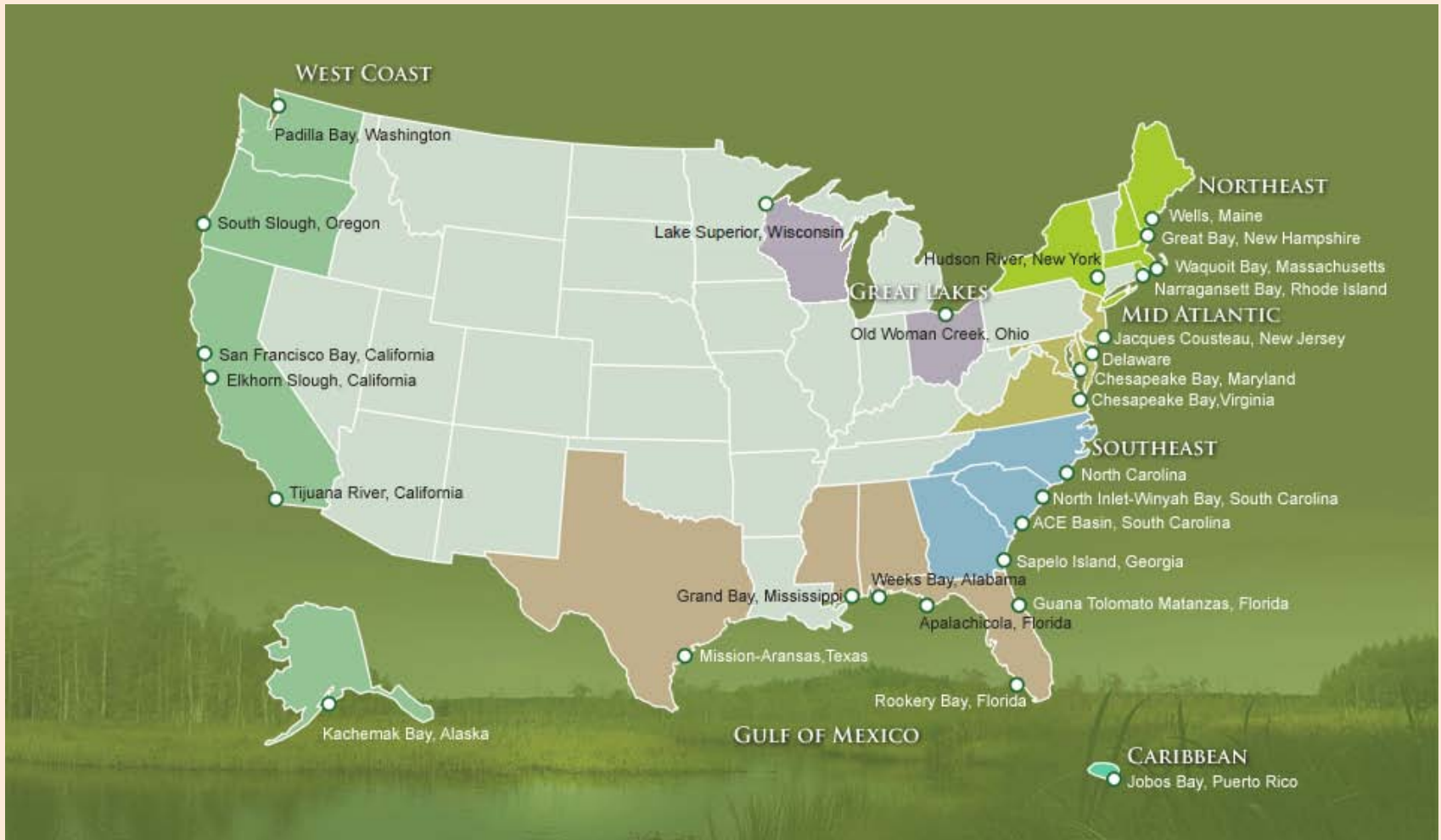
E. Johnson, M. Kimball, W. Eash-Loucks, M. Henzler, A. Brown, Y. Enriquez,
J. Ermak, M. Gonzalez de Acevedo, L. McLaughlin,
K. Olsen, B. Sleeth and C. Warhurst

GTM NERR
State of the Reserve 2013



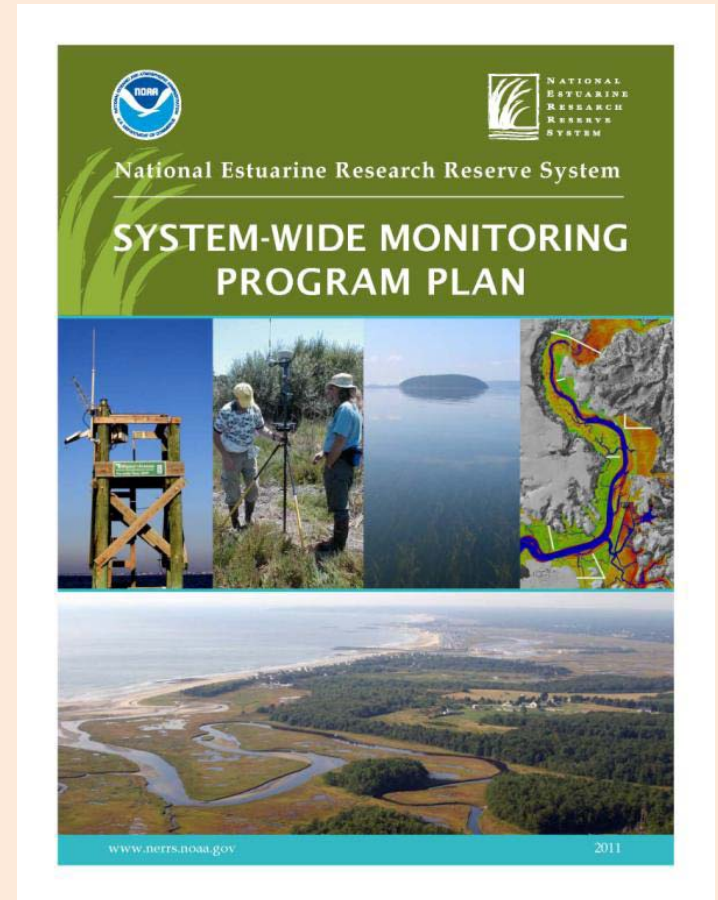
National Estuarine Research Reserve System

A system of 28 reserves in the United States and Puerto Rico.



NERR System-Wide Monitoring Program

Mission: Develop quantitative measurements of short-term variability and long-term changes in the meteorological, water quality, biological systems, and land-use / land - cover characteristics of estuaries and estuarine ecosystems for the purposes of informing effective coastal zone management.



Importance of long-term research programs

- Generate invaluable comprehensive baseline data
- Increase our understanding of coastal estuarine ecosystems
- Allow for evaluation of patterns and processes at large spatial and temporal scales
- Provide broad context for interpreting results of more detailed experiments



System Wide Monitoring Program - Elements

A NERRS monitoring activity with associated protocols, parameters, and budgets that has been fully vetted and approved by the NERRS as a fundamental component of reserve operational programs.

Core elements are required to be implemented at all reserves; standardized national protocols

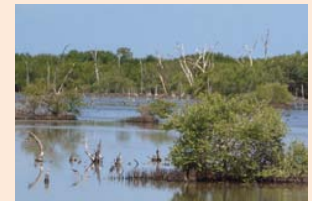
Elective elements are implemented by a single or a subset of reserves to address local or regional issues.

WATER QUALITY (continuous)
Water Temperature
Conductivity
Dissolved Oxygen
Pressure
pH
Turbidity
Depth (p. corrected)
WEATHER (continuous)
Air Temperature
Wind Speed
Wind Direction
Barometric Pressure
Precipitation
Humidity
Photosynthetically Active Radiation (PAR)
WATER CHEMISTRY (monthly)
Nitrate
Nitrite
Ammonium
Orthophosphate
Chlorophyll a

SWMP Data

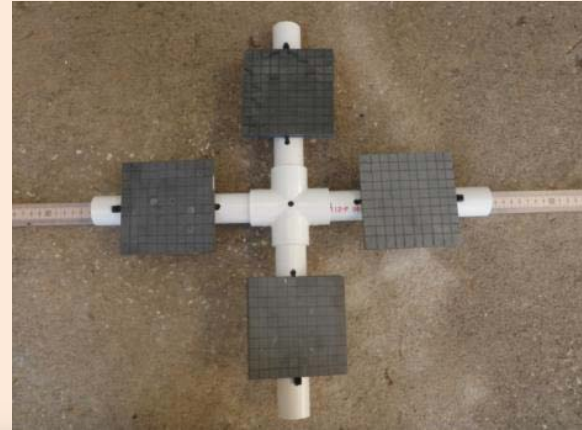
Data generated by all *Core Elements* is standardized and archived in the Centralized Data Management Office (CDMO)

The screenshot shows a web browser window displaying the National Estuarine Research Reserve System (NERRS) Centralized Data Management Office (CDMO) website. The page title is "Data Export System" and it is powered by the Centralized Data Management Office. The main content area features a map of the United States with a yellow star highlighting a specific location in the Southeast. The text on the page reads: "Please select a Reserve from the map below: If you already know the station code, enter it here. If not, choose a Reserve from the map below." There is a "Submit" button next to an input field. The website footer includes the Department of Commerce, NOAA, National Ocean Service, Ocean and Coastal Resource Management, NERRS, and Webmaster.



Elective elements at the GTM NERR include a diverse array of terrestrial and aquatic research programs

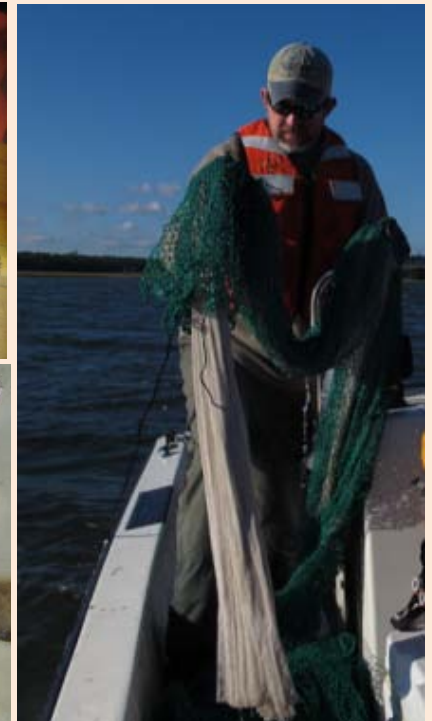
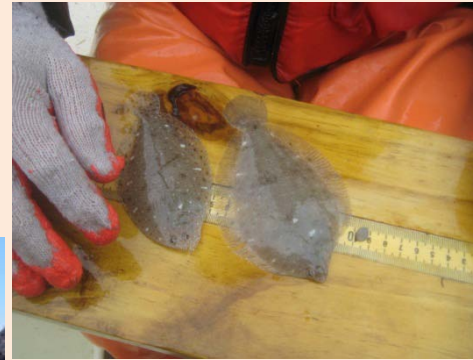
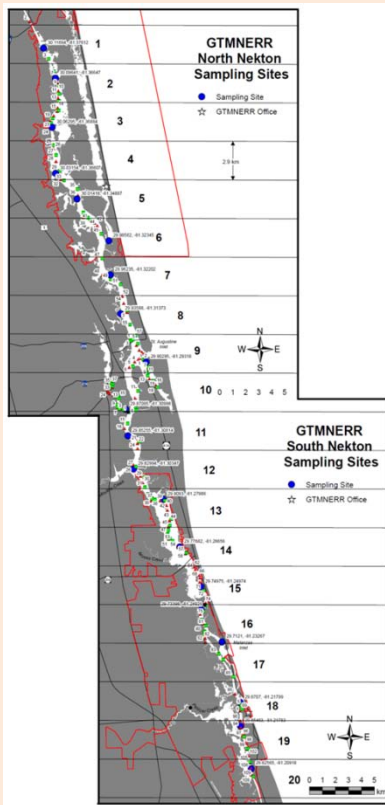
Seasonal dynamics of fouling communities



Northeast Florida is a historically understudied, yet critically important, region. The GTM NERR is located at the boundary of two biogeographical provinces.

Elective elements at the GTM NERR include a diverse array of terrestrial and aquatic research programs

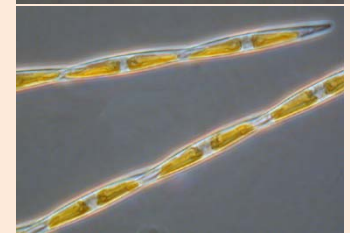
Seasonal dynamics of juvenile fish and invertebrates



Estuaries are critically important nurseries for many of Florida's recreational and commercial fisheries.

Elective elements at the GTM NERR include a diverse array of terrestrial and aquatic research programs

Harmful algal bloom monitoring



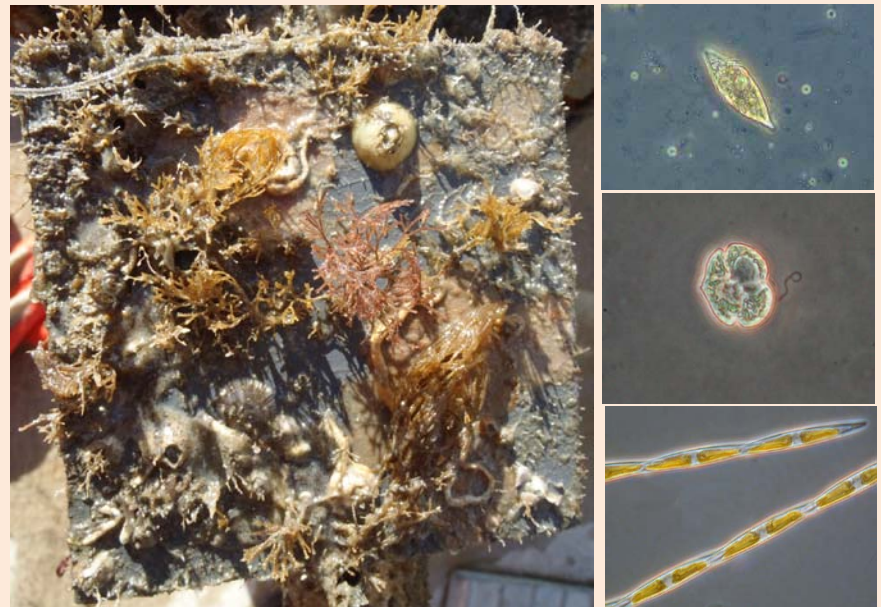
Harmful algal blooms can have severe adverse effects on coastal ecosystems and human health

The data collected for *core elements* is archived and available from the Centralized Data Management Office.

However, with limited resources, much of the important long-term data from *elective elements* at GTM NERR has yet to be comprehensively examined and analyzed.

There are many core and elective elements

The process doesn't always end with field collections



This problem is not unique to GTM, it is true of most organizations



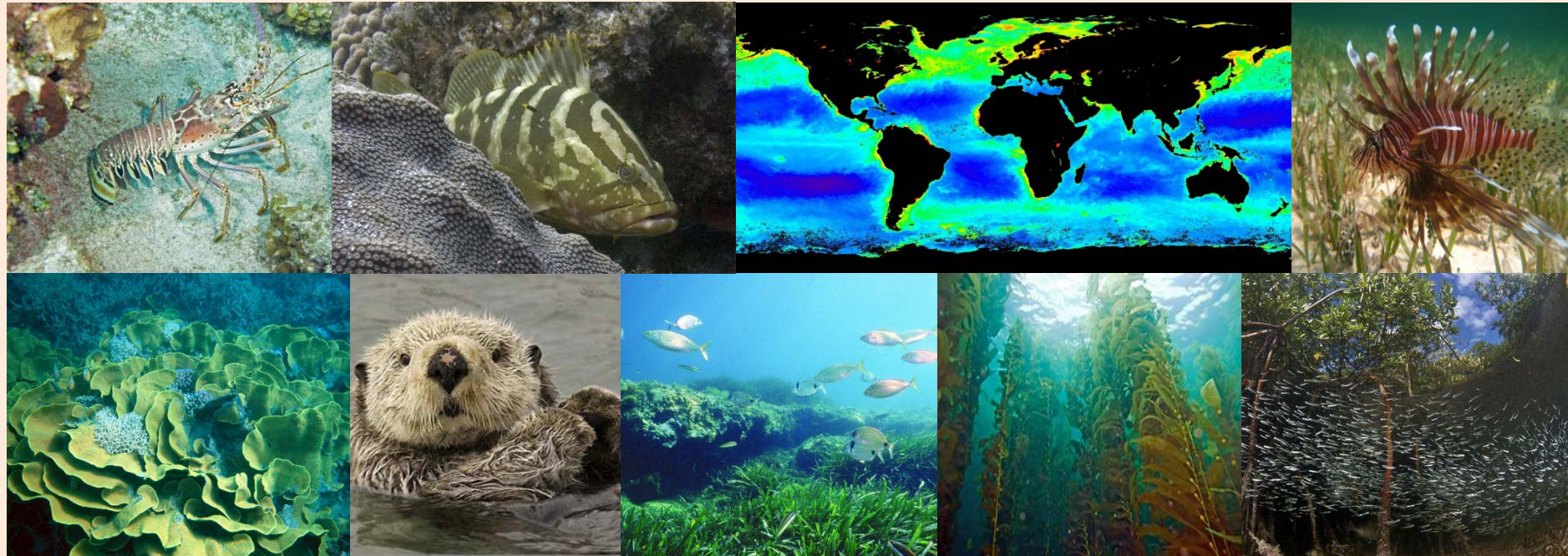
Beginning in 1984, the fish and invertebrate ecology laboratory at the Smithsonian Environmental Research Center has conducted four long-term surveys to understand the dynamics of fish and invertebrate populations in upper Chesapeake Bay.



“There is at least one science paper waiting in every freezer in every research laboratory”

Marine Ecology – acquiring knowledge

Course description: Ecology is the scientific study of the interactions among physical, chemical and biological factors that determine the distribution and abundance of organisms. In this course, we investigate the ecology of marine ecosystems in three broad arenas: (1) the unique physical environments that confront marine organisms, (2) the diverse array of marine habitats and associated fauna, and (3) human impacts on marine ecosystems and issues of sustainability and conservation.



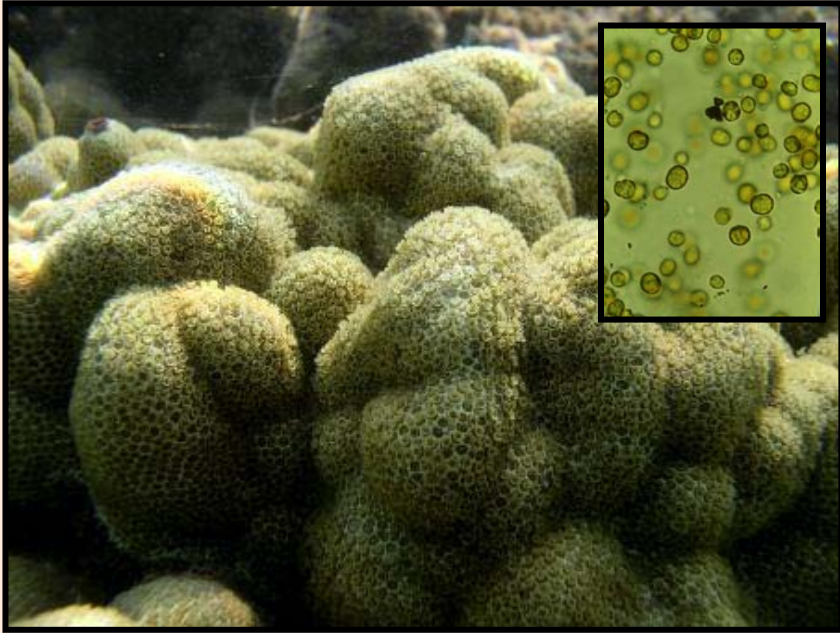
Marine ecology – developing critical skills

Course goals: Realizing that each student will pursue a varied career path and may not follow marine biology as their primary emphasis; my approach in this course will be to go beyond traditional content-based learning and also focus on the general tools and skills that are essential to success in any field. Specifically, these include: (1) critical thinking and problem solving, (2) written communication, (3) oral communication and (4) collaboration and team skills.

To build these skills, each student was required to conduct an independent research project, write a research manuscript and present a formal research seminar.

Sounds great in principle; now you just need to find worthwhile, logistically feasible, interesting, relevant independent research projects for eight highly motivated students every other year.

Mutualism is a close and often long-term interaction between different biological species that benefits both participants



Coral and zooxanthellae



Clown fish and sea anemone



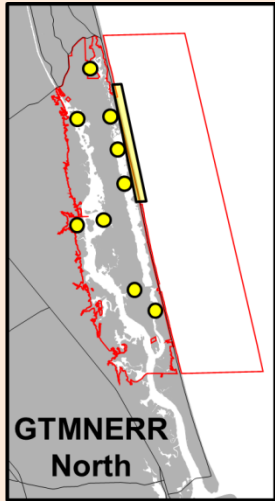
GTMNERR-UNF Collaboration



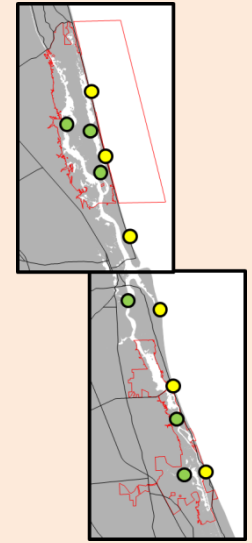
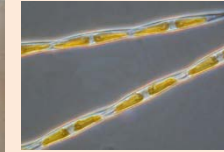
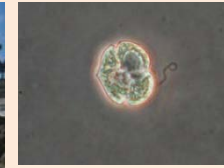
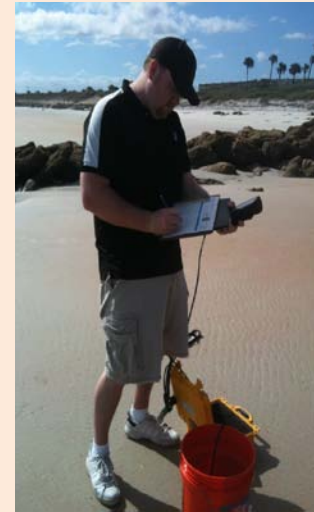
- Opportunity to mentor graduate students
 - Help with data manipulation, summary and analysis
 - Facilitation of public outreach
-
- Gain experience through participation in hands-on field research programs
 - Develop more rigorous scientific hypotheses with larger scopes
 - Access to long-term data sets with real world applications



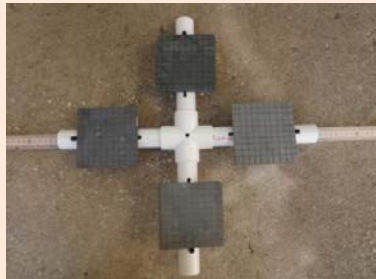
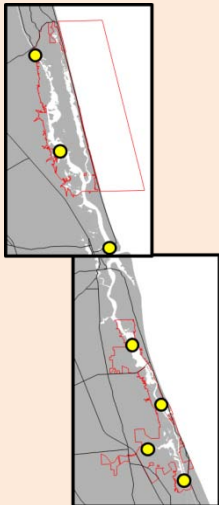
Shorebirds



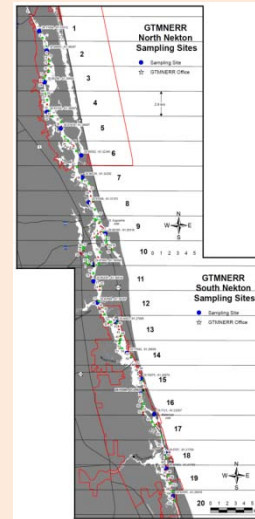
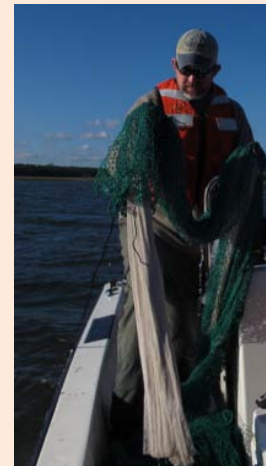
HAB monitoring



Fouling communities



Nekton survey



Patterns in Shorebird Abundance at GTMNERR

Laura McLaughlin and Jessica Ermak

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Red Tide Offshore Monitoring Program (RTOMP) – GTMNERR

Chris Warhurst

Recruitment and biofouling in the GTMNERR



Kevin Olsen

What's down there?

<http://www.nysm.nywd.gov/illustrations/fon/exhibitions/fon04/index.html>

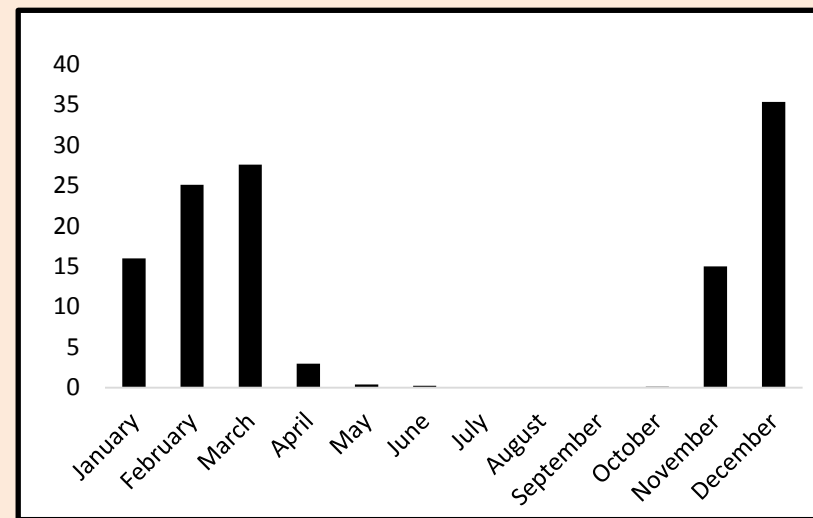
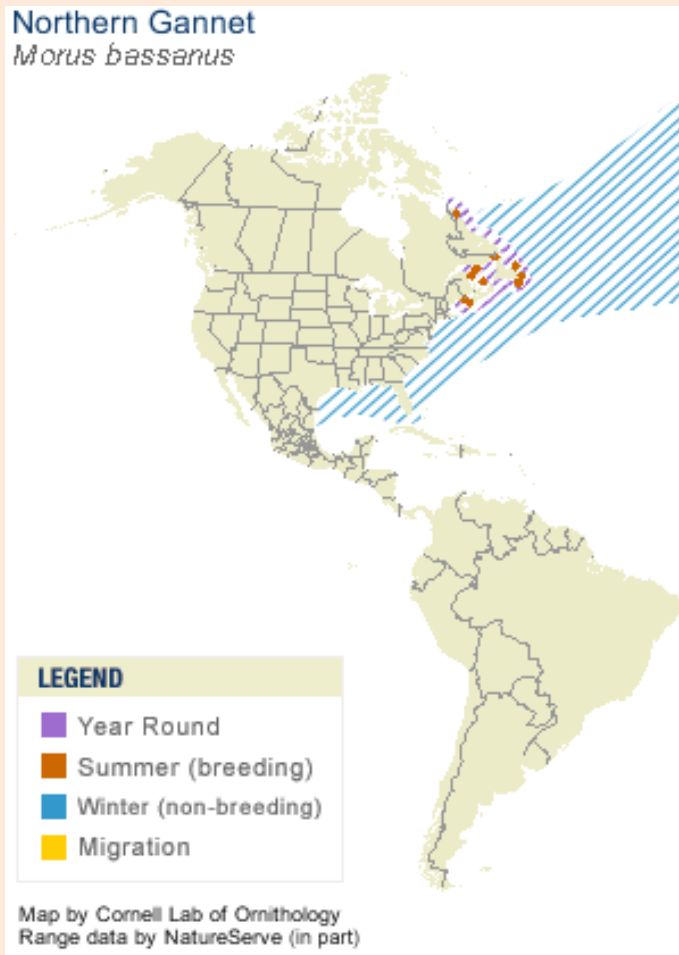
Nekton Monitoring within the GTMNERR

Brad Sleeth

&

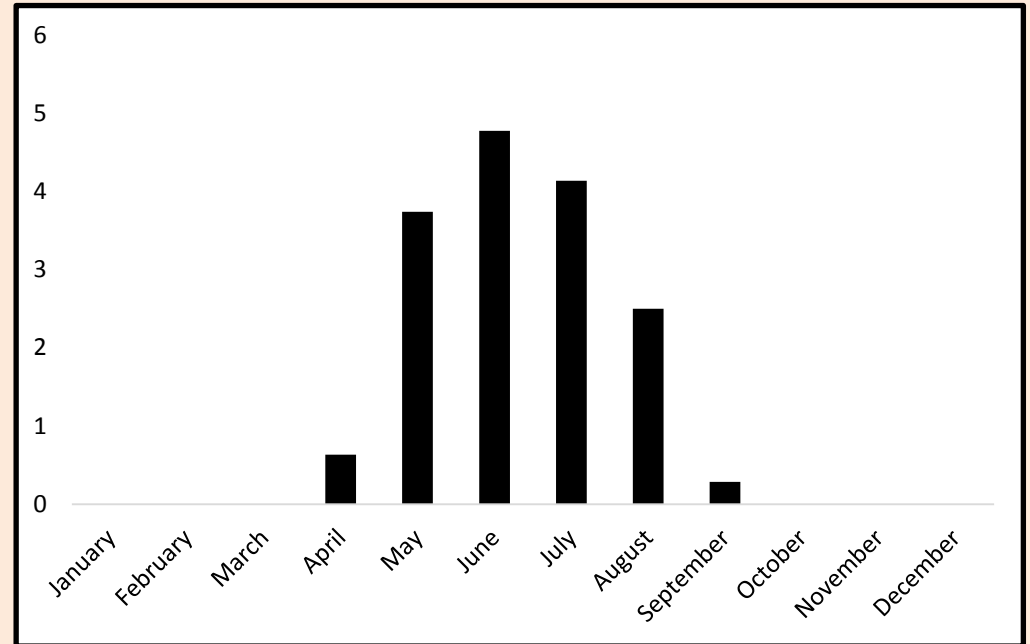
Melissa Gonzalez De Acevedo

Seasonal abundance of shorebirds (Northern Gannet)



Expectation: Winter Resident

Seasonal abundance of shorebirds (Least Tern)



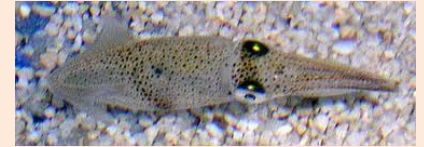
Expectation: Summer Resident

Common fish of the GTM Reserve

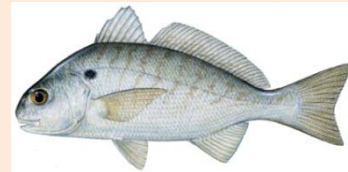
1) *Anchoa mitchilli* (Bay Anchovy)



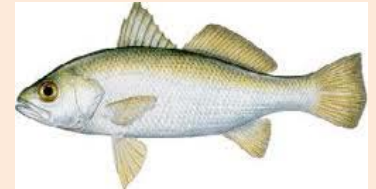
2) *Loliguncula brevis* (Squid)



3) *Leiostomus xanthurus* (Spot)



4) *Bairdiella chrysoura* (Silver Perch)



5) *Lagodon rhomboides* (Pinfish)



6) *Chloroscombrus chrysurus* (Atlantic Bumper)



7) *Anchoa hepsetus* (Striped Anchovy)



8) *Eucinostomus* sp. (Mojarras)



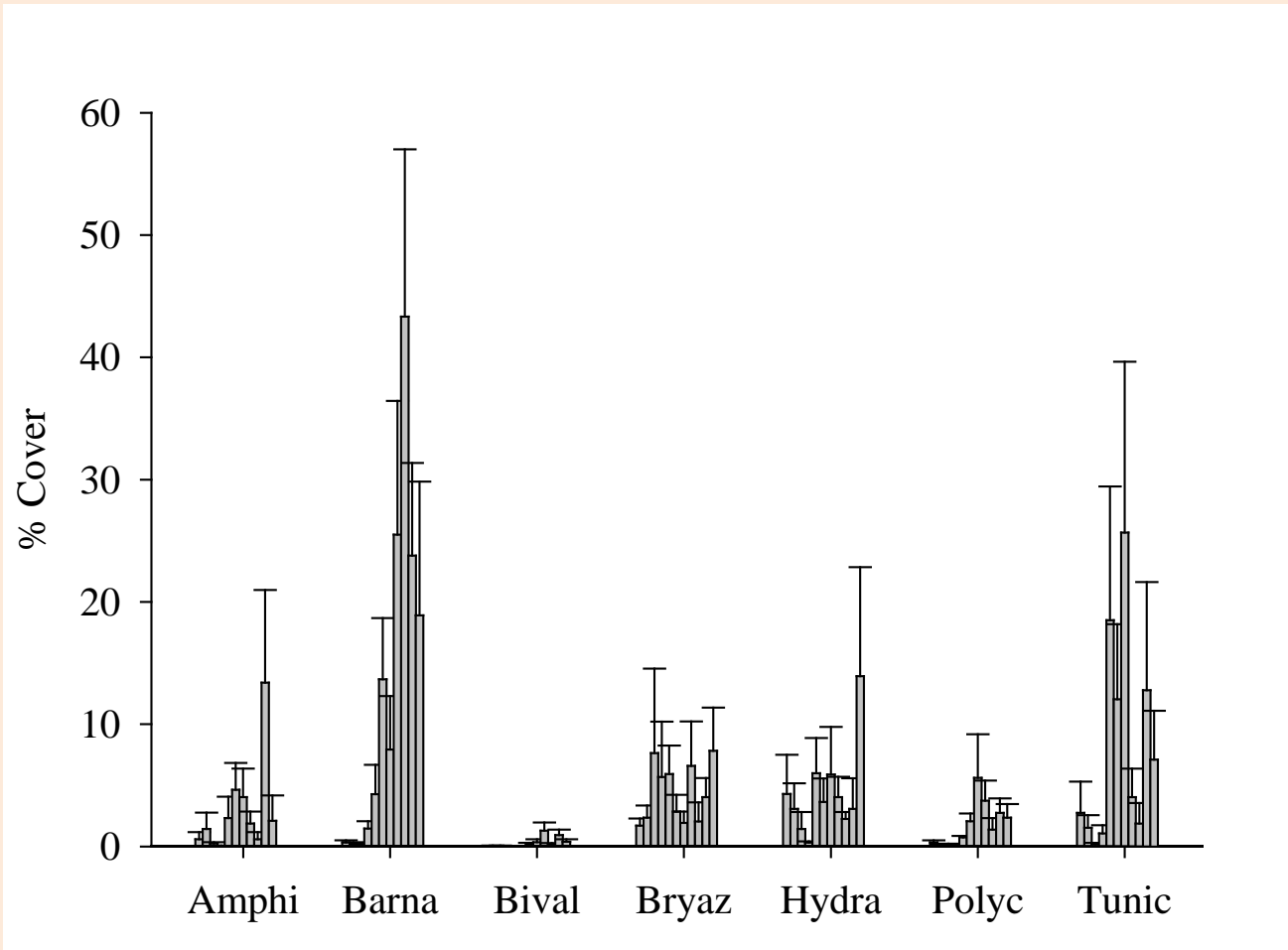
9) *Diapterus auratus* (Irish Pompano)



10) *Ariopsis felis* (Hardhead Catfish)

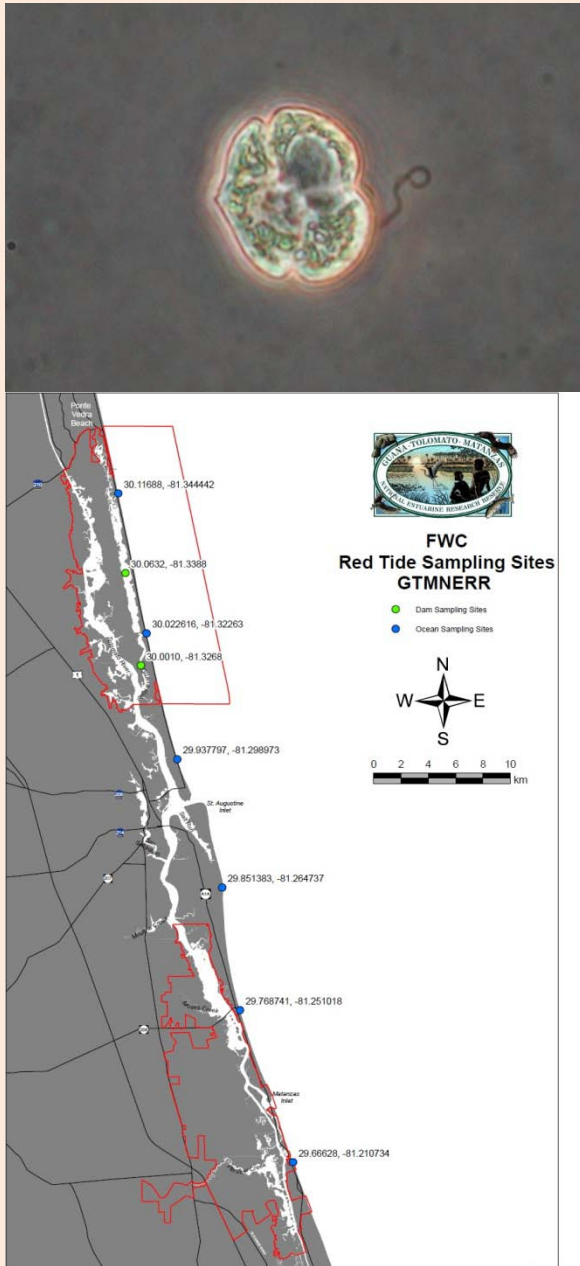


Monthly recruitment to the GTM reserve

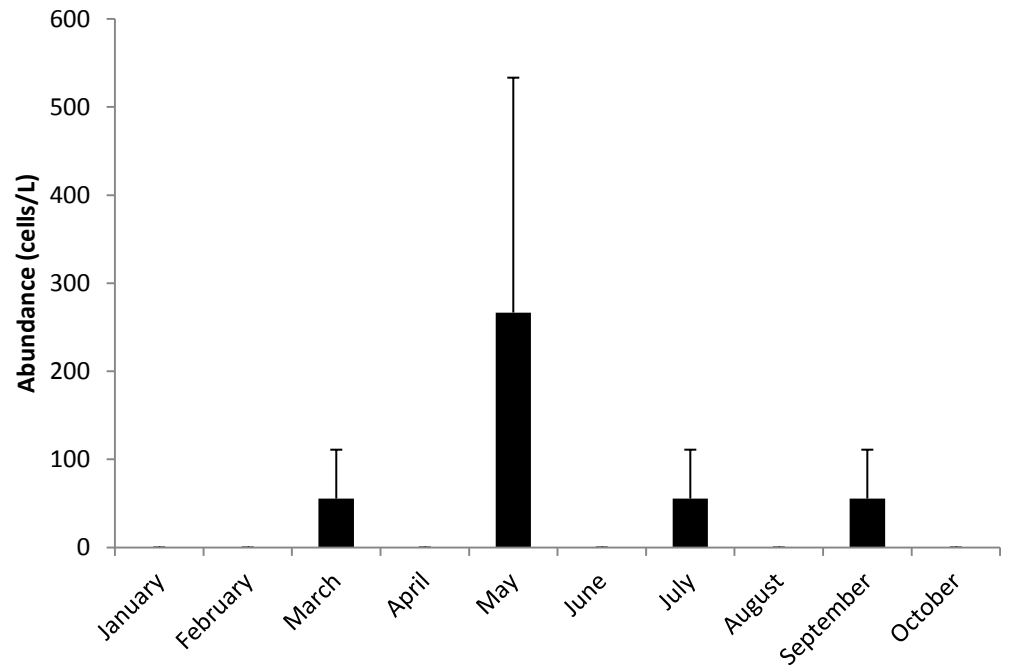


* Seasonal shift in recruitment among dominant taxa

Seasonal abundance of *Karenia brevis* in northeast Florida



Description	<i>Karenia brevis</i> cells/L	Possible Effects (<i>Karenia brevis</i> only)
NOT PRESENT - BACKGROUND	0 - 1,000	None anticipated
VERY LOW	> 1,000 - 10,000	Possible respiratory irritation; shellfish harvesting closures $\geq 5,000$ cells/L
LOW	> 10,000 - 100,000	Respiratory irritation; possible fish kills and bloom chlorophyll probably detected by satellites at upper range
MEDIUM	> 100,000 - 1,000,000	Respiratory irritation and probable fish kills
HIGH	> 1,000,000	As above plus discoloration





Conclusions



- Key step in moving towards the comprehensive examination and analysis of GTM NERR long-term data sets
- Students gain hands-on field and laboratory experience and opportunity to address meaningful research questions
- Anticipation is that many of the students will present research posters or talks at local, regional and national conferences.
- This ongoing collaborative partnership highlights the value of pairing state and federal research with universities to achieve common goals.