SPRING 2026

JOINT SCIENTIFIC MEETING

LIVING WITH WATER

MARCH 19–21

MOREHEAD CITY, NC

AERS

SEERS

Southeastern Estuarine Research Society

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President's Remarks

Dear AERS and SEERS Members,

Welcome to the Spring Joint Meeting of the Atlantic Estuarine Research Society (AERS) and the Southeastern Estuarine Research Society (SEERS). It is a pleasure to welcome you to coastal North Carolina for a meeting that brings together two closely connected communities of estuarine scientists, students, managers, and educators. Joint meetings like this highlight the strength of our regional societies and the value of gathering together to share ideas, build collaborations, and support the next generation of estuarine scientists.

This year's theme, ***Living with Water****, reflects the realities faced by coastal ecosystems and communities throughout our region. Estuaries are at the interface of those challenges and opportunities. From sea level rise and coastal development to restoration and resilience, our work helps society better understand and seek solutions to coexist with dynamic coastal systems. The conversations that happen in hallways, during poster sessions, and over shared meals are often where the most meaningful collaborations begin, and we hope this meeting provides many opportunities for those connections.*

We are especially pleased to welcome John Moseley, Curator of Education and Outreach at the North Carolina Maritime Museum, as our keynote speaker. John has spent his career connecting coastal history, science, and community, and his perspective reminds us that the story of estuaries is not only ecological, but also cultural and deeply tied to the people who live and work along the coast.

Holding this meeting in the Beaufort–Morehead City area also connects us to the long history of AERS. The first AERS meeting was held here in Morehead City in 1949, when a small group of scientists gathered at the University of North Carolina laboratory to form a society dedicated to the informal exchange of ideas about estuarine science. Returning to this region more than seventy-five years later is a fitting reminder of the enduring spirit of collaboration that continues to define both AERS and SEERS. North Carolina is also where SEERS and AERS have regional overlap, lending us perspectives and a reminder of the interconnectivity of the coastal systems.

Meetings like this are only possible because of the efforts of many people. We would like to extend our sincere thanks to Stacy Zhang, our local host, for the tremendous amount of work that goes into planning and coordinating a meeting of this size. We are also deeply grateful to AERS Program Chairs Cindy Palinkas and Taylor Beck and SEERS Program Chair Laura Treible for assembling an outstanding scientific program that reflects the diversity and strength of estuarine research across our regions.

We would also like to thank the society treasurers, Sara Blachman (AERS) and Rachel Brewton (SEERS), for managing the financial and logistical details that make meetings like this possible. In addition, we are grateful to the numerous members of both the AERS and SEERS Executive Boards who contributed their time and effort behind the scenes to help plan and execute this joint meeting.

Most importantly, we thank all of you for being here. Both AERS and SEERS have always been societies built on community. Whether this is your first meeting or one of many, we hope you find opportunities to reconnect with colleagues, meet new collaborators, support student scientists, and enjoy the conversations that make these societies special.

We look forward to a wonderful meeting together and to continuing to strengthen the collaborative estuarine science community that both AERS and SEERS represent.

Welcome to the meeting!

Sincerely,

Jessie Jarvis
President, Atlantic Estuarine Research Society

Amanda Kahn
President, Southeastern Estuarine Research Society

Local Planning Committee

Jessie Jarvis, Stacy Zhang

Welcome to the beautiful Crystal Coast of North Carolina! The rich maritime culture of this area goes back centuries and makes it a truly remarkable place to live, visit, and explore. You'll find a variety of things to do and see including Fort Macon State Park, wild horses on Carrot Island, the NC Maritime Museum, the Pine Knoll Shores Aquarium, and of course, the sprawling marshes and beach. We have a wonderful community of marine-focused labs, non-profits, and agencies in the area, so I encourage you to network and meet new folks while you're here. Meet someone for breakfast at Sweet Beans, snag a shrimp burger from El's across the street, or watch the sunset during dinner at Black Sheep. It's not easy getting here, so enjoy and take advantage of all the area has to offer before you leave.

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Welcome to the beautiful Crystal Coast of North Carolina! The rich maritime culture of this area goes back centuries from the native Croatan tribes to sunken pirate ships just outside Beaufort Inlet, fishing communities Down East, to the present-day abundance of marine labs. The sprawling marshes, seagrass meadows, beaches, and offshore reefs make the area a truly remarkable place to live, visit, and explore. I hope you enjoy your time while you're here.

Activities:

- Fort Macon State Park
- NC Maritime Museum
- NC Aquarium at Pine Knoll Shores
- Core Sound Museum

Places to Grab a Drink:

- Promise Land Market
- Fishtowne Brew House
- Backstreet Pub

Places to Snag a Bite:

- Reed's Coffee
- Sweet Beans Coffee
- The Friendly Market
- El's Drive In
- Thai Sticky Rice
- Black Sheep Pizza
- Clawson's 1905
- Mezcalito's

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National Estuary Partnership

NC COASTAL RESERVE & NATIONAL ESTUARINE RESEARCH RESERVE

North Carolina Sea Grant

Keynote Speaker

John Moseley *Curator of Education and Outreach - North Carolina Maritime Museum at Southport*

Originally from Jacksonville, Florida, he graduated from The Citadel in Charleston, SC with a bachelor's degree in history in 1989. He then spent the next decade and a half working in the for-profit and non-profit business world in Jacksonville, Florida, High Point, North Carolina, and Greensboro, North Carolina.

While living in Greensboro, he became a historical interpreter (reenactor) covering history from the colonial period to World War II. In addition, he joined a medical unit and specialized in dental practices of the mid-18th century to the middle of the 19th Century. He's traveled along the East Coast and as far south as Puerto Rico to talk about 18th century medical and dental practices. In 2001, Mr. Moseley returned to school to work on his master's degree. While at the University of North Carolina at Greensboro, he was awarded the 2003 North Carolina James Madison Fellow. The James Madison Foundation picks one candidate per state per year to study the history of the United States Constitution and includes a month in Washington, DC. Two years later, he received his master's degree in American history and the United State Constitutional History in 2005.

After graduation, he became a high school and middle school educator specializing in United States History, North Carolina History, and the History of the United States Constitution. Nearly twenty years ago, teaching brought him to the Cape Fear area. In April 2011, John began working at Fort Fisher State Historic Site in charge of the on-site and off-site educational programming. Over the years, John was the Volunteer Coordinator and trainer, Safety Officer and instructor for 18th,19th, and 20th Centuries Historic Small Arms and Artillery. During this time, Mr. Moseley has been a guest speaker for numerous educational and civic groups throughout the state and Southeast. For the last three years, we have been guest lecturers at the Osher Lifelong Learning Institute at University of North Carolina at Wilmington. In September 2022, he transferred to the State Division of Museums in Southport to overhaul their educational programming and develop new avenues of community support.

His proudest professional moment came in October 2019, when he submitted a recommendation for the emplacement of a NC Highway Marker to honor the Women Airforce Service Pilots at Camp Davis. On September 24, 2021, the marker was dedicated in the community of Holly Ridge, North Carolina to recognize this unique World War II activity. During his free time, he continues researching the Cape Fear area's Medal of Honor recipients, the Women Airforce Serve Pilots in North Carolina, and the North Carolina Shipbuilding Company during World War II.

My topic will be **"The Cape Fear River: A Brief History of its Importance and Changes"**

For thousands of years the Cape Fear River and its geology has dominated the coastline. It is the longest river within North Carolina and its only river which empties into the Atlantic Ocean. The geology of the area has been shaped by man and nature. Thanks to archeological investigations gathered from local burial mounds and pottery shards, American Indians are known to have been in the area as far back as 2,000 years ago. The first European contact with North America was near the mouth of the Cape Fear River in 1524. The area was known for its rich and abundant natural resources which led to colonization. The Cape Fear river's importance would only grow during times of domestic and world conflicts, local and foreign commerce, and immigration patterns. All water navigators would know to fear the dangers found at the mouth of the river. Today, the area is changing and the relationship with the river is changing too. Commercial use of the shoreline, dredging deeper shipping channels, overdevelopment, and the loss of wetlands are currently impacting the area today. The issues of the present can and are affecting the record of the past.

Local Map

CAMPUS MAP

A Automotive Technology Building
BC Bryant Student Center
BLET Basic Law Enforcement Training Center
BR Big Rock Career Center & NC Works
BY Boatyard (Donation & Resale Program)
CC Crystal Coast Civic Center
CMAST NCSU Center for Marine Science & Technology
F Foundation | Historic Camp Glenn Building
G Greenhouse
H Howard Building
HCAC Hospitality & Culinary Arts Center
HR Human Resources Building
M McGee Building
MT MARTEC
P Pottery Building
R Rhue Building
SBC Small Business Center & Carteret County EDC
SM Smith Building
WW Wayne West Building

Last Updated
6/19/23

Schedule at a Glance

THURSDAY, March 19

9:00-3:00 Workshop: YSI Troubleshooting & New Tech
3:00-5:00 AERS Board Meeting
4:30 REGISTRATION OPENS
4:30-5:45 Welcome Social; Connect and Collaborate: Student Networking Event
6:00-7:00 Keynote Address: John Moseley (NC Maritime Museum of Southport)

FRIDAY, March 20

7:30-8:15 Registration and Coffee
8:15-10:00 Concurrent Sessions
Room A: Plants
Room B: Microbes/eDNA
10:00-10:30 Break
10:30-11:45 Concurrent Sessions
Room A: Plants
Room B: Microbes/eDNA
11:45-1:00 Lunch (provided on site)
1:00-2:00 Concurrent Sessions
Room A: Biogeochemistry
Room B: Vertebrates
2:00-2:30 Break
2:30-3:30 Concurrent Sessions
Room A: Biogeochemistry
Room B: Vertebrates
3:30-4:30 AERS and SEERS Business Meetings
4:30-6:30 Poster Session
6:30-9:30 Banquet (catered on site) and Music

SATURDAY, March 21

7:30-8:00 Registration and Coffee
8:00-9:15 Concurrent Sessions
Room A: Biogeochemistry and Education
Room B: Invertebrates
9:15-9:30 Break
9:30-10:30 Concurrent Sessions
Room A: Education
Room B: Invertebrates
10:30-10:45 Break
10:45-12:00 Concurrent Sessions
Room A: Restoration
Room B: Invertebrates
12:15-1:00 Awards and Closing

Oral Presentations - FRIDAY, March 20th

*indicates student presentation

Time	Event	
7:30-8:15	Registration and Coffee	
8:15-8:30	Welcome and Announcements	
	Room A: Plants	**Room B: Microbes/eDNA**
8:30-8:45	**Jay Pinckney** *Marsh elevation effects on benthic microalgal biomass, community composition, and primary production in North Inlet Estuary, SC*	**Richard Kane** *Pilot community science campaign shows variation in biodiversity in the Lower Hudson Raritan Estuary and nearshore Atlantic Ocean using eDNA metabarcoding*
8:45-9:00	**Lori Morris** *What happens when Caulerpa prolifera becomes less prolific?*	***Carter Stancil** *Reemergent populations of an invasive Rhizocephalan parasite in Long Island Sound*
9:00-9:07	**Andrew Tweel** *Quantifying key constraints on marsh resilience in South Carolina*	**Melanie Cohn** *Introducing TEAL-SHIPS: a coast-to-gulf stream transect of seasonal and annual ecosystem features*
9:07-9:15	**Neil Ganju** *Predicting salt marsh loss in Chesapeake Bay: multi-model synthesis and management applications*	***Aidan Leahy** *The abundance of ammonia oxidizing Archaea in the Gulf Stream*
9:15-9:30	***Emily Hill** *Comparing coastal freshwater wetland plant communities to identify patterns of resilience to saltwater intrusion*	***Mikayla Brueshaber** *Metal and wooden wrecks: understanding heavy metals, environmental conditions, and microbial community*
9:30-9:45	***Mina Surprenant** *How can we use uncrewed aerial vehicles (UAVs) to forecast marsh stability?*	***Essence Tomabene** *Epiphyte dynamics on Sporobolus alterniflours (Spartina alterniflora): implications for salt marsh primary productivity*
9:45-9:52	**Byron Toothman** *Invasive macroalgal mats catalyze mercury assimilation in salt marsh estuaries*	***Rebecca English (9:45-10:00)** *Hypoxia induced changes in the phosphorus retention rates of sediments In Indian River Lagoon*
9:52-10:00	**Molly Bost** *Impacts of historical mosquito ditching on modern marsh dynamics*	
10:00-10:30	**Break**	
	Room A: Plants	**Room B: Microbes/eDNA**
10:30-10:45	**Wilson Freshwater** *Much ado about something – elucidating North Carolina Ulva diversity*	**Tahera Attarwala** *Assessing eastern oyster (Crassostrea virginica) predation and biodiversity utilizing real-time monitoring, eDNA analysis, and water quality in the Delaware Inland Bays*
10:45-10:52	**Anna Weber** *Complementary survey methods effectively characterize seagrass bed condition in the Albemarle-Pamlico National Estuary*	***Camille Michaud** *The dynamics of estuarine optical properties and phytoplankton communities in Winyah Bay, SC*
10:52-11:00	***Shilpa Rao** *The effects of H. wrightii on Z. marina seed germination*	***Henry Guy** *Measuring anthropogenic impacts on estuarine benthic microalgal communities using sister estuaries*
11:00-11:15	***Madison Lytle** *Temporal mismatch of seagrass structural and physiological indicators of stress to environmental conditions*	***Ima Hosseinzadeh** *Prey quality consistency of phytoplankton cultures in hatchery systems*

11:15-11:30	***Lindsay Curl** *Do mixed meadows matter? A stress-gradient approach to seagrass restoration success*	***Madison Eastburn** *Factors influencing the distribution of diatoms on goose-beaked whales (Ziphius cavirostris)*
11:30-11:37	***Ellyn Willse** *Impacts of Sargassum inundation on nearshore water quality in the Florida Keys*	***Lucas White** *Single reach mechanistic modeling of cyanobacteria in the Shenandoah River*
11:37-11:45	**Lauren Hall** *Patterns in the distribution of seagrass seeds in the Indian River Lagoon, Florida, USA*	***Ciara Daly** *eDNA detection of R. cuneata in Lake Mattamuskeet*
11:45-1:00	**Lunch**	
	Room A: Biogeochemistry	**Room B: Vertebrates**
1:00-1:15	***Zlatka Minerva Rebodello Sanchez** *Carbon and vegetation spatial variability in Virginia salt marshes*	***Emily Farrell** *What fish do we miss? Comparing seine surveys and eDNA for fish detection in the Indian River Lagoon*
1:15-1:30	**Michael Mallin** *Long-term degradation in the Cape Fear River Estuary by anthropogenic impacts, 2000-2024*	***David Brooks** *Characterizing spatiotemporal chorusing patterns of the silver perch (Bairdiella chrysoura) in Beaufort Inlet, NC, USA*
1:30-1:37	**Karen Knee** *What can radon tell us about methane emissions from cypress knees?*	**Melissa LaCroce** *Post restoration monitoring of oyster cultch reefs as essential fish habitat in Pamlico Sound, North Carolina, USA*
1:37-1:45	***Sebastian Diaz-Cortes** *Methane emissions from soil and trees in forested wetlands of the Atlantic Coast (NC, USA)*	***Alexis Longmire** *Do large-scale living shorelines effectively maintain seaward-landward connectivity for predatory fishes in nearshore landscapes?*
1:45-2:00	***Darian Ng** *Greenhouse gas and energy fluxes from contrasting towers within a forested riverine wetland*	***Shannon Powers** *Investigating benthic microalgal contributions to diets of larval and juvenile mummichogs (Fundulus heteroclitus) in North Inlet Estuary, SC*
2:00-2:30	**Break**	
	Room A: Biogeochemistry	**Room B: Vertebrates**
2:30-2:45	***Benson Ossai** *Dominant mechanism controlling secondary circulation on the oligohaline reach of Delaware River Estuary*	***Jennifer Angel** *Stable isotope insights into the nursery ecology of juvenile sandbar sharks in Winyah Bay, SC*
2:45-3:00	***Gavin Madgett** *Nutritional quality of surface sediment organic matter in North Inlet Estuary*	***Liam Batchelder** *Nekton community and trophic dynamics across southeastern estuaries with varying salinities*
3:00-3:07	**Zackary Johnson** *The Piver's Island Coastal Observatory: >15 years of weekly+ observations reveal the press and pulse of a changing temperate coastal marine system*	***Mark Fuchs** *Fish schooling behavior during the changing of the tides*
3:07-3:15	**Camilo Rey-Sanchez** *Water level controls on methane emissions in a restored wetland in coastal North Carolina*	*Withdrawn*
3:15-3:30	***Molly Frattasio** *Integrating methane emissions into blue carbon budgets of restored tidal marshes in the Chesapeake Bay*	**Michelle Brodeur** *Validation of nominated Strategic Habitat Areas in the White Oak and Cape Fear regions*
3:30-4:30	**AERS Business Meeting**	**SEERS Business Meeting**
4:30-6:30	**Poster Session**	
6:30-9:30	**Banquet (catered on site) and Music!**	

Oral Presentations - SATURDAY, March 21st

*indicates student presentation

Time	Event	
7:30-8:00	Registration and Coffee	
	Room A: Biogeochemistry and Education	**Room B: Invertebrates**
8:00-8:15	**Hans Paerl** *What's the potential for harmful cyanobacterial bloom proliferation in North Carolina's Albemarle-Pamlico Sound and other freshwater-marine continua?*	***Jessie Rivera Lafreniere** *The influence of localized water quality on eastern oysters (Crassostrea virginica) amidst changing environmental conditions*
8:15-8:30	***Mary Kate Rinderle** *Characterizing phytoplankton dynamics within cyanobacteria-dominated Lake Mattamuskeet, NC*	***Jessica Izaguirre** *Assessing spatiotemporal drivers of oyster restoration performance in Pamlico Sound, North Carolina*
8:30-8:37	**Grace Lower** *Improved understanding of a valuable ecosystem service: analysis of 15 years of oyster-mediated denitrification experiments*	***Mic Schulte** *Examining population trends and parasitism along the expanded range of Petrolisthes armatus in the southeastern U.S.*
8:37-8:45	***Ling Ren** *Advancing harmful algal bloom management: development and performance of North Carolina's statewide reporting system*	***Josie Bryan** *Spatial variation in resource use and species-level trophic niches of white and brown shrimp in Winyah Estuary, SC*
8:45-9:00	***Diandre Richie** *Evaluating long-term coastal resilience: a case study analysis of the North Caroline Resilient Coastal Community program*	***Charlotte Bickley** *Comparing population structure of an invasive parasitic barnacle and its mud crab host*
9:00-9:15	**Lynn Wilking** *A novel immobilized algicide for controlling red tide: incorporating a stakeholder-driven communication and engagement strategy to facilitate transition to end-users*	***Georgia Atcheson** *Community succession on living shorelines*
9:15-9:30	**Break**	
	Room A: Education	**Room B: Invertebrates**
9:30-9:45	**Nick Hendrix** *Applied resource management strategies of artificial reefs and estuarine habitats in North Carolina utilizing side-scan SONAR and multibeam echosounder hydrographic surveys*	**Gloria Massamba N'Siala** *Mechanisms of resilience to thermal variability in coastal invertebrate populations*
9:45-10:00	**Pamela Marcum** *Applications for long-term estuarine habitat quality monitoring along the South Carolina coast*	*Withdrawn*
10:00-10:07	**Quentin Walker** *A modern and open source Wave Exposure Model (WEMo)*	**Rachel Brewton** *Herbivory and population structure of Elysia subornata associated with Caulerpa prolifera in the Indian River Lagoon*
10:07-10:15	**Alyssa LeClaire** *Empirical evidence for the performance of natural infrastructure: a web experience*	**Justin Ridge** *Utilizing drone-derived metrics to examine oyster reef dynamics in the southeast*

10:15-10:30	**Kerryanne Newman** *Evaluating performance of a hybrid living shoreline incorporating eco-positive structural elements*	**Stephen Skrabal** *Trace metals in oyster tissues, southeastern North Carolina: current distributions and changes over a decade*
10:30-10:45	**Break**	
	Room A: Restoration	**Room B: Invertebrates**
10:45-11:00	**A. Loren Matthews** *Using salinity to monitor restoration efforts in an artificially cut estuary in Georgia*	**Jeffrey Cornwell** *Nutrient removal on engineered surfaces: denitrification by oyster and biofouling communities*
11:00-11:15	**Jenny Davis and Dawn York** *Living with water at the USS North Carolina*	**Bennett Paradis** *Summarizing 18 years of monitoring data with multi-model inference to evaluate Pamlico Sound's oyster sanctuaries*
11:15-11:22	**April Blakeslee** *If you build it, they will come: parasites as biodiversity surrogates for habitat restoration*	**Rileigh Hawk** *Assessing the spatial and analyst variation of oyster reef image classification using UAS-based imagery in South Carolina, USA*
11:22-11:30	**Ben Fertig** *The many hats of restoration scientists: a stormwater BMP retrofit implementation case study*	**Hans Prevost** *Effects of location and hand harvest of intertidal oyster (Crassostrea virginica) reefs on oyster populations and habitat characteristics*
11:30-11:45	**Brandon Puckett** *Where protection meets biodiversity: evaluating performance and tradeoffs in living shorelines*	**Nathan Hall** *Negative impacts of raphidophyte algal blooms on eastern oyster (Crassostrea virginica) recruitment*
11:45-12:00	**Trevyn Toone** *Incorporating secondary foundation species in coastal restoration*	**Kristina Flanigan** *Shellfish leasing as spatial ecology in practice: translating habitat data into management decisions*
12:15-1:00	**Awards and Closing Remarks**	

Poster Presentations - Friday March 20th

1. Energy Budgets and Foraging Behavior of Sanderlings (*Calidris alba*)
   Adams, Allison - Undergraduate Student
2. Evaluating the Ecology of Dinoflagellate Blooms in a Changing Estuary, the Indian River Lagoon
   Aldred, Paige - Masters Student
3. The fouling community thriving on oyster restoration structures in the Hudson Raritan Estuary: Implications for spat recruitment?
   Caraballo, Rashel - Undergraduate Student
4. Unearthing a Forgotten Coastal Plant Collection
   Caton, Milo - Undergraduate Student
5. NC shipwrecks as habitats and reservoirs of Vibrio and Aeromonas spp.
   Childs, Sarah Kate - PhD Student
6. Application of Aniline Derivatization to Quantify Osmolytes in Wetland Porewaters
   Christiansen, Ava - Undergraduate Student
7. Net heterotrophy and high carbon dioxide emissions in a blackwater estuary: Implications for the global carbon cycle
   Chuo, Mingying - PhD Student
8. Early development in estimating sea turtle incubation temperatures using publicly-available meteorological data
   Coker, Caitlin - Undergraduate Student
9. Shell-bag oyster reef restoration impacts on salt marsh conservation in coastal Georgia
   Czoer, Zachary - PhD Student
10. Associations between mangroves & oyster reefs in the Guana Tolomato Matanzas National Estuarine Research Reserve
    D'Arienzo, Nicole - Undergraduate Student
11. Feeding Matters: Optimizing Frequency to Improve Health Outcomes in Captive Cassiopea Jellyfish
    Dunfee, Abbey - Undergraduate Student
12. Tracking Diurnal Hypoxia and Geochemical Impacts in a Shallow, Well-Mixed Subtropical Estuary, the Banana River Lagoon, Florida
    Fox, Austin
13. Seasonal Dynamics of Hematodinium perezi Infection in Juvenile Blue Crabs (C.sapidus) within Estuarine Nursery Habitats
    Galavotti, Thomas - Undergraduate Student
14. Translating water quality research on Nu'uuli Pala Lagoon into educational illustrations
    Gasowski, Nya - Undergraduate Student
15. Salty Salamanders! Comparing the Osmoregulatory and Physiological Responses of Barrier Island and Mainland Aquatic Salamanders to Acute Salinity Stress
    Gavem, Henna - Master's Student
16. Biogeochemical Cycling of Particulate and Dissolved Total Inorganic Arsenic in the Lower Cape Fear River Watershed

Grazioso, Brandon - Master's Student

17. Counting on Seeds: Evaluating Methods for Assessment of a Seagrass Seed Bank in the Indian River Lagoon, Florida
    Hallock, Delanie
18. Seasonal patterns in carbon and alkalinity cycling in a temperate tidal marsh creek (Virginia)
    Hardison, Amber
19. Per- and Polyfluoroalkyl Substances (PFAS) in Spartina alterniflora: Visualizing PFAS in Emergent Vegetation
    Haugh, Sophie - Undergraduate Student
20. Traversing the Tolomato: An Investigation of Potential Eutrophication Within the GTM Research Reserve
    Howkins, Megan - Master's Student
21. Spatial and Vertical Patterns in Microbial Osmolytes Across a Coastal Gradient
    Kopczynski, Sarah
22. Evaluating Carbon Storage Potential in a Fringing Salt Marsh
    Lock, Henry - Undergraduate Student
23. From Exploration to Analysis: Building Data Skills with Open Access Environmental Datasets
    Lowe, Joshua - Undergraduate Student
24. Developing Multi-Variable Habitat Suitability Model for Seagrass Restoration
    McDonald, Mary
25. Shrimp Black Gill Disease Prevalence and Severity Across North Carolina
    Magee, Amelia - Master's Student
26. Investigating the Population Genetic Structure of Mudsnail-Specific Trematodes as Bioindicators of Definitive Host Biogeography
    Maggio, Garret - PhD Student
27. Modeling the Impacts of Climate Driven Weather Changes on Fisheries along the U.S. East Coast
    Marty, Elliana - Undergraduate Student
28. Climate Change Impacts on Farmed and Wild Oysters
    McDonald, Amelia - Master's Student
29. On a Nutrient Budget: How Osmolyte Production by Coastal Bacteria Responds to Nitrogen Availability
    McKinnon, Alexander - Undergraduate Student
30. Effects of meadow type on Zostera marina seed bank structure and function
    Mercurio, Ariel - Undergraduate Student
31. Drone Mapping of Ghost Crab Burrows Using Artificial Intelligence
    Moore, Riley - Master's Student
32. Seasonal Shifts in Trophic Energy Flow and Diet Consumption of Mummichogs, Fundulus heteroclitus in Coastal Marshes of Myrtle Beach, SC
    Morley, Abigail - Undergraduate Student
33. Seagrass saviors? The possibility of parasitic trematodes indirectly affecting seagrass ecosystem structure and functioning through snail host manipulation
    Nadzam, Meghan - Master's Student
34. Long-term trends in ribbed mussel (Geukenisa demissa) demographics in Georgia salt marshes
    Nicholson, Brianna - PhD Student

35. Use of in situ fluorescent dissolved organic matter sensors for high-resolution assessment of carbon dynamics in two contrasting Southeastern estuaries
    Rhodenhiser, Braddock
36. Brachial Macroparasite Loads in Estuarine Young-of-Year Striped Mullet (Mugil Cephalus)
    Rice, Triston - Undergraduate Student
37. Water temperature effects on timing of Zostera marina sexual reproduction in North Carolina
    Rundle, Christopher - Undergraduate Student
38. Salt Marsh Efforts in the ACE Basin NERR: From Oyster Restoration to Marsh Migration
    Sanger, Denise - PhD Student
39. A Holistic Approach to Eastern Oyster Crassostrea virginica Restoration in the Hudson-Raritan Estuary System
    Schleiden, Grace - Undergraduate Student
40. Influence of Habitat Type and Location on Shell Strength of Bay Scallops in Long Island, New York Estuaries
    Shepardson, Alaina - Master's Student
41. Comparative Analysis of Microplastics in the Sciaenidae Family Between the Marsh and Ocean
    Speck, Brayden - Undergraduate Student
42. Soil seed bank response to saltwater intrusion in Florida's coastal marshes
    Speirs, Ellen - Undergraduate Student
43. Self-Regulation of Elevation in Created Tidal Marshes
    Staver, Lorie
44. Areal and LIDAR survey of saltwater intrusion and Ghost Forest extent using Unmanned Autonomous Systems (UAS) on Mattix Run, NJ
    Straub, Peter
45. Water Quality Monitoring Across the Guana Peninsula to Assess Vulnerability of Coastal Freshwater Wetlands to Saltwater Intrusion
    Terwilliger, Elizabeth - Undergraduate Student
46. Effect of sediment ammonium and sulfide concentrations on cultured hard clam growth and mortality
    Thorne, Allison - Undergraduate Student
47. Greenhouse Gas Emissions from Coastal Wetland Soils Across a Marsh to Forest Salinity Gradient
    Vanderworth, Emily - Master's Student
48. Onshore to offshore water quality 'Halo' in the Lower Florida Keys
    Webber, Deanna
49. Application of an Adaptable Resilience Planning Framework for Coastal Habitats: Masonboro Island Reserve, North Carolina
    Williams, Abby

Abstracts - Traditional Orals

Stable Isotope Insights into the Nursery Ecology of Juvenile Sandbar Sharks in Winyah Bay, SC

Angel, Jennifer[1*], Ryan Rezek[1], Dan Abel[1], Matt Kimball[2]
1. Coastal Carolina University, 2. University of South Carolina Baruch Marine Field Laboratory

Winyah Bay, South Carolina, is the third-largest estuary on the U.S. East Coast by watershed area and supports diverse fauna, including twelve shark species. Juvenile sandbar sharks (Carcharhinus plumbeus) utilize this estuary as a critical nursery habitat, while adults function as apex predators with a trophic level near 4.5. To examine juvenile feeding ecology, we analyzed fin-clip tissue samples from 19 individuals (60–110 cm pre-caudal length) collected via longline. Stable isotope ratios of carbon ($\delta^{13}C$), nitrogen ($\delta^{15}N$), and sulfur ($\delta^{34}S$) were measured to trace energy pathways. Mixing model results indicate that juvenile diets are supported approximately equally by salt marsh–derived resources (Spartina) and by phytoplankton production within the estuary. Estimated trophic levels ranged from 3.33 to 3.92 (mean = 3.56), consistent with mesopredator status. No significant relationship was detected between trophic level and pre-caudal length ($p = 0.56$), suggesting limited size-based dietary shifts during early life stages. These findings highlight the strong reliance of juvenile sandbar sharks on salt marsh production and reinforce the ecological importance of conserving estuarine and marsh habitats that underpin shark nursery function.

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Community Succession on Living Shorelines

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Alternate stable states theory proposes that an ecosystem can exist in multiple distinct configurations under the same environmental conditions. This concept is particularly relevant for living shorelines that use nature-based materials, such as oysters, vegetation, and rock to reduce erosion and restore habitat, rather than relying on traditional hardened structures. Community development on living shorelines can vary among substrates due to differences in surface characteristics, surface area, interspecific competition, larval supply, and disturbance regimes. In late 2024, an extensive living shoreline was installed in Pine Knoll Shores, NC, using two substrate types: Quick-Reef, composed of limestone marl and oyster shell, and Natrx Exoforms, composed of sand and concrete. To assess community assembly, I conducted monthly surveys from February- June 2025, with follow-up surveys in November 2025 and January 2026. Preliminary results show higher invertebrate settlement rates on Quick-Reef substrate, compared to Natrx substrate. Although this research is ongoing, I hypothesize that the increased oyster coverage on Quick-Reef is driven by the presence of calcium carbonate from the oyster shell material used in its construction. These finds contribute to understanding how communities develop on novel substrates and can inform the selection of the most effective living shoreline materials for specific ecosystems.

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Assessing Eastern Oyster (Crassostrea virginica) Predation and Biodiversity Utilizing Real-Time Monitoring, eDNA Analysis, and Water Quality in the Delaware Inland Bays

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The Eastern Oyster (Crassostrea virginica) is an important commercial and ecological species in Delaware. Predation is an important stressor in marine ecosystems, and biodiversity is an important indicator of ecosystem function. To assess oyster predation and biodiversity, real-time monitoring and environmental DNA (eDNA) analysis were conducted at pilot artificial reefs, private aquaculture farms, and a control site without any oysters or habitat structure. GoPro cameras were deployed for real-time monitoring, and all observed species were identified and recorded for comparisons between sampling sites. Water samples were collected simultaneously for eDNA analysis to serve as a complementary method for species detection and identification. On-site water quality monitoring, along with collected water samples, was used to perform nutrient analysis and assess chemical and physical water quality conditions, which were then used to calculate the aragonite and calcite saturation states. There were similarities between species detected using both camera and eDNA methods. Physical water quality parameters varied across sites but remained within the optimal range for oyster growth. However, the aragonite and calcite saturation states fluctuated significantly and were often undersaturated. The results of this study will help to promote oyster restoration efforts and sustainable aquaculture practices in the Delaware Inland Bays.

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Nekton Community and Trophic Dynamics Across Southeastern Estuaries with Varying Salinities

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Understanding how environmental conditions and resource availability impact nekton communities both within and between estuaries is essential for the management of nekton and the estuarine habitats they rely on. To examine nekton community composition, we sampled subtidal creeks (n = 10) in three southeastern US estuaries using otter trawls from April to October in 2023 and 2024. We linked the abundance and community composition of nekton to water temperature, salinity, and dissolved oxygen in each subtidal creek. Additionally, we assessed the function of these creeks by examining the diets of juvenile Atlantic croaker and silver perch, two abundant consumer species in these estuaries. We found that nekton communities in creeks with comparable salinities were more similar to each other than they were to creeks within the same estuary with different environmental conditions. Rare species with specific salinity requirements drove much of the difference in community structure between estuaries. Croaker and perch of comparable size relied on similar prey items (e.g. demersal crustaceans and polychaete worms) in all three estuaries. Our findings emphasize the importance of salinity in shaping the function of subtidal creeks as habitat for diverse communities of nekton.

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Comparing population structure of an invasive parasitic barnacle and its mud crab host.

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Loxothylacus panopaei is a castrating parasitic barnacle that infects the flatback mud crab, Eurypanopeus depressus, in North America. L. panopaei and E. depressus are native along the Gulf coast of the United States; however, the parasite is invasive on the Atlantic coast following its accidental introduction in the 1960s. Their differing ecological histories and the impact of host infection may differentially affect their population structures and genetic diversity; however, a comparative genetics approach of the host and parasite has not yet been conducted. Here, we address these knowledge gaps using an overlapping fragment of the COI mitochondrial marker of host-parasite pairs to assess the genetic diversity and population structure of each species. We also calculated and compared genetic diversity statistics. We found that E. depressus maintains broad genetic diversity across its range, while L. panopaei exhibits pronounced bottlenecks. These findings show how interactions between a host and its castrating parasite may not significantly distort host population genetic structure, as we hypothesized. However, the impacts of invasion history on the parasite's population genetic structure are evident. This unique comparative analysis provides a foundation for better understanding the impact of a host and parasite on each other's population genetic structure.

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Validation of nominated Strategic Habitat Areas in the White Oak and Cape Fear regions

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"Identifying, designating, and protecting strategic habitat areas" has been a consistent goal of the North Carolina Coastal Habitat Protection Plan as a non-regulatory approach to habitat conservation. The NC Division of Marine Fisheries used the conservation planning tool MARXAN, which incorporated spatial analysis and subject matter expert input, to identify a network of high-quality habitat areas in coastal watersheds, referred to as Strategic Habitat Areas (SHAs). After SHA nominations were completed in 2017, field sampling was conducted in the White Oak and Cape Fear regions to validate fish use and habitat condition of the nominated areas. Nekton diversity and community metrics joined with habitat characteristics will be used to evaluate whether nominated areas represent high quality habitat that can be used to support exceptional levels of biodiversity and ecological functions of coastal ecosystems. If greater ecological function is confirmed for nominated SHAs, DMF may recommend rulemaking to codify boundaries, enabling future prioritization for increased nonregulatory conservation measures.

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Characterizing spatiotemporal chorusing patterns of the silver perch (Bairdiella chrysoura) in Beaufort Inlet, NC, USA

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Underwater soundscapes host a plethora of biogenic, anthropogenic, and geologic sounds. Many species of finfish utilize sound production as a form of communication, typically during reproductive spawning events. In North Carolina, species in family Sciaenidae are numerically-dominant coastal residents and significant to regional fisheries and economies. Traditionally, finfish have been surveyed using gill or otter trawl nets; however, these surveys have well documented limitations. In 2022-2023, this study utilized an innovative, coupled otter trawl and acoustic survey methodology. Passive acoustic monitoring (PAM) surveys in Beaufort Inlet, NC recorded a long term, continuous time-series of underwater soundscape data to monitor spatiotemporal patterns in abundance of the American Silver Perch (Bairdiella chrysoura). Silver perch displayed a preference for calling at night and during the spring/summer. Their chorusing times appear to oscillate on a bi-weekly basis, likely influenced by lunar and tidal cycles. A comparison between trawl and acoustic survey results highlights the need for coupled monitoring methodologies to provide a more complete record of coastal finfish habitat utilization.

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Metal and Wooden Wrecks: Understanding Heavy Metals, Environmental Conditions, and Microbial Community

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Just 30 miles south of Washington D.C., Mallows Bay is an estuarine area housing nearly 200 shipwrecks, most of which have been in the area for close to 100 years and can be leaching contaminants from residual fuel and ship materials. This study examines how the wrecks, environmental factors of the estuary, and the microbial community interact. Sediment samples were collected in three distinct time periods around both wooden and metal wreck sites in the area over a three-year period along transects up to 200 meters. The 100 samples were analyzed for 18 heavy metals and nutrients, including chromium, lead, and sulfur and DNA was sequenced using the V4-V5 region of the 16s rRNA gene. Results show heavy metals are higher closer to the wrecks and ship materials are influencing chromium and lead levels. Copper and iron seem to only be influenced by distance from ship and not material or sample direction. Preliminary microbial results show high diversity of communities and clusters of similarity by ship and sample year, with limited data connecting similarity of sample by location. Together, this suggests these shipwrecks are a contaminant factor, but it is yet unknown the full effect on the microbial community.

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Nutrient Removal on Engineered Surfaces; Denitrification by Oyster and Biofouling Communities

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Oysters provide a number of ecosystem services to coastal ecosystems, including enhancement of nutrient removal through filtration, assimilation and microbial denitrification. In the Chesapeake Bay, nutrient removal by oysters associated with aquaculture and restoration has been certified as a Best Management Practice (BMP). In this presentation, we present data on microbial denitrification associated with oyster and biofouling communities on reef balls, oyster castles, and surfaces in an urban harbor. Incubations of individual sub-tidal reef balls and intertidal oyster castles were carried out in tanks and changes in oxygen, nutrients and N2 were determined during short incubations and extrapolated to areal and structure-specific rates. The rates of nutrient exchange associated with biofouling communities in Baltimore Harbor was assessed following deployment of plastic disks and nylon straps which attracted a community of mussels, barnacles and other filtering animals. Biofiltration on these engineered surfaces, followed by biodeposit and ammonium production, results in conditions in which coupled nitrification-denitrification results in exceptionally high rates of N-2 production. Comparisons to on-bottom oyster denitrification rates suggest that with these engineered structure rates are quite efficient at nutrient mitigation.

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Do Mixed Meadows Matter? A Stress-Gradient Approach to Seagrass Restoration Success

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Seagrass meadows support coastal biodiversity, stabilize sediments, and buffer shorelines, yet they are increasingly threatened by eutrophication, coastal development, destructive fishing, and climate-driven stressors. The stress-gradient hypothesis (SGH) predicts that as environmental stress increases, positive interactions among species become more important for maintaining ecosystem resilience. In North Carolina, where temperate Zostera marina and subtropical Halodule wrightii meet, recent warming has shifted meadows toward H. wrightii dominance, raising concerns about long-term habitat stability. This project investigates whether multi-species plantings can enhance seagrass productivity under high-stress restoration scenarios. A combination of observational surveys with a manipulative field experiment was employed to quantify patterns of seagrass composition, abiotic conditions, and growth. Complementary restoration experiments at three sites (Harkers Island Bridge, the Pine Knoll Shores Aquarium, and Morada Bay) manipulated species composition (H. wrightii, Z. marina, mixed, or bare) and were monitored monthly for shoot density, percent cover, and shoot height. A generalized linear mixed-effects model will test whether mixed assemblages outperformed single-species treatments under stressful conditions.This research provides restoration-relevant insights into how species interactions influence resilience, productivity, and ecosystem services in a changing coastal environment.

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Living With Water at the USS North Carolina

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Coastal communities increasingly experience nuisance flooding driven by sea-level rise, yet relocation of culturally and economically significant assets is often infeasible. At Battleship North Carolina in Wilmington, the Living with Water project demonstrates a nature-based adaptation strategy that reframes water as an asset rather than a hazard. Moffatt & Nichol, serving as lead engineer, collaborated with the National Centers for Coastal Ocean Science to develop a water-centric design integrating flood mitigation, habitat creation, and water-quality improvement. Two acres of chronically inundated parking area were converted to intertidal wetland, while remaining infrastructure was elevated and coupled with a bioswale engineered to capture and treat stormwater prior to discharge to the Cape Fear River. The design preserves public access to a historic landmark while enhancing ecosystem services and long-term resilience. Ongoing monitoring by the National Centers for Coastal Ocean Science and the University of North Carolina Wilmington evaluates wetland development, hydrologic performance, and preliminary water-quality outcomes. Early results indicate successful establishment of intertidal conditions and effective stormwater conveyance. This project provides a transferable model for ecologically informed coastal adaptation where conventional flood defenses or relocation are impractical.

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Factors Influencing the Distribution of Diatoms on Goose-Beaked Whales (Ziphius cavirostris)

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Finding a photosynthetic symbiont on a deep-diving whale seems counterintuitive, which makes understanding the relationship between diatoms and beaked whales important. Specific analyses of the algae are underexplored, and no previous studies have discussed the Mid-Atlantic. We hypothesize that distinct diatom marks can be used for photo identification, and that percent coverage of diatoms can give insight into goose-beaked whale health. We have used various methods to explore the relationship between the goose-beaked whale (*Ziphius cavirostris*) and the algae that grow on its skin. Through genetic testing, microscopy, and photo analysis, we aim to quantify yearly and seasonal changes in diatom coverage across the skin and investigate the symbiotic relationship between this diatom species and goose-beaked whales. We conclude that there is seasonal and yearly variance, and that most algal coverage is towards the back of the animal, whereas the dorsal remains relatively free of diatoms. We identify the epizoic diatoms as being in the *Bennettella* genus, formerly *Cocconeis* (Holmes 1985), based on morphological studies. These results help us to understand the nuance of using diatom coverage as a characteristic in photo identification, and better inform us about the relationships formed between the elusive whales and their symbionts.

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Hypoxia Induced Changes In The Phosphorus Retention Rates Of Sediments In Indian River Lagoon

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Estuarine sediments may contribute significant phosphorus flux to the water column in Indian River Lagoon (IRL) during episodic hypoxic events. In oxic conditions, P can bind with Fe(III) to form insoluble compounds that sequester P within the sediment. During hypoxic events, anaerobic microbial processes produce hydrogen sulfide and reduce Fe(III) to Fe(II), releasing bound P. Reduced Fe(II) binds with sulfide to produce iron monosulfide, mitigating sulfide toxicity but decreasing the ability of the sediments to sorb P when oxic conditions return. Since 2011, an increase in the frequency and severity of harmful algal blooms has been observed in IRL, coinciding with increased average P concentrations in the water column. Changes in the ability of sediments to retain P contribute to a source of internal P loading to IRL, helping to sustain algal blooms independent of external inputs. By comparing the P sorption capacity of sediments under different redox conditions from 2001 and 2025, inferences can be made about the ability of sediments to act as a source or sink of P across IRL. This information may assist management strategies that intend to regulate or mitigate the effects of external loading in IRL by providing greater understanding of P dynamics.

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What fish do we miss? Comparing seine surveys and eDNA for fish detection in the Indian River Lagoon

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The Indian River Lagoon (IRL) is one of the most species-rich estuaries in the United States, supporting over 400 fish species, including ecologically important forage fishes as well as their commercially valuable predators. The Florida Fish and Wildlife Conservation Commission (FWC) conducts monthly seine surveys in the IRL, which serve as the foundation for fisheries management and conservation decisions in the region. However, key species may be systematically under-detected by these surveys due to gear bias. Environmental DNA (eDNA) - DNA shed by organisms into the water column - offers a complementary approach to fisheries monitoring that can reduce many limitations of traditional sampling methods. This study utilizes eDNA metabarcoding to address data gaps about fish populations in the IRL and develops a rapid, cost-effective approach to enhance existing monitoring programs. Water samples were collected concurrently with FWC's monthly fall and spring surveys at sites across the northern IRL. Water samples were filtered, and eDNA was analyzed using fish-specific 16S primers. Here, we present species composition and occurrence patterns detected by eDNA and compare these results with concurrent FWC seine survey data to evaluate differences in detection and assess how eDNA can complement existing monitoring programs for fish management.

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Shellfish Leasing as Spatial Ecology in Practice: Translating Habitat Data into Management Decisions

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Shellfish aquaculture in North Carolina is a state-managed resource, as shellfish leases are granted to farmers on public trust bottom. Shellfish leasing is often viewed primarily as a regulatory process, yet leasing decisions are fundamentally rooted in applied spatial ecology. The lease decision-making process is a direct example of integrating habitat suitability data, physical and biological constraints, and competing coastal uses to guide management outcomes. As aquaculture increases throughout the state, user conflict continues to rise. Managing these cumulative impacts presents a persistent challenge, particularly when available ecological data are collected at resolutions mismatched to regulatory decision-making[KF1.1]. To improve efforts to practice ecosystem-based management strategies, the state is interested in evaluating the habitat trade offs of shellfish leases. This talk will aim to outline the state's current proposed lease evaluation process while identifying current knowledge gaps that have the potential to improve our system-based management practices.

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Integrating Methane Emissions into Blue Carbon Budgets of Restored Tidal Marshes in the Chesapeake Bay

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While restored tidal marshes are recognized for their blue carbon sequestration capacity, methane (CH_4) emissions may offset climate benefits due to their high global warming potential. Although sulfate-rich seawater was once thought to suppress methanogenesis, salt marshes can exhibit substantial CH_4 fluxes, indicating that methane production and oxidation are subject to complex controls. Tidal salt marshes are commonly divided into zones based on vegetation and elevation relative to tidal inundation. We quantified spatial and seasonal CH_4 and carbon dioxide fluxes across high- and low-marsh zones at Poplar Island, a restored island constructed from dredged material in the Chesapeake Bay. Low marsh zones, dominated by Spartina alterniflora, occur at lower elevations and experience more frequent tidal inundation, whereas high marsh zones, characterized by Spartina patens, are less frequently flooded. Methane emissions were significantly higher in low marsh environments and peaked during the summer growing season. Stable carbon isotope signatures suggest differences in subsurface CH_4 processing between marsh zones. These findings highlight the importance of inundation dynamics, vegetation, and microbial processes in assessing carbon budgets of restored tidal wetlands, informing hydrologic design and vegetation selection to maximize climate benefits.

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Much Ado About Something – Elucidating North Carolina Ulva Diversity

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Ulva is a genus of green algae common to intertidal and shallow subtidal marine and estuarine habitats worldwide that is known for both beneficial and detrimental ecological and economic impacts. Knowing what species are involved is critical for understanding both types of impacts, but research over the past two decades has demonstrated that morphological plasticity, cryptic diversity and a bit of human hard-headedness make this difficult. Recent research on the diversity of Ulva species in North Carolina demonstrates the research needed for the proper assessment of this diversity and correct identification of the species resolved. DNA sequence analyses of three loci from 120 specimens collected at 52 locations along the coast revealed nine species. Comparisons to Ulva type specimen sequences allowed six species to be definitively named, albeit a newly released type specimen sequence will require the renaming of one. Analyses of twenty-five morpho-anatomical characters demonstrated they could not be used to distinguish or identify these species. These results as well as those of other recent studies show that DNA sequence analyses are currently the only way to accurately identify Ulva species.

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Negative impacts of raphidophyte algal blooms on eastern oyster (Crassostrea virginica) recruitment

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Raphidophytes have only recently been recognized as harmful to shellfish, and impacts on early life stages of eastern oysters (Crassostrea virginica) are unknown. This project used laboratory experiments and a field survey to understand poor recruitment of oysters in the New River Estuary, NC where summer raphidophyte blooms are common. Two laboratory experiments measured survival of D-stage larvae in the presence of different cell densities of two strains each of Chattonella marina and Heterosigma akashiwo and compared against survival of larvae incubated with a non-harmful (Isochrysis galbana) control. In the field, spat collectors were used to assess oyster recruitment and temporal variability in recruitment was compared to temporal variability in raphidophyte cell densities. Laboratory experiments revealed dose-dependent and strain-specific negative impacts on larvae survival. Experimental raphidophyte cell densities that approximated bloom conditions in the New River Estuary caused a 70-90% mortality compared to the control. Negative correlations between spat settlement and measures of raphidophyte abundance in the New River Estuary were consistent with the results from the laboratory studies. In estuaries prone to harmful raphidophyte blooms, improvements in water quality via nutrient reductions may be necessary before successful, self-sustaining recovery of oyster populations is possible.

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Applied Resource Management Strategies of Artificial Reefs and Estuarine Habitats in North Carolina Utilizing Side-Scan SONAR and Multibeam Echosounder Hydrographic Surveys

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The North Carolina Division of Marine Fisheries' (NCDMF) Habitat Enhancement Section is tasked with promoting sustainable fisheries through the creation of benthic habitat. This is accomplished via large-scale construction, enhancement, and monitoring of 43 ocean artificial reefs, 29 estuarine artificial reefs, and hundreds of oyster cultch reefs throughout North Carolina's coastal waters. Artificial reefs are constructed to meet site-specific objectives using a diverse range of materials including aggregate rock, oyster shell, recycled concrete, manufactured reef units, and decommissioned ships. NCDMF utilizes side-scan SONAR (SSS) and multibeam echosounder (MBES) hydrographic surveys for artificial reef planning, mapping, and monitoring efforts. NCDMF case studies showcasing this technology will be demonstrated including delineation of habitat boundaries, characterization of reef material, sediment characterization, advanced marine restoration techniques, and utilization of geographical information system (GIS) tools to support spatial planning, habitat assessment, and data-driven management of artificial reefs and estuarine benthic habitats.
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Comparing coastal freshwater wetland plant communities to identify patterns of resilience to saltwater intrusion

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Northeast Florida's coastal freshwater wetlands provide essential ecosystem services and support high biodiversity but are increasingly threatened by saltwater intrusion through sea-level rise and severe storm surge. Effective management of these wetlands requires spatially-explicit information to assess individual wetland resiliency and vulnerability. Here, we quantify ecological conditions of coastal depression wetlands at the Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR) by analyzing plant community diversity and composition. Data were collected along transects in 8 distinct wetlands classified as resilient or vulnerable to saltwater intrusion based on historical water quality data. Ordination analysis revealed plant community composition is clustered more by site than hydrological position, with two vulnerable marshes having more unique composition than the resilient marshes. Diversity indices indicate that there is not a significant difference in the number of species between resilient and vulnerable marshes but there is increased patchiness in the number of assemblages within vulnerable marshes. Resilient marshes had a greater number of assemblages between sites than vulnerable marshes. These spatially-explicit patterns of plant community diversity and composition for GTMNERR coastal freshwater depression wetlands support a better understanding of current and future impacts of salinity intrusion on wetland resilience.
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Prey quality consistency of phytoplankton cultures in hatchery systems

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Phytoplankton is the sole diet for larval oysters in hatchery systems, so enhancing their nutritional quality is very important to larval growth and survival. Although species selection in hatcheries emphasize lipid content, fatty acid profiles, and growth rates, less attention has been given to how stable and consistent these qualities remain throughout and between culture periods. In this research, I evaluated the variability in phytoplankton quality across 113 samples of Chaetoceros calcitrans, Tetraselmis chui, and Pavlova pinguis cultures used in the Virginia Institute of Marine Science (VIMS) Acuff Center hatchery from February to August 2024. Samples were collected at the start and harvest points of each culture cycle to measure pH, salinity, nutrient concentrations, cell abundance, chlorophyll-a, ash-free dry weight (AFDW), C:N:P ratios, and fatty acid composition. The preliminary findings suggest that water quality parameters such as pH, dissolved oxygen varied across some cultures, despite efforts to control them through CO_2 regulation, temperature stabilization, sterilization of source water, and standardized media enrichment. This variability may influence the quality of phytoplankton when they are harvested, potentially affecting the nutritional consistency of prey available to oyster larvae. This study highlights the importance of monitoring and optimizing culture conditions not only
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Assessing Spatiotemporal Drivers of Oyster Restoration Performance in Pamlico Sound, North Carolina

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Oyster reef restoration is widely used to recover ecosystem services in estuaries, including water filtration, shoreline stabilization, and essential fish habitat. However, restoration success varies across space and time, and understanding how oyster populations respond to reef age, material type, and local environmental conditions remains a key challenge. In wind-driven systems such as Pamlico Sound, North Carolina, reef vertical relief and sediment dynamics may strongly influence early restoration outcomes.This study evaluates oyster restoration performance within the North Carolina Oyster Sanctuary Program across multiple spatial and temporal scales. Oyster density, size structure, recruitment, growth, and survivorship were quantified at four newly established no-take sanctuaries (Cedar Island, Maw Point, Brant Island Shoal, and Gull Shoal) during the first four years after construction. These results were compared with long-term monitoring data from thirteen established sanctuaries (8-29 years old) to assess whether early patterns reflect broader network dynamics. All four new sanctuaries showed increasing oyster density over time, with particularly strong first-year recruitment at Brant Island Shoal. Variation among sites suggests that reef age, material, vertical relief, sedimentation, and local environmental conditions interact to shape population development. Integrating short and long-term data improves understanding of reef trajectories and supports more resilient restoration design.

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Pilot community science campaign shows variation in biodiversity in the Lower Hudson Raritan Estuary and nearshore Atlantic Ocean using eDNA metabarcoding

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In the face of global declines in biodiversity, effective monitoring campaigns have never been more important. Community science is often proposed as a way to facilitate monitoring while also engaging community members and enhancing environmental stewardship. In this study, we investigate the feasibility of integrating environmental DNA metabarcoding into a community science campaign to monitor fish biodiversity and community composition in New Jersey. In Fall 2025, 21 community scientists collected 1L water samples from shorelines near the mouth of the Raritan River to the Manasquan River. DNA was extracted from samples and 12S amplicon metabarcoding was performed. Across all sites we found an ASV richness of 68. Analysis showed statistically significant differences in biodiversity and community composition between sites located in the Atlantic Ocean and those located in the various estuaries of Monmouth County. Monmouth University hosted a live presentation of our findings which was well attended by both community scientists and members of the public. This pilot project shows that community scientists can successfully utilize eDNA sampling techniques to facilitate the collection of biodiversity and community composition data. In our experience, community scientists were excited to participate and invested in environmental stewardship.

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The Abundance of Ammonia Oxidizing Archaea in the Gulf Stream

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Microbes serve as the foundation of nearly every ecosystem by being at the base of food webs and cycling nutrients. It has long been known that bacteria play a key role in biogeochemical cycling, but it has only recently been discovered that archaea also contribute to these processes. One such group of archaea has been found to be vital contributors cycling nitrogen by converting ammonia into nitrite. These ammonia-oxidizing archaea (AOA) can be found in many microbial communities, including that of the Gulf Stream. In order to better understand which AOA are present in these communities and the extent of their contribution to the nitrogen cycle, samples are being collected at various depths and locations along a seasonal transect from North Carolina to the Gulf Stream through the Transect Expedition to Assess Land-to-Sea Habitats via Interdisciplinary Process Studies (TEAL-SHIPS) program. Following a phenol-chloroform extraction method, DNA from these samples underwent qPCR where it was found that the number of AOA gene copies per liter of seawater ranged from 8.9×10^6 to 3.15×10^8, increasing with depth. Ongoing work will compare abundance to environmental factors such as oxygen, light, and nutrient availability, furthering our research into AOA's contribution to the nitrogen cycle.

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Temporal mismatch of seagrass structural and physiological indicators of stress to environmental conditions.

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Seagrass monitoring programs often rely on structural metrics such as percent cover and areal extent to gauge seagrass health or status. While effective for tracking long term trends, these metrics may lag behind early physiological responses to environmental stressors. Seagrass response to stress occurs across multiple temporal scales: structural metrics responding over months, whereas physiological metrics respond within hours to days. We used trajectory analysis to determine if changes in monthly structural (percent cover, biomass, density, and leaf length) and physiological (sugar and starch in above- and belowground tissue) metrics change synchronously through time in response to changing environmental conditions. To evaluate the role of stress exposure duration, environmental data (e.g. variation in water temperature, cumulative hours within preferred temperatures, and water depth) were summarized across three temporal windows (7-, 14-, and 21-days). Generalized additive models showed structural metrics were best explained by environmental conditions summarized over the longest (21-day) window, a possible response to chronic stressors; whereas physiological metrics were best explained by short (7-day) windows, reflecting responses to acute stress. These results suggest physiological metrics should be incorporated into seagrass monitoring since they provide insight to responses to environmental conditions preceding structural changes.

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Nutritional Quality of Surface Sediment Organic Matter in North Inlet Estuary

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Total Organic Carbon (TOC) and Carbon to Nitrogen (C:N) ratios of sediments in estuarine ecosystems offer insights into nutrient storage within sediments. Based on spatial variation at different tidal elevations, both TOC and C:N can indicate how carbon and nitrogen storage are influenced by tidal inundation. The C:N ratio reflects sediment quality, with low ratios (< 20) signifying a relatively high nutritional quality for deposit feeders. This study collects samples seasonally from May 2025 to May 2026. TOC was determined using “loss on ignition” methods, while CHN analysis was employed to determine C:N ratios. Statistical methods included univariate, single-factor ANOVA to test the primary effects of elevation. This study has be conducted to examine the significance of spatial variations in sediment nutritional quality along an elevation gradient in this estuary.

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Long-term degradation in the Cape Fear River Estuary by anthropogenic impacts, 2000-2024

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Since the late 1990’s the lower Cape Fear River Program (LCFRP) has been sampling over 30 locations throughout the fresh and brackish water systems in North Carolina’s lower Cape Fear River watershed. A recent 25-year (2000-2024) trend analysis has shown significant long-term water quality changes in the estuary, indicating a worsening of water quality. Surface water temperature increased in the lower estuary, and there has also been a significant pH decrease throughout the estuary, both trends considered to result from global warming and increased CO2 uptake. In addition, surface waters throughout the Cape Fear River estuary are experiencing significant decreases in dissolved oxygen, and increases in ammonium, TKN, TN, and TP. The nutrient increases are likely due to upstream increases in nutrient loading from the major tributary Black and the Northeast Cape Fear River systems, which host abundant swine and poultry concentrated animal feeding operations. Our research has shown long-term nutrient increases at numerous CAFO-draining stream stations throughout these two major tributaries. Additionally, the response variable chlorophyll a has increased at 16 stations throughout the system. In sum, this large estuarine system is experiencing degrading water quality due to a combination of upstream nutrient loading and classic climate change symptoms.

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Applications for long-term estuarine habitat quality monitoring along the South Carolina coast

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The South Carolina Estuarine and Coastal Assessment Program (SCECAP) is a multi-agency collaboration that monitors the health of South Carolina's estuarine waters since 1999. The program, closely aligned to the USEPA's National Coastal Condition Assessment (NCCA), assesses overall habitat quality- through the collection of high-quality water, sediment, and biological data- that can be used to identify trends and highlight areas of interest or concern. In addition to program goals, the data collected has been shared with a variety of entities (academic, government, non-profit, public) for broader applications in research, management, and policy at the local, state, and federal levels.

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Mechanisms of resilience to thermal variability in coastal invertebrate populations.

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Coastal ecosystems are increasingly exposed to unpredictable temperature fluctuations due to the rising frequency and intensity of extreme climate events. Phenotypic plasticity is a key mechanism buffering populations under fluctuating conditions. However, plastic responses may become maladaptive under unpredictable regimes, which favor bet-hedging, a strategy involving increased within-brood variation. This study explores how plasticity contributes to persistence under different scenarios of thermal predictability in the marine annelid Ophryotrocha labronica. Hatchlings from 80 broods were assigned to four thermal regimes over three generations: constant control (24 °C) and high (27 °C), predictable or unpredictable fluctuation. At the F1 and F3, plasticity was assessed by exposing individuals from 4 selected broods to both 24 °C and 27 °C, while within-brood trait variation was measured across 16 broods per regime at both 24 °C and 27 °C. Survival, growth, as well as age, size, and fecundity at first reproduction were recorded. We predict that plastic responses will persist under predictable fluctuating regimes, be constrained under constant regimes, and that an increase in within-brood trait variation in the unpredictable regime may indicate a bet-hedging strategy. This work aims to clarify how plasticity and intra-brood variability interact to buffer marine populations under thermal unpredictability.

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Using salinity to monitor restoration efforts in an artificially cut estuary in Georgia

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Artificial cuts were made through the marshlands of the Satilla River Estuary, Georgia in the early 1900s to improve navigation and facilitate timber transport. Maintenance of the cuts eventually stopped, but their impact on the hydrology and water quality in the system became increasingly evident by local stakeholders. Resulting shifts in natural salinity gradients likely presented physiological and reproductive challenges for migrating fish and crabs that are valued regionally. Efforts to reverse these impacts and ultimately restore over 4,500 acres of habitat in the Satilla River Estuary are being led by the USACE following decades of grassroots efforts there. Two of three cuts of documented concern were closed with rip-rap "plugs" in March 2023, but the larger, infamous Noyes Cut closure structure is scheduled for completion in spring 2026. Measurements of salinity at six sites were recorded monthly between June 2014 and September 2019 prior to any cut closures. Sites were revisited in October 2023 following the phase I closures, and sampling resumed on a bi-monthly basis in February 2025 through present to capture any responses while phase II is underway. Spatial and temporal changes in salinity across the pre- and post-restoration process were examined as an indicator of success.

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What happens when Caulerpa prolifera becomes less prolific?

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Recent recovery of seagrass in the Indian River Lagoon (IRL) has not been evenly distributed; large areas in central IRL and Banana River Lagoon showed limited regrowth and dominance by the benthic macroalgae Caulerpa prolifera. In 2023 C. prolifera was included as an additional habitat to be mapped alongside the seagrass beds. At that time, over 15,000 ha of C. prolifera were mapped compared to just under 6,500 ha of seagrass from Ponce Inlet to Sebastian Inlet. Since 2023, and most notably in 2025, the presence of a sea slug, Elysia subornata contributed to large declines in C. prolifera. Declines in C. prolifera coverage may have promoted recent phytoplankton blooms, particularly in regions where no other benthic substrate has been observed. The potential boom and bust population cycles of C. prolifera and E. subornata warrant further study with potential implications on nutrient cycling and bloom dynamics.

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Evaluating Performance of a Hybrid Living Shoreline Incorporating Eco-Positive Structural Elements

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Living shorelines are increasingly implemented as nature-based solutions to reduce erosion, improve water quality, and enhance ecosystem services. Following decades of significant erosion and failed restoration attempts, a hybrid nature-based living shoreline was installed around the eastern end of Carrot Island within the Rachel Carson Reserve adjacent to Beaufort, North Carolina. The recently installed shoreline involved the application of three types of shoreline protection, a wave-attenuating outer layer of Natrx ExoFormsTM, a shoreward layer of Oyster CatcherTM tables, and vegetation plantings of marsh species. Researchers at the N.C. Coastal Reserve and National Estuarine Research Reserve collected baseline metrics prior to installation including geomorphic, ecological, and water quality parameters to compare to post-installation and ongoing annual monitoring. Using uncrewed aircraft systems (UAS) imagery and RTK-GPS surveys, we are examining changes in elevation, shoreline position, and substrate persistence. Ecological impacts are being evaluated through assessment of marsh vegetation and recruitment of benthic organisms using quadrat sampling to measure percent cover and plant growth along established transects. Water quality parameters are monitored seasonally and compared to nearby reference sites. The outcomes of this research will be used to inform future living shoreline design and estuarine shoreline management in coastal North Carolina.

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Greenhouse Gas and Energy Fluxes from Contrasting Towers within a Forested Riverine Wetland

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We established a new eddy covariance flux tower within the inundated zone of the Timberlake Observatory for Wetland Restoration, a bottomland forest with a mixture of low-lying wetlands and upland forests. This tower is complementary to a flux tower (US-TLR) previously constructed in 2023 in the upland area of Timberlake. Here, we present the greenhouse gas and energy fluxes from our new tower, alongside accompanying meteorological variables. The notable findings were considerably higher methane fluxes and much weaker net ecosystem exchange of carbon dioxide from the inundated wetland than from the upland forest. The significant differences in carbon dynamics between the two distinct regions of Timberlake underscore the importance of within-ecosystem heterogeneity when evaluating the role of forested wetlands as natural climate solutions.

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Dominant Mechanism Controlling Secondary Circulation on the Oligohaline Reach of Delaware River Estuary

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Classical estuarine circulation theory emphasizes steady shear dispersion and tidal-period correlations between salinity and velocity as primary mechanisms governing salt transport. The importance of these mechanisms varies across estuarine environments, and tidally driven salt fluxes are strongly influenced by lateral circulation. While recent advances have improved our understanding of cross-channel flow in mesohaline reaches of estuaries, few studies exist that examine the dynamics of lateral flows in oligohaline reaches, despite their socio-economic importance for potable water supply and irrigation. Recent observations in the oligohaline reach of the Delaware River show weaker horizontal salinity gradients relative to the mesohaline reach. Nevertheless, elevated gradients do occur in the vicinity of channel constrictions, and stratification varies over the tidal cycle. Despite this variability, lateral flow remains essential in controlling the spatial distribution of salinity. In this study, we analyze observational data and numerical model output to characterize the dominant processes driving dispersion in the oligohaline reach of Delaware River. Previous modeling work emphasized that both steady and tidal processes contribute to landward salt flux. Here, we examine both mechanisms and quantify the relative importance of differential advection and flow of curvature on driving lateral flows and landward salt flux in the oligohaline reach.

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What's the potential for harmful cyanobacterial bloom proliferation in North Carolina's Albemarle-Pamlico Sound and other freshwater-marine continua?

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Harmful cyanobacterial blooms (CyanoHABs) are increasing worldwide along the freshwater to marine continuum. North Carolina's Albemarle-Pamlico Estuarine Sound system (APES) continuum has experienced CyanoHABs, but thus far they have been confined to its riverine tributaries. However, increased anthropogenic nutrient loads coupled with more extreme hydrologic events including record rainfalls and droughts have provided increasingly favorable conditions for CyanoHAB expansion in APES. Using field and experimental data collected over the past 5 decades, we examined the occurrences and potential expansion of CyanoHABs throughout APES. Genetic data (16S rRNA & metagenomic) from across the APES has revealed multiple cyanobacterial lineages are endemic to the region with potential to form blooms and/or produce cyanotoxins. We also examined other geographically-diverse continua experiencing increasing wet/dry cycles (Florida's Okeechobee to Atlantic and Gulf coasts, Mississippi Delta-N. Gulf of Mexico, San Francisco Bay Delta, China's Yangtze River Delta, Western Lake Erie) in an effort to explore commonalities in interactive nutrient and hydrologic drivers promoting CyanoHAB expansion. Lastly, we will discuss management options to reverse this troubling trend.
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Summarizing 18 years of monitoring data with multi-model inference to evaluate Pamlico Sound's oyster sanctuaries

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In response to declining oyster populations, resource managers have turned to restoration strategies such as no-take reserves (ie, sanctuaries), to revitalize habitat functionality of subtidal oyster reefs. Development of oyster sanctuaries may entail replenishing bottom substrate with various alternative materials due to limited shell supply. However, project scale, design, and monitoring efforts vary significantly amongst practitioners, making it difficult to evaluate best practices. Between 1996 and 2025, North Carolina's Division of Marine Fisheries (NCDMF) constructed a network of 19 oyster sanctuaries totaling 789 acres across Pamlico Sound. From 2007 to 2025 NCDMF scuba surveys collected oyster density metrics across this network. We leveraged this dataset to determine how physical parameters influenced spatiotemporal patterns of size-class densities, including an evaluation of commonly used alternative materials. We observed high variation in total, market-sized, and recruit densities across 18 years of monitoring. Multi-model inference revealed that material type, material age, a material type*age interaction, and vertical relief were all highly influential parameters. In contrast, salinity, dissolved oxygen, and boring sponge had less definitive effects on the size-class densities considered. Our evaluation illustrates how long-term surveying can guide decisions made in the planning phase of future oyster sanctuary projects.
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Marsh Elevation Effects on Benthic Microalgal Biomass, Community Composition, and Primary Production in North Inlet Estuary, SC

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The food web base in estuaries is supported by microalgal primary production in both the water column (phytoplankton) and the sediments (benthic microalgae, BMA). Our objective was to quantify benthic microalgal production, biomass, and community composition along an elevational gradient (low to high tide region) in the Spartina marshes of North Inlet Estuary, SC. BMA primary production was quantitatively determined to characterize the spatiotemporal variability in BMA NPP to estimate the annual ecosystem-level contribution to total system NPP. Measurements included estuarine intertidal BMA NPP, biomass, community composition, and relevant environmental variables (nutrients, grain size, porosity, etc.) along fixed transects that span the intertidal elevational gradient from mean low water to mean high water. Preliminary results suggest that maximum BMA NPP occurs at intermediate intertidal elevations and ranged from 0 to 10 mmol O2 m-2 h-1 and biomass ranged from 5 to 20 µg chl a cm-2. System-wide, BMA may provide as much as 30% of the net ecosystem primary production.
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Investigating benthic microalgal contributions to diets of larval and juvenile mummichogs (Fundulus heteroclitus) in North Inlet Estuary, SC

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The mummichog (Fundulus heteroclitus) is an abundant resident estuarine killifish that plays an important role in estuarine food webs, yet the contribution of larval and juvenile stages remains poorly understood. Larval mummichogs exhibit conversion efficiencies comparable to other fish larvae, indicating that energy consumed during early life stages is converted into biomass and that their diets may be ecologically important within estuarine food webs. Larval and juvenile mummichogs occupy marsh pools at low tide and forage on the marsh surface. Gut preservation methods used in previous studies may have underestimated the consumption of benthic microalgal communities. Mummichogs representing multiple early life stages (5-30 mm) were collected from North Inlet Estuary, SC, from May - August 2025. Gut contents were analyzed using high-performance liquid chromatography (HPLC) and compared to benthic microalgal assemblages. This study examines ontogenetic shifts in diet to provide evidence for benthic-derived production entering estuarine food webs through early life stages of mummichogs. The primary hypothesis is that larval and juvenile mummichogs derive a significant portion of their diet from benthic microalgal communities, suggesting benthic-pelagic coupling during early life stages.

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Where Protection Meets Biodiversity: Evaluating Performance and Tradeoffs in Living Shorelines

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Living shorelines (LS) are being implemented with dual goals of protecting estuarine shorelines and supporting biodiversity. However, the variability in the delivery of these co-benefits across different LS designs, ages, and environmental contexts remains a significant barrier to effective permitting and implementation. We synthesized over 20 years of data from 30 LS sites across North Carolina to quantify performance and identify critical tradeoffs. Our analysis addresses three key questions: (1) How do LS compare to natural and hardened shorelines in terms of protection and biodiversity? (2) How do design specifications, site conditions, and time since installation influence these outcomes? (3) To what extent does optimizing for coastal protection come at the expense of biodiversity enhancement? Are there tradeoffs associated with optimizing for coastal protection versus supporting biodiversity? By bridging these knowledge gaps, this work provides the empirical foundation needed to refine LS design best practices and streamline regulatory frameworks.

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Carbon and Vegetation Spatial Variability in Virginia Salt Marshes

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A spatially explicit approach is needed to estimate carbon and vegetation metrics in marshes to reach conservation goals. However, most blue carbon studies rely on limited sampling from core portions of patches, and on local, regional, or national averages, often without considering spatial variability. In our research, we observed spatial heterogeneity at various scales, implying differences across and within sites in the lower Chesapeake Bay. To better understand this variability, we performed an intra-patch analysis focused on salt marsh-tidal flat transition zones. This involved establishing transects across these ecotones and examining aboveground vegetation, roots, and sediments. Preliminary results indicate differences in all metrics between marsh interior, marsh edge, and tidal flats, with edges displaying greater variability in plant-based metrics. It was also found higher aboveground biomass closer to the edge and higher soil carbon values in the interior areas of the patch. By incorporating this spatial framework, the applicability of blue carbon initiatives can be broadened, mitigation strategies can be better informed, and planning for future scenarios can be more robustly supported. Ultimately, our study emphasizes the need for a finer spatially explicit approach to estimating carbon and vegetation in marshes, which will support more realistic management and conservation strategies.

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Evaluating Long-term Coastal Resilience: A Case Study Analysis of the North Caroline Resilient Coastal Community Program

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North Carolina's coastal communities face accelerating threats from rising sea levels, intensified storm events, and chronic flooding, which increasingly jeopardize local infrastructure and social well-being. The NC Resilient Coastal Communities Program (RCCP) addresses these challenges by providing technical and financial support for vulnerability planning and project implementation. This research presents a case-study evaluation of the RCCP to analyze how stakeholders perceive coastal resilience and how the program supports long-term sustainability along the coast. Utilizing a mixed-methods approach, I conducted surveys and semi-structured interviews with town planners and contractors across participating municipalities. The study employs two established frameworks, the Adaptive Gradients and Rural Coastal Community Resilience (RCCR) frameworks, to assess their effectiveness in capturing program outcomes. By analyzing these diverse perspectives, the research explores the potential strengths and limitations of current resilience-building efforts and identifies best practices for future program evaluations. While analysis is ongoing, this project aims to provide a comprehensive understanding of how state-led initiatives can better align with local needs to ensure enduring coastal resilience. This work will ultimately inform more robust evaluation protocols for future resilience initiatives in North Carolina and other vulnerable coastal regions.

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Characterizing phytoplankton dynamics within cyanobacteria-dominated Lake Mattamuskeet, NC

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Located on the Albemarle-Pamlico peninsula, Lake Mattamuskeet is the largest natural lake in North Carolina. Historically, this shallow lake was dominated by submerged aquatic vegetation (SAVs) and was an important feeding ground for migratory birds along the Atlantic Flyway. Today, the lake is absent from SAVs and is instead dominated year-round by small, filamentous cyanobacteria (Raphidiopsis, Umezakia, Pseudanabaena). Consequently, Lake Mattamuskeet has experienced some of the nation's highest concentrations of the cyanotoxin cylindrospermopsin (6.6 µg L-1). High phytoplankton biomass (~100 µg chl a L^{-1}) creates steep light attenuation that prevents re-establishment of SAVs. Our research group monitored the lake over a 2.5-year period to characterize phytoplankton community dynamics and identify factors promoting cyanobacterial proliferation. Although the relative abundance of phytoplankton classes shifted seasonally, cyanobacteria remained dominant throughout the year. Nutrient availability also shifted seasonally, highlighted by an early spring ammonium pulse (up to 105 µM NH_4^+). Together, temperature and nitrogen form and availability strongly influenced community structure and cyanobacterial abundance. Ongoing research will investigate the role of diazotrophy in nitrogen cycling and the impact of nutrient stoichiometry on toxin concentrations within the lake.

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The Influence of Localized Water Quality on Eastern Oysters (Crassostrea virginica) Amidst Changing Environmental Conditions

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Oysters are ubiquitous in estuaries along the Georgia coast, where marsh morphology and large daily tidal fluctuations create dynamic and potentially stressful conditions that may lead to local adaptation. Based on water quality data from the Sapelo Island NERR, negative long-term trends may adversely affect oyster health. Specifically, ocean acidification alters the carbonate buffering capacity, increasing the amplitude of daily pH variations, and the rate of change in pH is not uniform within estuaries, varying on spatial and temporal scales. These variable pH conditions can be stressful for calcifying organisms like oysters, leading to reduced health. An increasingly studied metric of oyster health is the symbiotic relationship with the internal microbiome. For example, oysters continuously introduce microorganisms into their hemolymph, and certain core families of bacteria, including Mycoplasmataceae and Spirochaetaceae, have been identified as being associated with healthy oysters. The impacts of local water quality conditions, specifically variable pH, on the oyster microbiome is understudied. Utilizing reciprocal transplant and common garden tank designs, we aimed to examine the impacts of variability in water quality conditions as drivers of oyster health using physical and microbial indicators, including oyster growth, condition index, and shifts in microbial community dynamics.

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Trace metals in oyster tissues, southeastern North Carolina: Current distributions and changes over a decade

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Concentrations of arsenic, copper, and zinc were measured in oyster tissues and adjacent sediments from southeastern North Carolina. Oysters were collected from twenty sites including areas closed to shellfishing, higher quality waters, and shellfish cultivation operations. Metal concentrations were compared to a previous study (2011-2012) to evaluate the effects of rapid development in the region. Arsenic in oysters at all sites was above the “Mussel Watch” national median and 16 of 20 sites were higher than the 85th percentile, echoing previous observations of high As in southeastern oysters. Most Cu concentrations were close to the national median whereas over half of the Zn concentrations exceeded it. There were 20 significant differences between past and current concentrations. Current concentrations were higher for 3 of 7 comparisons for As, 3 of 7 for Cu, and 5 of 6 for Zn. Sites with lower As might reflect a decrease in As-containing herbicides and industrial emissions whereas lower Cu might reflect the phase-out of Cu in anti-fouling paints and brake pads. Zn increased at most sites, possibly reflecting increased traffic, boating activities, and construction-related sources from development. There were no strong relationships between oyster and sediment concentrations overall.
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Reemergent Populations of an Invasive Rhizocephalan Parasite in Long Island Sound

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Since its original introduction from the Gulf of Mexico to Chesapeake Bay in the 1960s, the parasitic barnacle Loxothylacus panopaei has become established along the southeastern USA from Maryland to Florida. Although spread primarily occurred southward, the parasite was detected along the New York shore of Long Island Sound (LIS) in 2012. Between 2016-2022, L. panopaei disappeared from previously established sites on the southern shore of LIS, leaving its continued presence in LIS uncertain. In 2022, community science surveys conducted by the non-profit organization SoundWaters documented L. panopaei infecting flatback mud crabs (Eurypanopeus depressus) on the northern shore of LIS in Connecticut for the first time. Here, we document the northernmost population of L. panopaei in Stamford, Connecticut, and evaluate biotic and abiotic drivers of parasite prevalence using data collected between November 2022 and December 2025. We also sequenced individuals using a fragment of the mitochondrial COI gene and confirmed that the Connecticut population belongs to the same clade infecting Atlantic coast populations. Infection prevalence was best predicted by Julian day and host size, and COI comparisons Our work highlights the importance of community science and the necessity of continued efforts in monitoring the spread of invasive species.
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How can we use uncrewed aerial vehicles (UAVs) to forecast marsh stability?

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Improved assessments of changing marsh conditions under rising seas are critically needed. Monitoring efforts are usually short-lived due to challenging field work. Shifting methods towards more cost-efficient and less labor-intensive techniques allow more consistent monitoring with less disturbance. The use of UAVs and remote sensing has seen a surge; however, few combine high-resolution aerial data with models forecasting marsh stability. The objective of this project is to combine UAV and remote sensing methods with biophysical data from the Coastal Wetland Equilibrium Model (CWEM) to predict how marshes will change and identify marshes most vulnerable to SLR. CWEM uses biophysical feedbacks within marshes that affect the stability of the system to predict marsh persistence under projected SLR. Field and aerial data collection occurred on Masonboro Island within the NC NERR. Vegetation indices were compared to identify peak biomass and parameterize CWEM. Results indicate GNDVI and SIPI were the strongest biomass predictors and incorporating their interaction improved model performance substantially (R^2=0.79). Canopy Height Models derived from LiDAR showed a strong relationship with field-measured canopy height (R^2=0.59). Preliminary data will be presented from aerial surveys and sample collections. This research will inform management needs and create a replicable methodology for evaluating marsh stability.
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Incorporating Secondary Foundation Species in Coastal Restoration

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Positive species interactions are well documented, particularly in stressful coastal environments where facilitations underly many ecosystems. However, coastal restoration traditionally fails to harness these mutualistic relationships, instead targeting only a single species for restoration at a time and seeking to minimize interspecific interactions. Here, we present results from the experimental enhancement of existing restored coastal ecosystems. Specifically, various secondary foundation species were added to each restored ecosystem and the continued success of the ecosystem was monitored including both the responses of the primary foundation species and overall biodiversity shifts as a result of the addition of the secondary foundation species. Ultimately, these results should help inform marine ecologists and restoration managers seeking to understand ways to improve and upscale current restoration techniques.

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Epiphyte Dynamics on Sporobolus alterniflours (Spartina alterniflora): Implications for Salt Marsh Primary Productivity

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Salt marshes are highly productive ecosystems where epiphytic microalgal communities contribute to primary production, nutrient cycling, and food web dynamics. In the North Inlet Estuary, *Sporobolus alterniflorus* (*Spartina alterniflora*) dominates the intertidal zone and serves as a primary substrate for epiphytic colonization. These communities, composed of diatoms, cyanobacteria, green algae, fungi, and heterotrophic bacteria, form biofilms on their substrates and experience periodic submersion during the tidal cycle. During high tides, epiphytes are almost completely submerged, allowing nutrient uptake and the recruitment of other microalgal species, whereas during low tides, they are exposed to desiccation. This study measures net primary production (NPP) of epiphytic communities on *Spartina* under subaerial and submerged conditions and evaluates non-destructive alternative substrates (wooden dowels, PVC pipe, and plastic straws) as sampling mimics. Chlorophyll *a* is used as a proxy for biomass to compare epiphytic growth with and without *Spartina* influence. We hypothesize that submerged conditions will support higher NPP due to consistent inundation and nutrient availability. Among the mimics, we expect wooden dowels to effectively support epiphytic growth due to their porous, hydrophilic surfaces. This research provides insight into epiphytic community dynamics, their contribution to ecosystem productivity, and a long-term methodology for monitoring epiphytic microalgal communities.

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A Novel Immobilized Algicide for Controlling Red Tide: Incorporating a Stakeholder-driven Communication and Engagement Strategy to Facilitate Transition to End-users

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There is an increasing need to communicate the advantages of emerging HAB prevention and control technologies to stakeholders, resource managers, and end-users to ensure an informed understanding, successful transition, and sustained use in operational programs. For example, DinoSHIELD is a naturally-derived, biological HAB control strategy in the field demonstration phase that aims to prevent and control red tide (Karenia brevis) blooms. A key component of the development of DinoSHIELD is the stakeholder-driven communication and engagement strategy that helps facilitate the future transition of this HAB control technology to end-users. Stakeholder engagement activities included multiple workshops in Southwest Florida to inform and engage local resource managers on the technology and benefits of DinoSHIELD as a tool to mitigate the negative impacts of K. brevis blooms. Workshop participants significantly increased their understanding and comfort level of DinoSHIELD post-workshop. Participants also offered valuable input for future research and development, including using biodegradable materials for containment and targeted testing on local ecologically important species. The workshops established valuable communication and trust with stakeholders and informed the research goals of DinoSHIELD in order to meet end-user needs. This framework serves as a useful guide for future HAB control technology development for regions around the US.

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Abstracts - Ignites

If You Build It, They Will Come: Parasites as Biodiversity Surrogates for Habitat Restoration

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As valuable bioindicators for myriad ecological questions, parasites can play a key role as surrogates of biodiversity, with important implications for conservation and applied ecology investigations. Here, we demonstrate the utility of parasites as indicators of temporal changes in community assembly, species composition, and taxa diversity following the restoration of oyster-reef habitat in coastal North Carolina (NC). First, using a BACI design, we surveyed for free-living and parasite biodiversity in reef-resident snails, crustaceans, and fish hosts within a restored tidal creek. We found restoration had a significant positive effect on biodiversity, with reef design influencing recruiting hosts and parasites. Second, we used a space-for-time approach to examine parasite and free-living biodiversity at multiple restored and natural reefs ranging in reef age in Back Sound, NC. Our results showed parasites to be better indicators of community succession than free-living hosts, presumably by better capturing taxa diversity within a community than sampling using traditional surveying techniques (e.g., passive fish and crustacean samplers). Altogether, our study adds to the growing literature demonstrating the utility of parasites as surrogate taxa for biodiversity assessments, providing another tool in our toolbox for evaluating the success of conservation efforts that aim to enhance biodiversity.
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Impacts of Historical Mosquito Ditching on Modern Marsh Dynamics

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Mosquito ditching is a widespread historical modification of salt marshes originally implemented for drainage and pest control. Despite their prevalence, the long-term impacts of ditches on ecosystem resilience remain poorly understood, particularly regarding sea-level rise. This project investigates how mosquito ditches alter salt marsh structure, function, and adaptive capacity by modifying hydrological processes, sediment dynamics, and biogeochemical cycling. Using a combination of literature synthesis, comparative field surveys, and remote sensing, this research seeks to compare ditched and unditched marshes in North Carolina. We will assess key indicators including elevation, vegetation composition, greenhouse gas fluxes, faunal communities, and carbon storage. This study is a collaborative regional effort, and we invite researchers across the Southeast to participate in cross-state data sharing. By fostering this partnership, the project aims to generate scalable insights that inform sustainable management, restoration, and the integration of legacy modifications into broader coastal resilience and flood mitigation planning.
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Herbivory and population structure of Elysia subornata associated with Caulerpa prolifera in the Indian River Lagoon

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Caulerpa prolifera, a native green macroalga, has become increasingly dominant in the Indian River Lagoon (IRL) since 2016, partially filling habitat gaps created by widespread seagrass loss. Recently, however, C. prolifera % cover begun to decline. During the 1980s, dense populations of the sacoglossan sea slug Elysia subornata were associated with rapid collapse of C. prolifera beds in the IRL, yet the grazing impact and population dynamics of this specialist herbivore remain poorly understood. Following the recent reappearance of E. subornata concurrent with declining C. prolifera cover, we investigated the relationship between these species using field surveys, laboratory feeding trials, and population genetic analyses. Feeding trials demonstrated consistent preference for C. prolifera over other drift algae. Genetic analyses of E. subornata from two IRL locations revealed two genetic clusters with limited admixture. Over the survey period, C. prolifera cover did not decline significantly; however, during this period, widespread mortality of both wild and captive slugs was observed. Collectively, these findings suggest that E. subornata herbivory has the potential to cause localized suppression of C. prolifera and highlight the importance of continued monitoring to better understand grazer-macroalgal dynamics in the IRL.
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Spatial Variation in Resource Use and Species-Level Trophic Niches of White and Brown Shrimp in Winyah Estuary, SC

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White (*Litopenaeus setiferus*) and brown shrimp (*Farfantepenaeus aztecus*) are ecologically and economically important species in the southeastern United States, supporting coastal food webs and valuable commercial fisheries. We conducted a spatial and temporal analysis of shrimp from Winyah Bay, South Carolina, using stable isotope analysis ($\delta^{13}C$, $\delta^{15}N$, $\delta^{34}S$) to evaluate trophic position and dietary sources across bay, marsh, and riverine habitats. Trophic position and mixing-model outputs were incorporated into a hypervolume analysis to quantify niche width and overlap between species. Results indicate that shrimp diet composition was consistent through time but varied significantly by habitat and species within some habitats. In riverine habitats, brown shrimp relied more heavily on phytoplankton-derived resources, whereas white shrimp showed greater dependence on terrestrial plant sources. Both species occupied their lowest trophic positions in marsh habitats, where diets were dominated by *Spartina alterniflora*. White shrimp exhibited a broader niche width and substantial overlap with brown shrimp, while also maintaining a significantly larger unique niche space. As climate change is expected to increase temporal overlap between these species in South Carolina estuaries, continued investigation of penaeid shrimp food web dynamics is critical for informing sustainable fisheries management and ensuring long-term population viability.
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Introducing TEAL-SHIPS: A Coast-to-Gulf Stream Transect of Seasonal and Annual Ecosystem Features

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The Gulf Stream is a major ocean current that carries warm water from the equator northward along the eastern United States. Initial research in the 1970s-1980s focused on the current's meanders and descriptions of nutrient-poor Gulf Stream waters mixing with nutrient-rich coastal waters. This current is also believed to be an important mode of transport, such as for fish larval dispersion. However, the coastal North Carolina region to the Gulf Stream has had little focus in recent decades, particularly from the ecosystem perspective. The Transect Expedition to Assess Land-to-Sea Habitats via Interdisciplinary Process Studies (TEAL-SHIPS) is a multi-institutional, interdisciplinary project that seeks to characterize the ecosystem structure and function from the Cape Fear River plume to the Gulf Stream through eight seasonal expeditions. Initial findings from 2025 explore community composition (from microbes to fish), microbial metabolic rates, nutrient gradients, and Gulf Stream modes. This presentation covers the project goals and preliminary results from the biological, chemical, and physical disciplines represented. For example, microbial respiration and production rates show shifts in community structure and metabolic efficiency across the coastal-to-offshore habitat gradient. Discussions regarding future collaborations to continue transect and time series work in this region are encouraged.
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eDNA detection of R. cuneata in Lake Mattamuskeet

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Lake Mattamuskeet is a shallow natural lake in Northern North Carolina, which is connected to the Pamlico and Albemarle Sounds. Since 2012, the lake has suffered an unprecedented die off of submerged aquatic vegetation (SAV) following the replacement of salinity gates and a resulting salinity regime change from brackish to freshwater. We hypothesize that this has resulted in the loss of a critical filter feeder and phytoplankton grazer, the brackish water clam Rangia cuneata. Using Ardura et al. 2015 as a model for detecting eDNA of R. cuneata in the Baltic sea, we took water samples, extracted DNA, and ran a qPCR detection assay to determine if larval DNA was present in and around Lake Mattamuskeet. Sampling was conducted during the late Summer and early Autumn months when water temperatures were high enough for spawning to seasonally occur. All Lake Mattamuskeet samples were negative. The sampling site for adult R. cuneata positive controls, Flanners Beach along the Neuse river, was positive. We detected borderline positives for R. cuneata in two environmental samples, both outfall canals on the Mattamuskeet refuge. These results indicate R. cuneata larval connectivity has likely been severed by the salinity gates and the salinity regime change is
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Methane emissions from soil and trees in forested wetlands of the Atlantic Coast (NC, USA)

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More than half of the bottom-up estimates of methane emissions originate from natural sources, wetlands being the primary contributors. Wetland CH4 emissions are expected to continue increasing even if anthropogenic emissions decrease. To improve the accuracy of methane budgets, understanding how tree community structure and composition influence methane fluxes is important as some species may be stronger sinks or sources of methane. We aimed to characterize the contribution of tree stem and soil fluxes to the total methane emissions in a coastal forested wetland in the Alligator River National Wildlife Refuge (NC, USA) integrating chamber-based data from soils and stems. We found high CH4 emissions from forests, but the budget was largely driven by soil emissions (<95%). Total fluxes ranged from 228.8 ± 80.0 mol ha-1 d-1 in summer and from 226.3 ± 252.6 mol ha-1 d-1 in the fall. Stem fluxes were driven by basal area and Nyssa sylvatica was the species with highest CH4 emissions in both seasons. We conclude that tree communities do not represent an ecosystem disservice in terms of global warming potential due to low CH4 flux contribution, and their role in summer as modulators of short-term methane increases from soil.

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The Many Hats of Restoration Scientists: A Stormwater BMP Retrofit Implementation Case Study

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Limited resources of time, money, stakeholder attention, public interest, etc. necessitate prioritized allocation of these resources. Effective communication of priorities facilitate translation of science into restoration action, but requires multiple skillsets and interdisciplinary familiarity. The Back Creek Action Plan identifies specific potential restoration projects, including stormwater BMP retrofits, in the #6 priority subwatershed of the Severn River (per the Severn River Action Plan). A stormwater BMP retrofit at the Georgetown East Townhouse Community was designed and constructed, with lessons learned presenting opportunities to explore the myriad of skills required for restoration scientists working in residential areas near shallow water coastal zones.

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Fish schooling behavior during the changing of the tides

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Schooling in fish is defined as a group of fish, usually all the same species, all facing the same direction, in close proximity of one-another, equidistant from each other, and swimming in a coordinated pattern. While a number of studies have observed fish schooling behavior and the reasons for its occurrence, there has been little research on how tide affects the dynamics of fish schooling. As the tide changes in shallow estuarine habitats, pressures driving schooling behavior such as food accessibility and predation risk also change. In this study, fish schooling behavior was compared during flood and ebb tide by comparing the number of schools and the number of fish exhibiting schooling behavior in a shallow tidal creek near Savannah, GA. Results showed a greater amount of schooling activity during flood tide than during ebb tide as there was a greater number of fish schooling as well as number of schools during flood tide than ebb tide. There was no difference in the number of fish per school between flood and ebb tide, indicating schools remained consistent in size over the change in tide and, revealing important information on how schooling fish behavior is regulated in shallow tidal estuarine habitats.

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Predicting salt marsh loss in Chesapeake Bay: multi-model synthesis and management applications

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Salt marshes are dynamic landforms reliant on organic and mineral input to maintain their configuration. Sea-level rise and sediment deficits can lead to submergence, open-water expansion, and loss of vegetated marsh and ecosystem services. Management models emphasize vegetation zonation in response to sea level but neglect sediment transport. Conversely, research models represent biogeomorphic interactions but operate on scales that are not directly transferable to restoration or management. We bridged these two paradigms with a novel geomorphic model, the Unit-Based Morphological model (UBMorph), which is based on the sediment-based lifespan concept. We apply the model to predict salt marsh area in Chesapeake Bay under various sea level rise scenarios. Model parameters are selected using a biogeomorphic model and the lifespan is then compared with a zonation model (SLAMM). UBMorph estimates a loss of 404 km2 (37%) of marsh area under a dynamic 3-12 mm/y sea-level rise scenario (2010-2110). We then demonstrate a management-focused application of UBMorph and SLAMM for evaluating present and future marsh condition and restoration needs. The models indicate if no action is taken, over 700 km2 will require high effort intervention by 2070. This synthesis of multiple models demonstrates an advance in bridging process-based research and restoration needs.
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Measuring anthropogenic impacts on estuarine benthic microalgal communities using sister estuaries

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As key drivers of neritic primary productivity, benthic microalgae play essential roles in biogeochemical cycling and estuarine food webs. When considered alongside their shallow, restricted habitats, BMA contribute disproportionately to global carbon fixation. However, the extent of human impact on BMA communities is largely unknown. Our study aims to quantify anthropogenic forcing through specific abiotic drivers of benthic microalgal success. We measured BMA biomass, community composition, porewater nutrients, and sediment composition within two South Carolina Estuaries. North Inlet, SC, and Murrells Inlet, SC, share similar geographic and morphological characteristics but differ significantly in terms of watershed population. Dissolved phosphate, nitrate, and ammonium were measured spectrophotometrically. Grain size fractionation data were collected using standard sorting methods. BMA biomass was quantified fluorometrically, and community composition was determined using a Flowcam. We found higher biomass and weaker community structures in Murrells Inlet due to forcings on grain size and porewater chemistry. Understanding anthropogenic drivers of BMA structure and distribution provides key insights into potential abiotic regulation of spatio-temporal patterns of BMA in intertidal sediments.
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Patterns in the Distribution of Seagrass Seeds in the Indian River Lagoon, Florida, USA

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The Indian River Lagoon (IRL) experienced a 75% decrease in extent of seagrass between 2009 and 2021 due to intense, long-lasting, and widespread phytoplankton blooms between 2011 and 2020. Vegetative fragments of seagrasses have been shown to successfully colonize bare areas in the IRL, but the ability to recover from extensive losses likely relies on both the extension of rhizomes and the presence of a viable seed bank. The goals of this study were to identify patterns in the distribution of seagrass seeds in the IRL and to collect baseline data on sediments and porewater to better understand their impact on seeds. Seed density for Halodule wrightii varied widely, with mean densities far lower than reported in other estuaries. While Ruppia maritima seeds occurred at higher average densities in the IRL, this species is highly ephemeral, rarely forming expansive, long-lasting beds. Densities of seeds for the two species were related to the salinity of porewater, but the role of other sediment metrics was less clear. Understanding patterns in seed distribution and the effects of sediment characteristics will help guide targeted restoration and conservation of this important habitat by identifying prime sites for natural recovery.
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Assessing the Spatial and Analyst Variation of Oyster Reef Image Classification using UAS-Based Imagery in South Carolina, USA

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Accurate assessments of Eastern oyster (Crassostrea virginica) reef metrics such as area and density of live oysters are essential for understanding the ecological role of oyster reefs and making appropriate harvest management decisions. Traditional methods for quantifying live oyster density and area are labor intensive, limited to short observation windows due to tides, and often do not capture the variation in oyster density within an individual reef. Two previous NERRS Science Collaborative funded projects have developed methods for mapping intertidal habitat and classifying oyster reefs using uncrewed aerial system (UAS)-based imagery and machine learning image classification. Building on this effort, in the summer of 2025, South Carolina Department of Natural Resources (SCDNR) researchers used UAS to map representative areas of state-managed shellfish grounds and classified oyster reefs from the resulting imagery. Image classification was conducted at three spatial scales: an individual reef, several representative reefs, and the entire flight area. Image classification was also independently conducted by three analysts. To explore the effects of spatial scale and analyst on the resulting classifications, we performed accuracy assessments on the classified products. This presentation will discuss the variance in classification accuracy among 1) different spatial scales and 2) different analysts.
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The Piver's Island Coastal Observatory: >15 years of weekly+ observations reveal the press and pulse of a changing temperate coastal marine system

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Historically, oceanographic time-series have focused on long-term measurements of large open ocean gyres; yet, the coastal oceans, with their high productivity, tidal impacts, human feedbacks, and land-sea coupling, represent critical regions for predicting ocean dynamics and biogeochemistry under global change.The Piver's Island Coastal Observatory (PICO) time-series, located in the second largest estuarine system on the US East Coast (Albemarle-Pamlico Sound), comprises more than 15 years of weekly (or more frequent) measurements of core physical, chemical, and biological oceanographic variables. Here, we report on a decade and half of observations focusing on pulse and press ecosystem changes. We observe strong mean annual cycles in environmental variables including temperature, pH, chlorophyll upon which are layered episodic disturbances (e.g., tropical cyclones) that dramatically and persistently (>1 month) impact this ecosystem. Among other variables, long term trends in pH, inorganic carbon and chlorophyll are exceeding those observed in the open ocean, suggesting an ecosystem in flux. These analyses provide a benchmark for future studies of the impact of changing climate and oceanographic climatology; further research will use this long-term research to develop targeted sampling and experimental manipulations to better understand ecosystem structure and function.
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What Can Radon Tell Us about Methane Emissions from Cypress Knees?

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Baldcypress (Taxodium distichum), a deciduous conifer native to the southeastern United States, has unique conical above-ground root structures called knees that may play an important role in greenhouse gas transport and carbon cycling. Methane emissions from knees have been documented for decades, and recent work has revealed correlations between knee methane emissions and environmental variables. (temperature, water level, precipitation, and distance to stream) In this study, we explore the use of radon, a radioactive noble gas that is naturally elevated in soil and groundwater, to investigate the relative contributions of knees, tree stems, and soil surfaces to total methane emissions from a baldcypress swamp in Maryland. We also explored seasonal differences in methane and radon emissions between the summer/growing and winter/dormant seasons. Maximum fluxes of methane per unit surface area were substantially higher for knees than for stems, and knees <30 cm accounted for the bulk of knee gas flux because they had greater cumulative surface area and were lower to the ground. Preliminary results suggest that knees are an important component of methane fluxes from baldcypress swamps, and that they may both facilitate methane transport and be sites of methanogenesis.
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Post restoration monitoring of oyster cultch reefs as essential fish habitat in Pamlico Sound, North Carolina, USA.

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Cultch oyster reefs in Pamlico Sound, NC make up a large area of restored oyster reefs and are valued as essential fish habitat (EFH). Distribution, abundance and size structure of fish on six restored oyster cultch reefs within Pamlico Sound (three northern and three southern) and two non-reef control sites were quantified from 2016-2021 using gill nets. Although certain species were unique to oyster reefs, there was high overlap of species between reef and non-reef sites. There was no difference in mean catch-per-unit-effort (CPUE) among sites, however mean CPUE was significantly higher in 2016, likely due to an immediate influx of fish in response to the recent material deployment in 2016. Mean CPUE also varies by season, with winter having the lowest of all seasons. These results highlight how cultch reefs likely serve as part of the overall habitat mosaic for estuarine fish in Pamlico Sound. A similar study investigating the EFH of sanctuary reefs found that sanctuary reefs harbored more unique species than unstructured bottom, likely due to the relatively high relief sanctuary reefs provided compared to cultch reefs. Understanding reef utilization changes over time and space is essential for establishing restoration targets for the persistence of cultch reefs.
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The Abundance of Ammonia Oxidizing Archaea in the Gulf Stream

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Microbes serve as the foundation of nearly every ecosystem by being at the base of food webs and cycling nutrients. It has long been known that bacteria play a key role in biogeochemical cycling, but it has only recently been discovered that archaea also contribute to these processes. One such group of archaea has been found to be vital contributors cycling nitrogen by converting ammonia into nitrite. These ammonia-oxidizing archaea (AOA) can be found in many microbial communities, including that of the Gulf Stream. In order to better understand which AOA are present in these communities and the extent of their contribution to the nitrogen cycle, samples are being collected at various depths and locations along a seasonal transect from North Carolina to the Gulf Stream through the Transect Expedition to Assess Land-to-Sea Habitats via Interdisciplinary Process Studies (TEAL-SHIPS) program. Following a phenol-chloroform extraction method, DNA from these samples underwent qPCR where it was found that the number of AOA gene copies per liter of seawater ranged from 8.9×10^6 to 3.15×10^8, increasing with depth. Ongoing work will compare abundance to environmental factors such as oxygen, light, and nutrient availability, furthering our research into AOA's contribution to the nitrogen cycle.
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Empirical evidence for the performance of Natural Infrastructure: A web experience

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Natural Infrastructure (NI) enhances coastal resilience by leveraging natural habitats, often alongside built structures, to deliver benefits such as habitat creation, improved water quality, recreation, and adaptation to sea-level rise. Despite increasing implementation, uncertainty remains about the long-term performance of many NI projects.To address this gap, we assess mature NI projects (constructed more than five years ago) across diverse geographies and project types. To date, we have evaluated projects along the coasts of Texas, North Carolina, and Maryland, with site selection informed by practitioners including the NOAA Restoration Center, the U.S. Army Corps of Engineers, and state coastal managers. Using hydrodynamic modeling, remote sensing, and field data, we quantify performance relative to design conditions and characterize local physical environments. Findings are shared through a publicly accessible, interactive web platform featuring project-specific modules and StoryMaps that synthesize performance metrics and field data. We invite collaborators to contribute additional NI projects to expand this resource, strengthen the evidence base, and build confidence in NI solutions across coastal settings.
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Do large-scale living shorelines effectively maintain seaward-landward connectivity for predatory fishes in nearshore landscapes?

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The degree of connectivity between habitats (determined by the ease and frequency that materials/organisms move) can strongly affect ecosystem functionality. Thus, a single fragmented or lost habitat can have landscape-wide effects. In North Carolina, large-scale (>300 meters) living shorelines (LSs) are increasingly employed to mitigate shoreline erosion while restoring salt marshes and oyster reefs. Theoretically, LSs should attract more fauna, including highly mobile predators, compared to unaltered shorelines lacking vertical structure. However, LSs built parallel to shore may lower intertidal-to-subtidal connectivity by limiting larger fauna/predator access into landward foraging and spawning habitat like marshes. We surveyed predatory fish richness, abundance, and size landward and seaward of LSs and paired unaltered shorelines via gillnet sampling. Though mean richness and abundance were similar, LSs and unaltered shorelines only shared 50% of all predator species surveyed. Mean predator size was 0.8x greater at unaltered shorelines due to the presence of sharks and larger sting ray species not found at LSs. Drum species dominated predator communities landward of LSs, but piscivorous, active-pursuit predators (e.g., bluefish) found in seaward and unaltered shoreline habitats were absent. LSs may not affect landscape-level predator diversity but do change what types of predators utilize landward habitats.

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Improved understanding of a valuable ecosystem service: Analysis of 15 years of oyster-mediated denitrification experiments

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Denitrification is the microbial conversion of bioavailable nitrogen into inert dinitrogen gas (N2-N), removing excess nitrogen from waterbodies and helping mitigate harmful algal blooms and eutrophication. In estuaries, oysters enhance microbial denitrification; however, the loss of roughly 90% of global oyster reefs has reduced their ecosystem services. This study evaluates restored and aquaculture reefs as potential nature-based solutions to compensate for the decline of natural reefs and associated oyster-mediated denitrification (OMD). Spanning 15 years of experiments across coastal North Carolina, OMD rates were directly measured with membrane inlet mass spectrometry across management contexts (natural, restored, and culture) and habitats (reefs and tidal flats). Results supported previous findings that oyster reefs maintain greater N2-N flux than distal flats. During summer, OMD rates were comparable among reef types. Restored and culture reefs even showed higher denitrification efficiency than natural reefs likely due to greater measured ammonium (NH_4^+) flux from natural reefs. OMD varied between sub-watersheds and was strongly associated with anthropogenic N loading, suggesting that reef restoration or aquaculture may be particularly beneficial in areas with high nutrient inputs. Overall, OMD rates were similar across habitats and management contexts, while geographic setting and nutrient loading emerged as influential.

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The dynamics of estuarine optical properties and phytoplankton communities in Winyah Bay, SC

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Estuarine systems present complex light environments due to large amounts of colored dissolved organic matter (CDOM) and turbidity that absorb and scatter light, respectively. Optical properties influence phytoplankton communities because their photosynthetic efficiency depends greatly on light availability. This study examined the optical properties of the Winyah Bay estuary in South Carolina using mixing diagrams and related these factors to phytoplankton biomass and community composition across the salinity gradient. Results showed that the behavior of optical properties and their relationship to chlorophyll-a changed under various environmental conditions. Notably, CDOM and chlorophyll-a showed different correlations—positive or negative—based on river discharge and wind direction. Additionally, the phytoplankton community also showed a gradient along the estuary with diatoms highly associated with marine, low-CDOM waters whereas cryptophytes and green algae were associated with fresher, high-CDOM waters. These results have implications for remote sensing of phytoplankton biomass as algorithms should not rely on fixed CDOM correction factors to estimate biomass across varying environmental conditions in estuarine waters. Overall, these findings improve understanding of how optical properties fluctuate in estuaries and how environmental changes influence phytoplankton, which are foundational species in the estuarine food web.

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Effects of Location and Hand Harvest of Intertidal Oyster (Crassostrea virginica) Reefs on Oyster Populations and Habitat Characteristics

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Centuries of anthropogenic pressures, especially harvesting, have reduced eastern oyster (Crassostrea virginica) populations along the eastern coast of North America by degrading reef structure, lowering habitat complexity, and removing reproductive adults and shell material needed for larval settlement. While the effects of tonging and dredging on subtidal reefs are well documented, the impacts of hand harvesting on intertidal reefs remain poorly understood. To address this gap, intertidal reefs in the Tolomato, Matanzas, and Salt Run estuaries in Northeast Florida were sampled during 2015–2016, comparing oyster population and reef structure metrics inside and outside commercial and recreational harvest areas. It is hypothesized that live oyster density, oyster clusters, mussel density, and available cultch would be lower in open harvest areas. In Salt Run, where harvest pressure was greatest, all metrics were lower in open areas, and closed reefs supported higher proportions of juvenile oysters, suggesting reduced recruitment on harvested reefs. Patterns in the Tolomato and Matanzas Rivers were less consistent, likely reflecting lower harvest intensity or additional environmental stressors. Overall, findings indicate that hand harvesting can negatively affect intertidal oyster reef structure and population dynamics, with impacts closely linked to harvest intensity.
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The effects of H. wrightii on Z. marina seed germination

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North Carolina coasts are dominated by co-existing seagrass species: mixed-annual, temperate Zostera marina and perennial, subtropical Halodule wrightii. Understanding the potential effects of H. wrightii on Z. marina seed germination is increasingly critical as seeds become the primary mechanism for Z. marina recovery. The goal of this study was to determine if the presence of H. wrightii inhibited Z. marina seed germination, and if this differed in source and non-source sediment types. We cross-planted Z. marina seeds from three different North Carolina populations (Bogue Sound, North River, and Topsail) into three sediment types (one from each source meadow) with half of the treatments receiving transplanted H. wrightii shoots at in-situ densities (n = 5). The presence of H. wrightii did not impact Z. marina germination or seedling biomass. Germination metrics were affected by population only; Bogue seeds were larger, heavier, and had faster and greater germination in comparison to North River and Topsail. Seedling biomass was affected by seedling population and sediment type, with Topsail seeds yielding the highest above ground biomass. Our results highlight the shift in resource allocation between seeds and seedlings and demonstrate that H. wrightii does not limit Z. marina's germination in a laboratory setting.
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Advancing Harmful Algal Bloom Management: Development and Performance of North Carolina's Statewide Reporting System

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Harmful algal blooms (HABs), particularly cyanobacteria, in U.S. freshwater systems have become more frequent and widespread over the past few decades. In North Carolina, in response to growing scientific, public, and media awareness of algal blooms and HABs, NC DEQ Division of Water Resources launched a statewide report-and-track system in 2022. The system, featuring an online reporting app and interactive dashboard/map, has been reevaluated and adjusted after every bloom season and as software improves. It plays an increasingly important role in the timely reporting, investigation, and documentation of algal blooms and fish kills in NC waters. In 2025, 315 algal blooms, 78 fish kills and 15 both were reported and addressed through the platform. This presentation will outline the development, functionality and benefits of the public-facing system, and discuss the issues and challenges, as well as future directions in enhancing the system's functionality in responses to HABs, especially concerning cyanobacterial blooms and associated toxins.
High School Student

Water level controls on methane emissions in a restored wetland in coastal North Carolina

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Restoring wetlands can provide multiple ecosystem services but potentially lead to high methane emissions, thus creating a warming effect on the planet. Water level management can play an important role in reducing the amount of methane released to the atmosphere by means of reducing the amount of methane produced or increasing the amount of methane oxidation in the water column. In this study we evaluated how water level drives methane emissions in a freshwater restored marsh located on the coast of North Carolina. Using continuous half-hourly methane flux derived from the eddy-covariance technique we evaluate how changes in water level and other environmental drivers control the total amount of methane released to the environment. This knowledge can help create better models to improve the methane budget from natural systems and can be used to improve water level management practices that can lead to a reduction of net methane emissions.

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Utilizing drone-derived metrics to examine oyster reef dynamics in the southeast

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The National Estuarine Research Reserves in collaboration with NOAA National Centers for Coastal Ocean Science and state resource managers have been leading a regional effort in the southeast to explore how uncrewed aircraft systems (UAS, or drone) technology could be incorporated into oyster (Crassostrea virginica) management toolkits. The research group has been examining how UAS-derived imagery products (e.g., orthomosaics, digital elevation models, texture layers) compare to conventional metrics for intertidal oyster reef assessment (e.g., elevation, density, rugosity, percent cover). Oyster reef data were collected to encompass the geographic spread across the southeast, varying reef morphologies (patch and marsh-fringing), and management regimes (open or closed to harvest). Further, leveraging the water level data from nearby NERR System-Wide Monitoring Program platforms and NOAA CO-OPS tide stations, we are examining the relationship of tidal exposure to reef patterns across the region. The catalog of both drone-derived and on-the-ground data is providing an opportunity to explore oyster reef dynamics at a greater resolution within reefs and across larger spatial scales.

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Examining population trends and parasitism along the expanded range of Petrolisthes armatus in the southeastern U.S.

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Climate-driven biological invasions and range expansions of marine and estuarine species are increasing in rate and frequency with rising ocean temperatures. This trend is important to investigate as these organisms can disrupt recipient environments by altering ecosystem dynamics through novel species interactions (i.e. competition, predation, and parasitism). The movement of (sub)tropical western Atlantic species into temperate regions along the southeast U.S. has been termed the “Caribbean creep”. One species creeping northward is the green porcelain crab (Petrolisthes armatus). My research examines P. armatus population demographics and parasitism by marine bopyrid, Aporobopyrus curtatus from the Indian River Lagoon, Florida through the leading edge of the non-native range in North Carolina. In 2024 and 2025, porcelain crabs were collected via passive samplers and by hand from sites in Florida, Georgia, South Carolina, and North Carolina. We found that probability of bopyrid infection in green porcelain crabs decreases as latitude increases along the non-native range. Additionally, we expect increasing latitude to correlate with smaller body sizes at maturity likely resulting from enhanced physiological stress in temperate conditions. Altogether, my research allows us to gauge the status of P. armatus populations in the southeast U.S. and provides insight into their biogeography and invasion success.

Master’s Student

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Invasive macroalgal mats catalyze mercury assimilation in salt marsh estuaries

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Nuisance macroalgal blooms of invasive Gracilaria vermiculophylla (Gracilaria) alter water column structure, promote hypoxia, and support microbial communities involved in mercury (Hg) cycling. Estuaries are catchments for terrestrial (Hg) deposition centers for transformation with neurotoxic intermediates, with most Hg methylation occurring along REDOX gradients in benthic sediments. Because of these potential ecosystem impacts, Gracilaria is listed as a research priority for the NCNERR. We hypothesize that Gracilaria mats decouple Hg biogeochemistry from sediments, increasing food web exposure to toxic intermediates such as methylmercury (MHg). We used a two-phase approach to determine if Gracilaria mats influence invertebrate Hg assimilation: (1) spatial distribution of THg, and (2) use stable isotopes (δ 15N, δ 13C) to evaluate THg and MHg assimilation in invertebrates with differing mobility and feeding strategies: Crassostrea virginica, juvenile penaeid shrimp, and Ilyanassa obsoleta (mudsnails). Total Hg was significantly higher in consumers collected from Gracilaria mats. However, increased methylation potential within algal mats does not sufficiently explain the THg:MHg observed across taxa, nor the large difference between THg and MHg observed in mudsnails. This unexpected pattern suggests additional mechanisms may drive Hg uptake in consumers. It is likely that these effects on food webs extend to other species blooms.

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Quantifying key constraints on marsh resilience in South Carolina

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Salt marshes are dynamic and highly productive ecosystems that play a critical role in maintaining the integrity of coastal environments, yet the response of salt marshes to sea level rise along the South Atlantic Bight remains uncertain. This is complicated by environmental characteristics that vary substantially throughout the region. While resilience models continue to advance, their accuracy can be limited by low-resolution, outdated, or surrogate data that does not reflect site-level marsh conditions. Here we present a suite of refined metrics, including elevation and tidal datum, and explore how improving these alters model outputs. This will allow for more accurate assessments of marsh resilience, with the end goal of improving our understanding of site-level resilience to inform management decision-making.

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A Modern and Open Source Wave Exposure Model (WEMo)

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WEMo is an open-source R package that reimplements the NOAA Wave Exposure Model in a modern, reproducible computing environment. The package translates the original ArcGIS-based model developed by NOAA's National Centers for Coastal Ocean Science into a fully scriptable R workflow, preserving the underlying linear wave theory while removing dependence on proprietary GIS software. WEMo computes wind-driven wave height and representative wave energy using wind speed and direction observations, shoreline geometry, and bathymetry. This implementation of WEMo provides robust features to make finding and downloading input wind, bathymetry, and shoreline data quick and user friendly. By leveraging modern R spatial libraries, the package improves analysis time and enables easy and straightforward scenario testing such as altered wind regimes or water levels. WEMo is intended to support coastal and inland water applications including habitat assessment, restoration planning, and vulnerability analysis, while ensuring long-term accessibility and reproducibility of the original model.

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Complementary survey methods effectively characterize seagrass bed condition in the Albemarle-Pamlico National Estuary

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With marine ecosystems undergoing rapid change, effective biomonitoring is increasingly important, particularly for foundation species such as seagrasses. In 2021, a biannual seagrass survey was implemented in the Albemarle-Pamlico National Estuary following a hierarchical approach, pairing aerial surveys of seagrass beds (Tier 1) with ground-based point surveys (Tier 2). While resource-intensive, data from these dual approaches can inform decision-making, so their validation is crucial. We overlaid Tier 2 points with Tier 1 polygons of seagrass extent to estimate Tier 1 detection error, identify bed traits affecting detection ability, and test whether Tier 1 classifications of bed patchiness align with Tier 2 percent cover estimates. We found that Tier 1 has 81.9% detection accuracy overall, and that detection probability increases rapidly with percent cover. Points with mean Braun-Blanquet scores around 2 (5%-25% cover) have approximately 90% probability of detection, although Tier 1 frequently excludes points in sparse beds (<5% cover) (20.1% false negative rate). Tier 1 classifications of bed patchiness are also strongly correlated with Tier 2 percent cover. This demonstrates that, despite Tier 1's exclusion of low-cover seagrass beds, combining these complementary surveys yields powerful data that accurately represents seagrass condition in the estuary.

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Single Reach Mechanistic Modeling of Cyanobacteria in the Shenandoah River

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Given the increasing frequency and severity of freshwater harmful algal blooms (HABs), early warning systems are critical for protecting public and ecological health. However, traditional forecasting approaches require either extensive historical water quality datasets for statistical modeling or a complex multi-station monitoring network, both of which are often unavailable to smaller communities. To address these issues, this research aimed to develop a short-term forecasting model of cyanobacterial biomass in the North Fork of the Shenandoah River using minimal monitoring infrastructure. I implemented a single-reach Whitehead algal model using continuous phycocyanin and temperature data from a single monitoring station, supplemented by interpolated USGS streamflow data and NASA solar radiation estimates. The model incorporates a 10-day physiological lag to account for delayed biological responses to conditions. Calibration using constrained optimization revealed strong temperature sensitivity and hydrologic flushing as the dominant controls on algal growth in the study area. Rolling origin validation demonstrated strong predictive performance for 1-4 day forecasts (R^2>0.7). This single-station approach offers a scalable, cost-effective solution in data limited watersheds, enabling proactive management decisions without substantial monitoring infrastructure investments.

Master's Student

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Impacts of Sargassum inundation on nearshore water quality in the Florida Keys

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Increased abundance of the pelagic brown macroalga Sargassum in the central Atlantic Ocean has resulted in massive accumulations of stranded biomass on beaches throughout southeastern Florida. These Sargassum inundation events have caused severe water quality impacts in some locations, but the duration and spatial extent of these impacts have not been quantified in the Florida Keys. To address this knowledge gap, water quality at Sargassum inundation sites in the Florida Keys was studied from April 2025 to February 2026. A transect spanning the Sargassum inundation was sampled perpendicular to shore. Seawater environmental parameters were measured, and seawater samples were collected for analysis of dissolved nutrient concentrations, chlorophyll a, water color, and turbidity. Negative water quality impacts were observed during inundations and continued to be observed after inundations had dissipated. These impacts included hypoxia, decreased pH, and greatly elevated nutrients, chlorophyll a, and turbidity. The greatest impacts were seen within the Sargassum biomass, with lesser impacts observed outside the biomass. Overall, water quality improved with increasing distance from shore. Based on these results, Sargassum strandings degrade water quality and threaten sensitive habitats in the Florida Keys, including coral reefs, seagrass beds, and mangroves, as well as the organisms that inhabit them.

PhD Student

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Abstracts - Posters

Energy Budgets and Foraging Behavior of Sanderlings (*Calidris alba*)

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Sanderlings (Calidris alba) are small migratory shorebirds that forage actively along sandy shorelines, relying on intertidal habitats for food resources. This study examined sanderling feeding behavior, prey capture strategies, and relative energy expenditure across three coastal sites in South Carolina: Myrtle Beach State Park, Waties Island, and Huntington Beach State Park. Observational field methods were used, with individual birds monitored for one-minute intervals using a spotting scope during peak feeding periods and low tide. Data collected included feeding methods, time allocation to behaviors, environmental conditions, and relative energy levels associated with different activities. Results indicated that sanderlings primarily used probing and pecking techniques while foraging in wet sand near the water's edge. Birds exhibited increased activity levels during low tide, displaying more frequent sprinting, chasing, and playful movements compared to higher tide periods. These findings suggest that low tide conditions enhance prey availability and promote higher energy foraging behavior. Overall, this study highlights how tidal cycles influence sanderling activity, feeding strategies, and energy use within coastal ecosystems.

Undergraduate Student

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Evaluating the Ecology of Dinoflagellate Blooms in a Changing Estuary, the Indian River Lagoon

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In the Indian River Lagoon (IRL), benthic algal communities are critical to ecosystem health and food web support, yet they have undergone major changes in recent decades. Nutrient enrichment, hydrologic alterations, and harmful algal blooms (HABs) have altered the balance of benthic microalgae, particularly diatoms and dinoflagellates, but long-term trends and toxin risks remain poorly documented. Inlets are gateways for oceanographic exchange that shape community composition, while macroalgal rafting provides a transport mechanism for redistributing populations throughout the lagoon. Understanding these processes is essential for predicting ecological change and assessing risks to wildlife and human health, including the occurrence of spinning fish disease that is predicted to be linked to benthic dinoflagellates. This study will assess benthic dinoflagellates across four IRL inlets (Sebastian, Fort Pierce, St. Lucie, and Jupiter) during seasonal surveys. At each inlet, macrophyte and water samples will be collected from four different sites. Laboratory analyses will include nutrient concentrations, chlorophyll-a, stable isotope ratios ($\delta^{13}C$, $\delta^{15}N$), wastewater tracer (sucralose) and FlowCam imaging with a Python-based classifier. This study will provide an updated baseline of benthic algal communities in the IRL, evaluate the influence of inlet dynamics and macrophyte rafting on toxin risk, and improve monitoring and management programs.

Masters Student

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The fouling community thriving on oyster restoration structures in the Hudson Raritan Estuary: Implications for spat recruitment?

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The Hudson River Estuary once supported extensive oyster reefs that enhanced biodiversity, stabilized shorelines, and improved ecosystem function. Urbanization, overharvesting, and environmental degradation have since caused severe declines in Crassostrea virginica, leaving the estuary both spat- and substrate-limited. Restoration efforts now deploy artificial structures such as reef balls, gabions, and oyster castles to increase settlement surface area, but these substrates also attract fouling organisms that compete with oyster larvae for space and food, restrict water flow, release toxins, and sometimes prey on larvae. Although species such as tunicates, barnacles, and boring sponges have been shown to inhibit oyster recruitment elsewhere, their effects in the HRE remain poorly understood. This study assessed how fouling communities influence oyster recruitment by comparing percent cover of fouling organisms and oyster spat on settlement shells and tiles deployed at multiple field sites. It provides the first in-situ evaluation of oyster–fouling interactions in the estuary and tested the hypothesis that dense fouling communities suppress recruitment. Results aim to guide restoration strategies by informing substrate design and placement, ultimately supporting long-term oyster recovery and urban estuarine resilience.

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Unearthing a Forgotten Coastal Plant Collection

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University of North Florida students began forming the beginnings of an herbarium in 1972. This plant collection provides an irreplaceable record of plants from coastal counties in Northeast Florida, a region that has seen extensive development since the creation of this herbarium and is underrepresented in broader herbaria collections. Of SERNEC's 15,115 specimens from Duval County, many are low quality- roughly half do not have a collection date. Comparatively, Alachua County in central Florida has over 42,000 specimens in SERNEC's database, and Florida represents almost 800,000 specimens. This project aims to catalogue and publicize our collection and continue building it to preserve pieces of threatened coastal systems. We followed standard protocol for cataloguing the herbarium specimens, sourcing metadata such as collection date, location, and habitat from voucher labels and recording it in an Excel file. So far, we have catalogued 1,235 specimens and 555 species. Of those, the majority are from coastal counties, such as Duval with 848 specimens. The uncatalogued samples are from 2023-present and originate from WE~ECO lab field surveys of various coastal wetland sites and a 2025 field botany class.

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NC shipwrecks as habitats and reservoirs of Vibrio and Aeromonas spp.

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Biofilms, or aggregates of microbes, are a fundamental way that bacteria exist in the environment. This includes pathogenic species, including members of the Vibrio and Aeromonas genera, which can cause gastroenteritis, wound infections, and septicemia. Here, we are exploring the biofilms on the iron/steel components of shipwrecks in coastal NC as a habitat and reservoir for pathogen species. Since cases are generally reported between May-October, we sampled wrecks during the summer and early fall. Using plastic scrapers to avoid damaging historic wrecks, we collected biofilm, water, and sediment from USS PC-1084 (CFR0103), USS Picket (TRR0002), Eureka (TNR0009), Argonauta (CFR00015), Waccamaw (CFR0001), and the Pappy Lane shipwreck (PAS0001). These samples were used to inoculate TCBS Vibrio isolation agar, and DNA was extracted for sequencing. Preliminary results indicated that multiple Vibrio and Aeromonas spp. were associated with shipwreck sites. Salinity appears to be an important indicator of the presence of either Vibrio or Aeromonas spp. These results show that shipwrecks can harbor potentially clinically relevant bacterial species and begin to explore relevant environmental factors.

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Application of Aniline Derivatization to Quantify Osmolytes in Wetland Porewaters.

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Wetlands are one of the largest natural sources of methane, yet some of the ways wetland microbes produce methane remain poorly understood. For instance, some osmolytes—small labile organic molecules—are used as substrates for methanogenesis, but their abundance and composition in wetland porewaters are not well characterized due to analytical challenges associated with their high polarity and low concentrations. To address these limitations, this study will employ aniline derivatization on a set of porewater samples that were collected monthly from five distinct sites on the Cape Fear River that represent a salinity gradient. Aniline derivatization targets functional groups common in osmolytes including carboxyls and carbonyls, modifying the analyte through attachment of an aniline-derived benzene ring which facilitates easier detection of dissolved metabolites that are otherwise difficult to quantify. Following derivatization, osmolytes will be isolated via solid-phase extraction and analyzed using liquid chromatography-tandem mass spectrometry, with a focus on known substrates for methanogenesis (e.g., glycine betaine). Application of aniline derivatization is expected to enable measurement of osmolytes in wetland porewaters, providing insight into substrate availability for methanogenesis, and osmolyte characterization at each site will allow assessment of how environmental variability across wetland types regulates osmolyte production.

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Net heterotrophy and high carbon dioxide emissions in a blackwater estuary: Implications for the global carbon cycle

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Blackwater rivers are rich in dissolved organic carbon (DOC), with yields that can be 30 times higher than the global average for large rivers. However, blackwater rivers, particularly those with relatively small watershed sizes, have been underrepresented in global carbon budgets. From July 2023 to August 2025, we measured gross primary production (GPP) and community respiration (CR) to calculate net community production (NCP=GPP-CR) and estimate carbon fluxes in Chowan River, a blackwater estuary in northeastern North Carolina. During the study period, GPP and CR ranged from 0 to 68 (median=3.5) and 0 to 50 (median=19) µmol O2 L-1 d-1, respectively. Both GPP and CR were generally higher in summer and decreased with increasing depth. Depth-integrated NCP ranged from -246 to -11 (median=-83) mmol O2 m-2 d-1, with lower values observed in summer. Chowan River exhibited strong net heterotrophy (NCP<0), releasing 2.4x104 mmol CO2 m-2 yr-1. This is equivalent to 1.3 times the annual DOC load of Chowan River and about twice the global average CO2 emissions for estuaries (1.3x104 mmol m-2 yr-1). Our study adds to growing evidence that blackwater rivers are crucial sources of carbon, and their role in the global carbon cycle deserves greater attention in future research.

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Early development in estimating sea turtle incubation temperatures using publicly-available meteorological data

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Sea turtle hatchling sex is determined by egg incubation temperatures. Warmer temperatures lead to higher ratio of female turtles. Further, extreme high temperature incubation can lead to reduced nest hatching success. Both factors are important for threatened sea turtle conservation and their population recovery from substantial losses incurred during the last century. Measuring in situ nest incubation temperatures is onerous and disturbs the nest, potentially risking egg loss. Developing proxies for nest incubation temperature may help conservation scientists predict species recovery without invasive nest monitoring. Using NOAA National Weather Service, National Ocean Service, and National Data Buoy Center hourly meteorological data available along the southeast coast from Edisto, SC south to Jacksonville, FL, approximately 50 nautical miles inland to 50 nautical miles offshore, we developed an hourly air-temperature model for all 14 Georgia barrier islands during 2017-2024 sea turtle nesting seasons. Combined with Georgia Department of Natural Resources sea turtle nesting data, we estimated air temperatures for the incubation of each individual nest on Ossabaw Island, GA during these seasons. Analyses will be presented comparing estimated air temperature and measured in situ nest temperatures on Ossabaw for multiple seasons during this time.

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Shell-bag oyster reef restoration impacts on salt marsh conservation in coastal Georgia

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Salt marshes are highly productive intertidal ecosystems that capture and store carbon through biomass and sediment burial for long-term carbon sequestration. Ongoing threats to these blue carbon ecosystems from accelerated sea-level rise and increased coastal development necessitate effective conservation strategies for coastal land managers. In Georgia, a commonly used nature-based strategy for conserving salt marshes has been the restoration of fringing oyster reefs through bagged oyster shell deployment. These shell bags provide a hard substrate for oyster spat recruitment and mitigate erosion through enhanced wave attenuation and sediment capture. Using aerial imagery and elevation data collected by Georgia DNR's Coastal Resources Division through UAV surveying, this study assesses changes in salt marsh vegetation and coastal geomorphology before and in the years following shell-bag deployment. Shell-bags were deployed in September 2023, and subsequent aerial surveys were conducted 5-, 8-, 13-, and 24-months post restoration. Initial results suggest greater vegetation growth rates and marsh migration at restoration sites than nearby control sites, although there is considerable variability among sites. Further analysis will determine which factors, such as hydrodynamics, marsh geomorphology, and position in tidal prism, influence shell-bag oyster reef restoration for salt marsh conservation.

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Associations between mangroves & oyster reefs in the Guana Tolomato Matanzas National Estuarine Research Reserve

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Foundational species like smooth cordgrass (Spartina alterniflora) and the eastern oyster (Crassostrea virginica) provide stability within northeast Floridian ecosystems. A lack of hard freezes has caused mangrove expansion, outcompeting saltmarsh grasses. Recently, mangroves have established on oyster reefs in the Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR). Little is known about the interactions between C. virginica and mangroves. Will mangroves outcompete oysters for space and/or increase sedimentation? Do mangroves reduce heat stress, benefiting oysters? In summer 2025, sedimentation, temperature, and live oyster cover were measured on oyster reefs with black and red mangroves. Accretion tiles and deposition traps were deployed to estimate sediment accretion and deposition rates. Sediment organic matter was analyzed to infer sediment source. Preliminary results suggest live oyster cover was significantly higher under red mangroves compared to outside the canopies ($p = 0.005$). Control sites had higher daily deposition rates compared to under red mangroves. Therefore, prop roots may aid in oyster larvae establishment. Oyster reefs had the highest daily accretion and deposition rates across all habitats. Future oyster management and shoreline protection may benefit from this research as mangroves will likely continue to establish throughout the GTMNERR estuary.
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Feeding Matters: Optimizing Frequency to Improve Health Outcomes in Captive Cassiopea Jellyfish

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Upside-down jellyfish (Cassiopea spp.) are increasingly used in biomedical, ecological, and aquarium-based research due to their mixotrophic lifestyle and ease of care. However, there remains a notable lack of standardized husbandry protocols—particularly in feeding frequency—which can affect growth, health, and reproducibility across studies. Inconsistent feeding regimens may obscure biological trends and limit the comparability of findings between laboratories. This study investigates how feeding frequency affects the condition of captive Cassiopea. Tagged juvenile jellyfish are maintained in four tanks connected to a shared sump system to ensure consistent environmental parameters. Two treatment groups are compared: one fed seven times per week and another fed three times per week. After a ten-week period, individual changes in bell diameter and oral arm length are used to assess health outcomes. Preliminary findings suggest that more frequent feeding promotes improved growth and overall condition. Given Cassiopea's reliance on photosynthetic symbionts, their response to different feeding frequencies offers insight into the balance between heterotrophic intake and autotrophic support. Results from this study contribute to the development of standardized husbandry protocols, enhance aquaculture practices, and improve our understanding of jellyfish symbiosis, feeding ecology, and experimental reproducibility.
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Tracking Diurnal Hypoxia and Geochemical Impacts in a Shallow, Well-Mixed Subtropical Estuary, the Banana River Lagoon, Florida.

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Eutrophication and hypoxia have contributed to deteriorated water and sediment quality in coastal systems around the globe. Hypoxia can change how nutrients are cycled and assimilated within ecosystems, thereby contributing to a positive feedback loop, where sediments can switch from a sink to a source of dissolved nutrients, reinforcing eutrophication. In shallow, well-mixed systems, hypoxia often occurs as chronic, short-duration, diel, or episodic events. As a result, the symptoms of hypoxia are often cryptic and go undetected by established water quality monitoring efforts. A network of >80 bottom water dissolved oxygen monitoring stations was established in Banana River Lagoon, Florida to track the spatial and temporal extent of hypoxia. These data are combined with results from extensive benthic flux monitoring and laboratory experiments to model the impacts of chronic short duration hypoxia on concentrations and cycling of nutrients. Enhanced benthic fluxes of phosphorus under anaerobic conditions help to explain a >50% increase in dissolved phosphorus concentrations in Banana River Lagoon, despite no appreciable change in external loading. These new data and models provide new science-based tools for managers to characterize internal nutrient loading that can result from expanding spatiotemporal extents of Hypoxia.
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Seasonal Dynamics of Hematodinium perezi Infection in Juvenile Blue Crabs (C.sapidus) within Estuarine Nursery Habitats

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Blue crabs (Callinectes sapidus) play a central role in estuarine food webs while also supporting coastal fisheries, making factors that regulate their early-life survival critical to population stability and resilience. In North Carolina estuaries, juvenile blue crabs concentrate in seagrass nursery habitats, where high densities and environmental stress may increase susceptibility to disease-mediated mortality. Hematodinium perezi is a parasitic dinoflagellate potentially responsible for significant blue crab mortality events, yet transmission dynamics and population-level impacts in NC are poorly understood. Disease expression and virulence are strongly influenced by environmental conditions—particularly salinity and temperature. Between June and November 2025, specimens were collected monthly from seagrasses in the southern Outer Banks of NC to assess H. perezi infection prevalence and examine potential spatiotemporal transmission patterns. Infection status was determined through hemolymph DNA extraction and qPCR targeting the ITS2 region. Based on prior work demonstrating strong seasonality and heightened susceptibility in juveniles, we expected infection prevalence to increase through summer and peak late summer to early fall. We further anticipate spatial hotspots of infection in warmer, higher-salinity nursery areas influenced by ocean exchange. Collectively, early-life infection may represent a critical bottleneck for blue crab populations, given consequences for recruitment and future spawning stock.

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Translating water quality research on Nu'uuli Pala Lagoon into educational illustrations

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This NOAA-funded project aimed to translate findings and broader implications of the impacts of groundwater and stream water on water quality issues within the Nu'uuli Pala Lagoon. The Nu'uuli Pala Lagoon is the largest and most threatened wetland in American Samoa, located on the largest and most populated island, Tutuila. As per the NSF definition, research translation describes "conducting academic research into tangible solutions that benefit the public." This research identified and quantified submarine groundwater (SGW) discharge and nutrient loading from groundwater discharge and streams, and provided insight into primary producers and sources of nitrogen in the Pala Lagoon. A main component of the translation project is the creation of a website to share these findings with the public in American Samoa and interested audiences worldwide. Included on this website, as a visual form of accessible education, are illustrated graphics demonstrating the processes of SGW discharge, the volume of its flow into the lagoon, and a map of the lagoon's watershed. This presentation will share the illustrations and the process of turning technical scientific information into accessible educational content.

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Salty Salamanders! Comparing the Osmoregulatory and Physiological Responses of Barrier Island and Mainland Aquatic Salamanders to Acute Salinity Stress

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Coastal freshwater wetlands (CFWs) support wide faunal assemblages, and their integrity is threatened by a combination of land loss, hydrological modification, and salinity intrusion. Two-toed Amphiuma (Amphiuma means) are large, fully-aquatic salamanders endemic to the Southeastern Coastal Plain and function as important mid-trophic consumers in CFWs. A. means populations are present on three of Georgia's barrier islands, with this inherent spatial and genetic isolation potentially leading to an increased tolerance to salt stress. In this study, we evaluate potential differences in the physiological response of A. means from barrier-island and mainland populations when exposed to acute salinity stress. Individuals from both groups were subjected to environmentally relevant increases in salinity within an intermittent flow-through respirometry system to quantify cutaneous respiration and blood plasma osmolality. Preliminary analyses indicate that cutaneous respiration and plasma osmolality exhibit similar responses across both 5-ppt and 10-ppt exposures, suggesting that A. means may possess a capacity to regulate respiratory and osmotic function under acute salinity stress. This work provides novel insight into the physiological tolerance of A. means and enhances our ability to anticipate how coastal amphibian populations may respond to future environmental change in imperiled freshwater ecosystems.

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Biogeochemical Cycling of Particulate and Dissolved Total Inorganic Arsenic in the Lower Cape Fear River Watershed

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This research seeks to understand the mobility and biogeochemical cycling of dissolved and particulate arsenic in tidal creeks in the lower Cape Fear River watershed, southeastern North Carolina. Results to date show that dissolved total inorganic arsenic (TIAs) concentrations averaged 14.8 nM (range 9.3-21.8 nM) while particulate TIAs concentrations averaged 1.3 nM (range 0.7 to 3.6 nM). These data indicate that the dominant form of TIAs in the water column is in the dissolved state (92%) and the remaining 8% occurring as particulate TIAs. Particulate TIAs is positively correlated with both particulate iron and manganese, suggesting that TIAs is associated with Fe-Mn phases on particle surfaces, pointing to a similar transport mechanism. In future work, sampling will include sites further along the heads of tidal creeks to determine distributions of analytes along the creeks, as well as identification of potential sources of these analytes.

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Counting on Seeds: Evaluating Methods for Assessment of a Seagrass Seed Bank in the Indian River Lagoon, Florida

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The Indian River Lagoon (IRL) is a 250 km estuarine system that has experienced large-scale loss of seagrass over the last two decades. Recovery via sexual reproduction is an area of increasing interest. Seed and vegetation densities provide valuable information about natural recovery potential and help assess potential restoration sites, however, the lack of a standardized method to assess seagrass seed banks has appeared as a major gap, even while vegetation monitoring is still extensive. This study compares sampling approaches used across three efforts to develop a feasible and replicable method for seed bank assessment. Initially, ten sediment cores were composited into a single sample per site. Building on that data, five replicate cores were collected at shallow and deep habitat zones, along with an additional set of twenty haphazardly placed cores at seven sites to evaluate fine-scale spatial variability. By analyzing how replication, location, and distribution influence density estimates, this project aims to identify the minimum sampling effort needed to generate reliable, comparable data across the IRL. The resulting standardized methodology will be recommended for restoration practitioners to better inform selection of sites and to ultimately improve understanding of the capacity for natural seagrass recovery in the IRL.

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Seasonal patterns in carbon and alkalinity cycling in a temperate tidal marsh creek (Virginia)

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Varying watershed inputs of nutrients, particulates, organic matter, and dissolved inorganic carbon (DIC) combined with dynamic physical, chemical, and biological processes, lead to complex patterns in estuarine biogeochemistry that vary over both space and time. Tidal marshes within estuaries can act as sources or sinks of particulate organic carbon (POC), dissolved organic carbon (DOC), DIC, and total alkalinity (TA) to the adjacent estuary, although this remains understudied. To that end, we measured DIC, DOC, and POC along with pH, TA, calcium ion, and water quality parameters in the water column of Taskinas Creek, a temperate tidal marsh–upland forest system that empties into the York River, a Chesapeake Bay tributary. Surface samples were collected hourly for 24 hours seasonally for 2 years, allowing for tidal, seasonal, and annual timescales to be observed. Taskinas Creek is part of the Chesapeake Bay National Estuarine Research Reserve, which has continuous water quality monitoring data for this location, including water temperature, salinity, and depth. DIC and TA varied inversely with salinity, suggesting tidal control over their patterns, with higher DIC and TA associated with low tide. This dataset will eventually be used to calculate fluxes of carbon and TA to/from the adjacent estuary.

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Per- and Polyfluoroalkyl Substances (PFAS) in Spartina alterniflora: Visualizing PFAS in Emergent Vegetation

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Spartina alterniflora dominates salt marsh ecosystems throughout the eastern coast of the Americas, providing erosion control, carbon sequestration, and flood defense to the coastal ecosystems they inhabit. Per- and polyfluoroalkyl substances (PFAS) have been found ubiquitously throughout the environment, including wetlands. How PFAS moves through the environment remains unknown, and phytoremediation by wetlands is a promising avenue to remove PFAS from the environment. In this study, S. alterniflora seedlings were exposed to four PFAS of varied chain length in a greenhouse, and tissues were harvested at multiple time points. Using scanning electron microscopy (SEM) with an energy dispersive spectroscopy (EDS) detector, samples of roots and leaves were analyzed to gather spectral and map data. Spectra will be used to determine the presence or absence of fluorine (F) in the tissues, while SEM-EDS map images will highlight the distribution of F over a cross-sectional sample of roots and shoots across plants exposed to the different treatments and time points. The results of this study will visualize the location of PFAS in plant tissue allowing inferences to how they move through tissue, providing insights about the movement of four PFAS in the vegetated, saline environment.

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Traversing the Tolomato: An Investigation of Potential Eutrophication Within the GTM Research Reserve

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Nutrient loading into estuaries has the potential to negatively impact ecosystem health. The implications of eutrophication can be witnessed in environmental health crises like increased regularity of harmful algal blooms and consumption of toxic fish and shellfish, or in damaged ecosystem functions, like sediment hypoxia and decreased biodiversity. However, each estuary is unique and experiences its own local stressors and environmental processes, thus efficient management actions are best informed by estuary-specific investigations. Leading symptoms of eutrophication are an increase in chlorophyll-a concentrations, a measure of microalgae biomass, and a decrease in dissolved oxygen concentrations, both of which are recently evident within the Tolomato River of the Guana Tolomato Matanzas National Estuarine Research Reserve (NERR) in Northeast Florida. The NERR System-Wide Monitoring Program provides the advantage of standardized, long-term monitoring allowing trend analysis of water quality parameters that reveal early symptoms of eutrophication within the Tolomato River. An exploration of potential drivers (e.g., residence time, precipitation, and anthropogenic impacts) of eutrophication within this estuary through nutrient source tracking and land-use change mapping aims to support early management actions and suppression of unsustainable ecosystem damage.

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Spatial and Vertical Patterns in Microbial Osmolytes Across a Coastal Gradient

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Osmolytes are small organic molecules required for cellular homeostasis that accumulate at high intracellular abundances in aquatic microbes. As carbon substrates and sources of nitrogen and sulfur, osmolytes likely comprise an important component of elemental cycles, yet factors affecting their production and fate remain largely unknown. Because coastal zones are sites of rapid and significant elemental cycling, understanding controls on osmolyte standing stocks along coastal transitions is particularly important. Accordingly, samples for intracellular osmolyte characterization were collected in November 2025 across a six-site transect on the North Carolina coast that extended from the Cape Fear River discharge plume to the Gulf Stream as part of an ongoing seasonal sampling effort. Targeted metabolomics using liquid chromatography–tandem quadrupole mass spectrometry will be employed to measure a suite of osmolytes (e.g., glycine betaine, DMSP)—concomitantly with microbial abundance (e.g., cell counts), community composition (e.g., 16S rRNA gene analysis), and physicochemical parameters (e.g., nutrients, salinity)—across vertical profiles at each site. Together, this work will examine how osmolyte profiles are shaped by microbial community structure and environmental conditions, thereby enhancing our understanding of elemental and nutrient cycling in coastal microbial communities across spatial and vertical gradients.

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Evaluating Carbon Storage Potential in a Fringing Salt Marsh

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Salt marshes are highly productive ecosystems that provide many benefits including long-term carbon storage. This study will quantify the carbon content of water, plant, and soil pools plus atmospheric fluxes in a fringing salt marsh along the Cape Fear River in Wilmington, NC, estimated at approximately 3.5 hectares. Pools were sampled at 10 randomly selected plots, where we clipped aboveground biomass from quadrats, extracted 30 cm deep cores for belowground biomass, cored soil to 20+ cm, and extruded ~100 mL of porewater using sippers. Carbon concentrations will be measured from each of these samples using an elemental analyzer and converted to mass carbon from biomass, bulk density, and estimated water volume. Water volume will be estimated from repeated discharge measurements every 15 minutes using an Acoustic Doppler Current Profiler at the creek mouth. Simultaneously, surface water will be sampled every 30 minutes at the creek outlet to determine dissolved and particulate carbon concentrations. After Spring green-up, we will measure photosynthesis and soil respiration at 4 of the plots. We expect that this work will reveal a highly productive marsh with key carbon storage pools, which will be a useful baseline for ongoing evaluation of ecosystem dynamics along the estuary.

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From Exploration to Analysis: Building Data Skills with Open Access Environmental Datasets

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Gaining hands-on experience with real data in an accessible way is important for students. To gain this experience, we explored environmental data from the Southeast Coastal Ocean Observing Regional Association (SECOORA). Open-access datasets such as SECOORA are useful because the data are simple to search, navigate, and visualize with a large potential range of scientific questions. We first explored the online data portal and learned to access, filter, and download data for analysis. We compiled metadata from the ten years of available glider deployments into an Excel sheet, then categorized by season, sorted based on latitude, and separated into a northern and southern region of the South Atlantic Bight (SAB). R was used to create depth profiles of temperature and salinity for select gliders. Through this process, we gained a base understanding of coding for more complex analyses, experience in visualizing and interpreting data in different ways, and confidence in being able to find data to answer scientific questions. Moving forward, we will use glider data to compare seasonal Chl trends, consider and compare major local storm events from the past 13 years, and create a guide for students to help navigate, visualize, and analyze large datasets.

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Developing Multi-Variable Habitat Suitability Model for Seagrass Restoration

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Seagrass restoration remains an evolving practice, with restoration success often limited by multi-variable site-selection frameworks. Many restoration efforts rely on a narrow set of environmental criteria, potentially overlooking interacting factors that influence long-term persistence. In this study, we developed a habitat suitability model incorporating sediment characteristics, spatial trends, and historical data across short-, medium-, and long-term timescales to identify sites most resilient to environmental stressors. A Habitat Suitability Index (HSI) was combined with a Monte Carlo simulation [MM1.1]approach to assign parameter weights based on historical records and field-collected data while assessing resistance to parameter effect variations. This method generates random parameter weight combinations to reduce bias toward expected preferred parameters, increasing confidence in results independently of unknown exact parameter interactions. Short-term results (one year) indicate that sites with pre-existing seagrass exhibited higher overall suitability, with grain size distribution, increasing infaunal abundance and distance from shore emerging as key drivers of site performance. This adaptable modeling framework can be integrated into environmental planning and restoration protocols to support more robust, data-driven seagrass restoration site selection.

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Shrimp Black Gill Disease Prevalence and Severity Across North Carolina

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Penaeid shrimp hold immense economic and ecological significance across North Carolina (NC), providing key ecosystem services within their coastal environments and supporting a highly profitable fishery. Penaeid shrimp have been in decline across the southeastern United States, however, with one proposed cause for this decline being shrimp black gill disease (sBG). This disease is associated with the gill parasite Hyalophysa lynni, and causes the formation of melanized nodules in the gill tissue that drive increased host mortality due to enhanced predation and vulnerability to changing environmental conditions. Due to its recent detection in NC, sBG remains poorly understood across the state. My work aims to determine the main drivers of sBG prevalence and severity across NC. To address this aim, field data was collected from multiple estuarine sites (n=42) from 7 different water bodies across the Pamlico Sound and southern NC rivers between 2022-2025. Analysis of this data revealed that prevalence of sBG appears to be primarily driven by water temperature and salinity across NC. Additionally, there is a seasonal component to sBG prevalence, with highest prevalence levels occurring during late summer/early fall. Understanding sBG prevalence and severity in NC is crucial for addressing its impact on penaeid shrimp populations.

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Investigating the Population Genetic Structure of Mudsnail-Specific Trematodes as Bioindicators of Definitive Host Biogeography

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Parasites with complex life cycles that infect multiple host species are increasingly being recognized as tools for investigating host ecology. Digenean trematodes (i.e., flukes) can typically be collected within abundant gastropod intermediate hosts, yet can be informative of the biogeography of their definitive hosts. Research has shown that the population genetic structure (i.e., distribution of genetic diversity over geographic space) of flukes often reflects the population connectivity of their definitive host. We will test this concept by collecting nine estuarine fluke species along the U.S. Atlantic coast from eastern mudsnail (Ilyanassa obsoleta) intermediate hosts that differ in their definitive hosts, including one fluke reliant on diamondback terrapins, four dependent on birds, and four reliant on teleost fishes. We will then use comparative population genetics of the COI mtDNA gene to test our hypotheses, which include: 1) the terrapin fluke will exhibit the highest degree of population isolation and genetic structure; 2) avian flukes will depict the highest rates of gene flow and lowest structure; and 3) fish flukes will be intermediate. This project will improve understandings of the distribution and genetic diversity of nine understudied trematode species, while also demonstrating their utility as surrogates of vertebrate definitive hosts population ecology.

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Modeling the Impacts of Climate Driven Weather Changes on Fisheries along the U.S. East Coast

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This study examines how climate driven changes in weather conditions affect commercial fisheries along the U.S. East Coast, using the summer flounder fishery as a case study. We use historical NOAA offshore buoy data on winds and wave heights to calculate the historical spatial-temporal distribution of "bad weather days" (that prevent fishing) by fishing port and vessel size. We then develop a representative set of alternatives, hypothetical spatial-temporal distributions of bad weather days based on climate projections. The influence of changes in the distribution of bad weather days on the spatial-temporal distribution of fishing vessel effort and catch is investigated using a fishery simulation model. Model results inform discussion of the differential impacts of changing weather across states and vessel sizes, implications for adaptive fisheries management, and climate resilience planning.

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Climate Change Impacts on Farmed and Wild Oysters

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Oysters support commercial and recreational fisheries, and hold considerable economic and cultural value in North Carolina. However, oysters are increasingly exposed to climate change related stressors that can interact with factors, such as pathogens and predation, to negatively impact oyster growth, reproduction, and survival. Widespread mortality events in North Carolina oyster farms have grown in frequency, but their drivers remain poorly understood. Building on prior research, this project used field-based monitoring to assess how environmental variability influences oyster performance at the Duke Aquafarm and four other oyster farms in North Carolina, particularly during summer and fall months when mortality peaks. Continuous environmental data were collected using oceanographic sensors that measured water temperature, salinity, pH, dissolved oxygen, and wave energy. Oyster performance was evaluated through repeated assessments of growth, body condition, and mortality across four genetic family lines to identify links between environmental stress and performance. Environmental conditions differed significantly between farms, with oysters at some sites exhibiting limited growth and poor body condition. Mass mortality events were also detected at these sites. A publicly available web-based platform was developed to share findings and foster communication among regional stakeholders to support adaptive management.

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On a Nutrient Budget: How Osmolyte Production by Coastal Bacteria Responds to Nitrogen Availability

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Aquatic microbes produce small molecules called osmolytes to maintain turgor pressure and homeostasis. Osmolytes are laible sources of carbon and nitrogen and accumulate in high intracellular concentrations, making them an important portion of dissolved organic matter in aquatic ecosystems. However, information regarding osmolyte cycling remains largely unknown, limiting our understanding of how they influence carbon and nitrogen patterns. To investigate how nitrogen availability governs osmolyte production in microbes, we grew two highly abundant, coastal, heterotrophic bacteria, Ruegeria pomeroyi and Alteromonas macleodii, under nitrogen (ammonium) replete and limited conditions. The bacteria were monitored until low-nitrogen samples reached stationary phase, at which point samples were collected for intracellular osmolyte profiling, analysis of particulate organic carbon, and cell abundance. Over 20 different osmolytes, some nitrogen-containing (e.g. glycine betaine) and some not (e.g. sucrose), were characterized using standard extraction methods and liquid chromatography-tandem mass spectrometry. We hypothesized that decreases in nitrogen availability will result in lowered abundance of intracellular nitrogen-containing osmolytes and increases in nitrogen-independent osmolytes. Our results will elucidate species-specific differences in osmolyte production between these different coastal bacteria and enable a better understanding of how they respond to nitrogen limitation.

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Effects of meadow type on Zostera marina seed bank structure and function.

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Zostera marina in North Carolina (NC) provides nursery habitats for fish, sequesters Carbon, and prevents erosion. At the southern edge of its range, Z. marina experiences seasonal summer declines when water temperatures exceed its thermal optimum (23–25 °C). Historically, meadows recovered each winter; however, increasing temperatures are now driving annual declines in Z. marina area. Co-occurring in NC meadows is the tropical seagrass Halodule wrightii, which persists year-round, and maintains meadow structure during summer months. However, it does not fully replace lost Z. marina biomass or area. NC Z. marina follows a mixed-annual reproductive strategy that relies on a seed bank for recovery. Seeds are released in spring and remain buried during stressful summer conditions. Meadow structure during this period may be critical for retaining viable seeds. This study determined if meadow type (Zostera-dominant, Mixed – Zostera+Halodule) affects Z. marina seed bank structure and function. Seed bank cores were collected from Middle Marsh and Topsail, NC in May (post-flowering) and September (post-seasonal decline), and viability was assessed. These results will improve our understanding of the influence of meadow type on seed bank structure and function and its implications for the recovery potential of these important coastal habitats.

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Drone Mapping of Ghost Crab Burrows Using Artificial Intelligence

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Ghost crabs (Ocypode quadrata) are commonly used as bioindicators of sandy beach condition and human disturbance, yet conventional burrow surveys are time-consuming, spatially constrained, and subject to observer bias. This study evaluates the use of low-altitude drone imagery combined with artificial intelligence and ArcGIS analysis to improve the efficiency and scale of ghost crab burrow mapping on sandy beaches. High-resolution imagery was collected using a drone and processed in ArcGIS, using both a traditional plotting method (by hand) and by training a machine learning based object detection model to identify ghost crab burrow openings based on their morphological characteristics. Automated detections were converted to georeferenced point features, allowing for rapid estimation of burrow density, spatial distribution, and larger scale burrow surveys. Model outputs were validated against the manually annotated datasets, demonstrating strong agreement while substantially reducing survey time and field effort compared to traditional methods. Preliminary results highlight the potential for AI-assisted drone surveys to enhance non-invasive monitoring of sandy beach ecosystems, particularly in sand dunes which may be harmed by more invasive survey methods. This approach provides a more time-effective and reliable method for incorporating ghost crab burrow data into long-term coastal assessment and management strategies.

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Seasonal Shifts in Trophic Energy Flow and Diet Consumption of Mummichogs, Fundulus heteroclitus in Coastal Marshes of Myrtle Beach, SC

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Coastal marsh ecosystems undergo strong seasonal changes that influence energy flow and nutrient cycling. The mummichog (Fundulus heteroclitus) is a key indicator species and plays a critical role in transferring energy within marsh food webs. This study examines seasonal shifts in trophic energy flow and diet consumption of F. heteroclitus across multiple saltmarsh sites along the Myrtle Beach, SC coastline. Monthly sampling is currently underway, with data collection continuing until a full annual data set is obtained. Isotopic analyses of stomach contents and body tissue will be performed to elucidate temporal trophic shifts. Preliminary results indicate clear seasonal differences in body size and condition, with individuals collected during early fall exhibiting greater body mass compared to those sampled in winter months, which are smaller and leaner. These patterns are consistent with previous research documenting seasonal change in diet, abundance, and behavior, including winter burrowing that limits detectability. Continued data collection will allow for a comprehensive analysis of seasonal trends and further clarify the role of mummichogs in nutrient cycling and energy transfer at the base of coastal marsh ecosystems.

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Seagrass saviors? The possibility of parasitic trematodes indirectly affecting seagrass ecosystem structure and functioning through snail host manipulation

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Seagrasses are vital habitats for marine communities. Amongst the diversity of organisms that may influence seagrass habitats are epibionts that may inhibit seagrass growth rates, small mesograzers (e.g., amphipods) that consume epibionts, and larger epibiont grazers such as the eastern mudsnail (Ilyanassa obsoleta). This snail hosts 9 parasitic trematodes that could modify snail consumption behavior of epibionts, with higher consumption rates when snails are infected by certain trematode species. As a result, higher infection prevalence of some trematodes could heighten epibiont grazing and therefore have an indirect positive effect on seagrass growth. To examine this, we collected seasonal data on snail and seagrass (Halodule wrightii) density, epibiont biomass on H. wrightii blades, trematode diversity in snails, and mesograzer diversity across 8 sites in Bogue Sound and the Straits of North Carolina. We expect seagrass density to increase during warmer seasons, with larger snail populations resulting in lower epibiont loads. Both trematodes Lepocreadium setiferoides and Zoogonus lasius were most prevalent across all time-points and have previously shown higher epibiont consumption by I. obsoleta. This could lead to direct and indirect correlations with epibiont biomass, seagrass growth, and mesograzer diversity, demonstrating connections between infection prevalence, snail grazing, and ecosystem functioning.

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Long-term trends in ribbed mussel (Geukenisa demissa) demographics in Georgia salt marshes

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Ribbed mussels (Geukensia demissa) are ecosystem engineers and secondary foundation species in salt marsh habitats; they stabilize sediments, deposit nutrients, and increase marsh resilience to stressors. Although many studies explore their distribution, there is a lack of long-term studies on mussel demographics, which are critical to predict how mussel populations might change with future climate conditions. This study examines how patterns in size, abundance, growth rate, and predation of ribbed mussels is changing over spatiotemporal scales by leveraging long-term data from the Georgia Coastal Ecosystems Long Term Ecological Research (GCE LTER). From 2000-present, Geukensia populations were monitored annually at ten sites across the Altamaha, Doboy, and Sapelo Sounds in coastal Georgia. Mussels were collected in random quadrats at three locations of the mid marsh and creek bank areas at each site. Preliminary analysis suggests that both abundance and size of adult ribbed mussels is increasing over time throughout the domain. We selected the site with the highest abundance of mussels over time for more in-depth analysis, including growth rate calculations and predation prevalence. By comparing environmental and morphometric data across broad spatiotemporal scales, this study can help generate predictions of mussel growth, abundance, and varying ecosystem functions.

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Use of in situ fluorescent dissolved organic matter sensors for high-resolution assessment of carbon dynamics in two contrasting Southeastern estuaries

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Dissolved organic carbon (DOC) is often the dominant form of reduced carbon in aquatic ecosystems and plays a vital role in biogeochemical and ecological processes. Watershed input of terrestrial organic matter, which commonly has fluorescent properties, is a major component of estuarine carbon budgets and therefore a key variable for understanding coastal DOC dynamics. We measured fluorescent dissolved organic matter (FDOM) at high-frequency (15-minute) intervals using in situ sensors in two contrasting estuaries: a shallow, ocean-dominated lagoonal system (North Inlet) and a river-dominated system with an expansive watershed (Winyah Bay). In both estuaries, FDOM concentrations (normalized to a quinine sulfate standard) were highly dynamic, exhibiting tidal, seasonal, and event-based variability. Additionally, FDOM dynamics differed between the two systems, with higher mean concentrations occurring in Winyah Bay (103.7 ± 33.6 QSU) than in North Inlet (34.8 ± 30.7 QSU). However, variability relative to average concentrations was greater in North Inlet (88%) compared to Winyah Bay (32%), suggesting that FDOM cycling in North Inlet may be more strongly influenced by local-scale rain events. While further investigation is needed to clarify factors driving FDOM dynamics, our results highlight the value of high-resolution FDOM measurements for capturing DOC variability across many ecologically relevant timescales.

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Brachial Macroparasite Loads in Estuarine Young-of-Year Striped Mullet (Mugil Cephalus)

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Climate change is a growing threat to marine habitats globally. One ecological impact that warming water temperatures poses is the increased metabolic rate of many parasite species. Their promoted reproductive and feeding rates could pose a threat to the stability of many host populations. Parasites of the gills, or brachial parasites, can have various negative effects on fish populations, especially in commercial fisheries. As parasitism is not limited to a specific taxon and comprises a large diversity of ecomorphs and behaviors, geographically distinct areas may be differentially affected by the changing prevalence of parasites. This study aimed to survey current brachial parasite abundance and prevalence in the young-of-year population of striped mullet (Mugil cephalus) from a northern South Carolina estuary. Abundance and prevalence were relatively healthy for this population when compared to historic records, although the limitation of only YOY specimens means that the parasite community which parasitizes the juvenile and adult stages are unobserved, and therefore future research is required to determine the full current impact parasites could be having on the striped mullet population in northern South Carolina. Additionally, DNA barcoding was used to provide a more accurate identification of subsamples.

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Water temperature effects on timing of Zostera marina sexual reproduction in North Carolina

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Seagrasses, submerged marine angiosperms, serve vital roles in nearshore environments including providing nursery habitat and sequestering carbon. Unfortunately, seagrasses are declining globally due to climate change, increased pollution and physical disturbances. Zostera marina, eelgrass, is the dominant species in temperate seagrass meadows throughout the northern hemisphere. At the southern end of its range in North Carolina, Z. marina has experienced significant heat stress resulting in a shift from perennial to mixed annual life history strategies. While studies have focused primarily on impacts of summer heat stress on meadow declines, less is known about how temperatures are changing during key periods in eelgrass sexual reproduction. Timing of temperature cues for flowering, seed release, and germination were compared over 30 years (1995-2024) in Back Sound North Carolina to investigate shifts in species phenology. Changes in timing could significantly impact the success of eelgrass sexual reproduction, potentially limiting recovery following annual eelgrass declines.

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Salt Marsh Efforts in the ACE Basin NERR: From Oyster Restoration to Marsh Migration

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The ACE Basin National Estuarine Research Reserves (NERR) is working on a wide range of efforts to assess and enhance marsh habitats using a variety of techniques. The ACE Wetland and Water Level (WWL) site has been monitored for over 10 years gathering data on vegetative species composition, cover, and density plots and surface elevation tables (SETs). More recently, we have expanded our monitoring area using Uncrewed Aerial Systems (UAS)-based, aerial, and satellite data collection, enhancing current NERR monitoring efforts to better inform marsh vulnerability metrics at a local marsh platform scale. In addition, a marsh migration mapping effort was undertaken to identify unprotected parcels with vulnerability potential to future sea level rise. An ArcGIS Story Map for the public and an Experience for Stakeholders were created to share the information. Finally, living shoreline testing and implementation of oyster-based restoration efforts have been conducted to enhance the resilience of the marsh platform. All of these efforts provide new knowledge and information for the protection of salt marsh habitats in the ACE Basin NERR.

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A Holistic Approach to Eastern Oyster Crassostrea virginica Restoration in the Hudson-Raritan Estuary System

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The once abundant Eastern Oyster, Crassostrea virginica, has noticeably declined in the Hudson, Raritan, and Sandy Hook estuarine system. Despite the historic decline in population size, little data has been collected on oyster population metrics in the Sandy Hook and Raritan Bay area. A data gap regarding oysters exists here, further complicating restoration efforts. A holistic approach helps to propel restoration efforts while gathering knowledge needed to improve management of the species. A broad shoreline survey across the entire estuarine system will quantify local Eastern Oyster populations and locations. Reef building projects and environmental DNA experiments will be conducted in the protected waters around Naval Weapons Station Earle. Environmental DNA sampling at and around oyster castle sites will be used to understand microbial, invertebrate and fish community composition, which can help determine success of the installations. By continuing restoration efforts through aquaculture and reef building, progress that has already been made can be maintained. Further knowledge on local oyster populations through research can help direct the future revitalization of the species.

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Influence of Habitat Type and Location on Shell Strength of Bay Scallops in Long Island, New York Estuaries

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Eelgrass meadows were once abundant habitats for the northern bay scallop (Aregopecten irradians), a commercially and recreationally important species, along the U.S. Atlantic Coast. Anthropogenic activities have led to declines of eelgrass habitat, leaving managers to search for alternative substrates for scallops. Previous studies suggest that the introduced, canopy-forming algal species, Codium fragile, might serve as a suitable alternative habitat for scallops in New York. However, structurally complex habitats, such as seagrass and macroalgae, can lead to trade-offs between growth and survival. For this study, we examined the impact of habitat type on scallop shell strength in two estuaries on Long Island, New York: Shinnecock Bay and Sag Harbor. At each site, scallops were deployed in three different habitats: bare sand, Codium and eelgrass, and harvested after 12 weeks. We measured the length, mass, and crushing index of scallop shells to examine shell thickness and strength. We found that shells from scallops grown in Shinnecock Bay have more mass and are stronger than shells from scallops in Sag Harbor. Additionally, there were differences among habitats within Shinnecock Bay; scallops in eelgrass exhibited the highest crushing index. These results can inform site management decisions for scallops in New York.

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Comparative Analysis of Microplastics in the Sciaenidae Family Between the Marsh and Ocean

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Microplastics in coastal and estuarine systems have been increasing due to human-induced anthropogenic impacts. As these plastics drift through currents, many organisms ingest them. The Sciaenidae family, including Red Drum (Sciaenops ocellatus), Atlantic Croaker (Micropogonias undulatus), and Spot (Leiostomus xanthurus) are common along the U.S. eastern coast and can serve as bioindicators of microplastic contamination. This study investigates the microplastic concentrations in the digestive tracts. Digestive tracts were digested in 4 M KOH for one hour, followed by the addition of hydrogen peroxide for 30 minutes while stirred. The samples are then filtered and analyzed using a 125 µm sieve and a dissecting microscope. Preliminary observations show that microplastic fibers are present in the digestive tracts of these fish at varying concentrations. The concentrations were standardized by the number of microplastic fibers per gram of wet digestive tract mass, ranging from 0 to 15.38 MP/g. Understanding the abundance of microplastics within these species provides insight into pollution pathways, potential ecological impacts, and a basis for future monitoring efforts.

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Soil seed bank response to saltwater intrusion in Florida's coastal marshes

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Florida's coastal freshwater marshes are threatened by climate change, particularly through saltwater intrusion and storm surge. Increases in salinity act as a filter for germination, which can change the composition of plant communities. The response of dominant, mature plants to increased salinity levels is more well known than the response of seeds, crucial for community persistence and regeneration. We will present data on seed germination rates from freshwater wetland soils exposed to treatments that varied in salinity. We expect reduced germination rates and a shift in which species germinate under higher salinity conditions. Evaluating which plant species can regenerate from freshwater wetland seed banks experiencing salinity intrusion will inform predictions about future community composition in these rare ecosystems. This information will be valuable to land managers when making decisions about potential restoration efforts.

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Self-Regulation of Elevation in Created Tidal Marshes

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Tidal marshes are positioned at elevationswithin the tidal frame and must accrete vertically during periods of sea-level rise (SLR) to avoid drowning. The capacity for adjustment of accretion to keep pace with SLR, and optimal target elevations for marsh restoration are related and as yet unresolved questions. For restoration, elevation has been shown to be an important factor, yet achieving precise elevations in restored and created marshes is challenging. In this study, a fifteen-year data set from surface elevation tables (SETs) in the created marshes at Poplar Island, Maryland, in Chesapeake Bay, was analyzed to assess the response of accretion rates to initial elevation and gain insights to support marsh design. The results show that sites at lower initial elevations have higher long-term accretion rates than those constructed at higher elevations, trending toward a convergence in elevation. The response of accretion rates to elevation is similar to the response of biomass production, but the optimal elevations are slightly offset, suggesting contributions of inorganic sediment to accretion at elevations below the optimum for biomass production. The study provides guidance for marsh restoration, demonstrating that even in a microtidal environment, there is leeway in acceptable elevations due to variable accretion rates.

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Areal and LIDAR survey of saltwater intrusion and Ghost Forest extent using Unmanned Autonomous Systems (UAS) on Mattix Run, NJ

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Sea level rise along the eastern seaboard of the United States has resulted in migration of coastal saltwater and saltmarsh vegetation into adjacent brackish and freshwater systems. One of the most vulnerable tidal freshwater systems in the region is dominated by Atlantic White Cedar and also includes adjacent fringing maritime forests of red maple, black gum, sweetgum, pitch pine and American holly. A DJI Matrice 350 RTK with a DJI Zenmuse L2 LIDAR/camera was deployed from an anchored vessel in the creek and flown at 350 ft altitude to collect LIDAR and photo data. A Hemisphere RTK rover was used to determine surface control points for corrections of the position and elevation data. Raw data was processed in DJI TERRA to develop georeferenced RGB point cloud data (horizontal datum NAD83 (2011) and vertical datum NAVD88). Point cloud data was cleaned and visualized in QPS Qimera and analyzed in ARC Pro (ESRI). LIDAR models were overlain onto historical imagery and document a steady progression of tree loss and phragmites invasion of the upstream Mattix Run system.

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Water Quality Monitoring Across the Guana Peninsula to Assess Vulnerability of Coastal Freshwater Wetlands to Saltwater Intrusion

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Freshwater wetlands are exceptionally biodiverse ecosystems that provide habitat to a variety of protected species and serve an important role in protecting inland areas from floods and storm surge. Due to their low elevation and proximity to saltwater systems, coastal freshwater wetlands are especially vulnerable to disturbance from extreme storms or sea-level rise. Here, we examine patterns in water quality across various freshwater wetlands within the Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR) in an effort to assess vulnerability to saltwater intrusion. In total, 11 separate wetlands within the GTMNERR were sampled for porewater salinity and surface water quality (temperature, pH, dissolved oxygen). Porewater wells were constructed, and continuous water loggers were deployed at 5 sites to provide data every 15 minutes on temperature, salinity, and water table level. The most vulnerable marshes within the Peninsula had greater variability in seasonal surface water conditions, with higher salinity and higher water levels in the summer compared to more resilient marshes. Porewater salinity and pH were also found to be consistently higher in vulnerable marshes. Future monitoring will allow for a deeper understanding of these patterns which provide insight into resilience of coastal freshwater marshes and guidance for future management.

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Effect of sediment ammonium and sulfide concentrations on cultured hard clam growth and mortality

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Virginia is the leading state in cultured hard clam production, with the industry valued at $52 million. Recently, large scale mortality events, referred to as Sudden Unusual Mortality Syndrome (SUMS), have caused losses of up to 80% of market-sized clams on some farms. Ongoing research has provided a deeper understanding of SUMS events in the Chesapeake Bay, including application of an ecosystem-hard clam bioenergetics model. However, this model does not include the effects of sediment ammonium and sulfides, environmental toxins that may be associated with clam mortality. We analyzed porewater ammonium and sulfide concentrations from three clam farms in Cherrystone Inlet, the epicenter of Virginia hard clam aquaculture. The highest concentrations were found at a site afflicted with a SUMS event during the project. Concentrations were used alongside the literature to develop filtration and respiration limitation formulations as a function of ammonium and sulfides, which have been incorporated into the model. The model is currently being used to quantify the effect of porewater concentrations on clam growth, energy budgets, and mortality.

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Greenhouse Gas Emissions from Coastal Wetland Soils Across a Marsh to Forest Salinity Gradient

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Saltwater intrusion increases root zone soil salinity and often alters soil oxygen availability, leading to plant stress and mortality. These conditions regulate microbial processes responsible for the production and consumption of greenhouse gases. This study aims to quantify how soil salinity and associated environmental conditions influence greenhouse gas emissions from coastal wetland soils. The study is conducted on Sapelo Island, Georgia, where sea level rise has increased salinity intrusion from marsh environments into adjacent forested areas. We implemented a gradient-based study design with three sampling stations positioned along a marsh to forest transect where soil oxygen ranged from zero to ambient and EC as high as 3 mS/cm. Each station includes gas probes sampling at three depths and preliminary results show soils emitting CO2, CH4, CO, NOx, and other trace gases. Greenhouse gas concentrations are measured using a Shimadzu greenhouse gas analyzer, and soil respiration is quantified using a LI-COR 8100 system. Continuous sensors record changes in the soil environment, while soil samples are collected to measure laboratory EC and carbon and nitrogen using a CHN analyzer. This work will improve understanding of how saltwater intrusion influences biogeochemistry and ecosystem health in maritime forests under progressive sea level rise.

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Onshore to offshore water quality 'Halo' in the Lower Florida Keys

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The Florida Keys hold many sensitive, economically and ecologically important habitats, such as seagrass beds and coral reefs, that depend on good water quality. Unfortunately, water quality in the Florida Keys has deteriorated over the past 40 years, resulting in a decline of hard coral and seagrass cover throughout the Keys. More recently, harmful algal blooms (HABs), including inundations of Sargassum sp. and cyanobacterial blooms, have further degraded the water quality in the Florida Keys. To define the spatial extent of land-based contributions to these HABs, a defined onshore-to-offshore transect in the Lower Florida Keys, spanning from Newfound Harbor to Hawk Channel to Looe Key Reef to offshore, was surveyed from May to December 2025. At each site along the transect, environmental parameters were recorded, and water and Sargassum tissue samples were collected. Environmental parameters included light attenuation (Kd), temperature, salinity, pH, and conductivity. Water samples were analyzed to determine chlorophyll a and sucralose concentrations. Both the water and tissue samples were analyzed for nutrient contents. The data will help define the halo of land-based impacts to sensitive habitats in the Florida Keys and will be useful for resource managers seeking to improve water quality.

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Application of an Adaptable Resilience Planning Framework for Coastal Habitats: Masonboro Island Reserve, North Carolina

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The North Carolina National Estuarine Research Reserve (NC NERR) is utilizing a habitat resilience planning process for its sites to prepare for the effects of climate change within the next 30 years. Building from the development of the NC NERR Rachel Carson Reserve Habitat Resilience Plan, the resilience planning process was applied to the NC NERR Masonboro Island Reserve, a barrier island that protects much of New Hanover County, NC, from the Atlantic Ocean. The resilience planning framework, an easily adaptable and reproducible process, includes knowledge-base development, habitat change analysis, and determination of priority areas and risk identification. This information is then brought to a resilience workshop where local experts provided feedback and brainstorming on appropriate intervention or research and monitoring strategies. Finally, suggested actions from the workshop are put through an internal prioritization process using a modified Resist-Accept-Direct (RAD) framework. Major outputs from this process include several research priorities that will inform future collaborations and resilience actions in the various coastal environments within Masonboro Island Reserve. These priorities are being captured in the Masonboro Island Reserve Habitat Resilience Plan, a living document that will evolve as these research needs are addressed, while helping update our NC NERR Management Plan.

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