Southeastern Estuarine Research Society
Est. 1974

Semi-annual Meeting

March 8—10, 2018

Contributing over 40 years of estuarine and coastal research and management in the southeast

Flagler College
St. Augustine, Florida

PROGRAM & ABSTRACTS

SEERS

The Southeastern Estuarine Research Society (SEERS) is a 501(c)(3) non-profit educational organization dedicated to the informal exchange of interdisciplinary information related to estuaries of the southeastern United States. SEERS promotes discussion of estuarine research, science, and management; promotes discussion of current research projects and management issues; and encourages participation of student colleagues. SEERS membership is largely, but not exclusively, from the states of NC, SC, GA and FL. SEERS typically meets twice per year, including the biennial Coastal and Estuarine Research Federation Conference. SEERS is an affiliate society of the Coastal and Estuarine Research Federation (CERF).
SEERS website: www.SEERS.org

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Southeastern Estuarine Research Society
March 8—10, 2018
Flagler College
74 King Street, St. Augustine, Florida

Schedule at a Glance

Thursday, March 8

3:30 p.m. -- 6:00 p.m.	Registration and Poster set-up
3:30 p.m. – 5:00 p.m.	Light snacks
5:00 p.m. – 6:30 p.m.	Welcome Reception Poster Presenter Introductions Hors d'oeuvres & beverages
6:30 p.m.	Welcome: Erik Smith, SEERS President
6:45 p.m. - 7:30 p.m.	Keynote Address: **"Two decades of tropical cyclone impacts on North Carolina's estuarine ecosystems: Implications for water and habitat quality in a stormier world"** *Hans Paerl, UNC-Chapel Hill Institute of Marine Sciences*

Friday, March 9

7.45 a.m. – 8:45 a.m.	"Coffee and Career Advice" Student Networking Event and Breakfast
8:00 a.m. – 8:55 a.m.	Registration and Poster set-up Breakfast (for all attendees)
8:55 a.m. – 9:00 a.m.	Welcome/Announcements
9:00 a.m. – 10:30 a.m.	Session 1: Ecosystem Processes
10:30 a.m. – 11:00 a.m.	Break

Friday, March 9 – Continued

11:00 a.m. – 12:45 p.m.	Session 2: Special Session, Part 1 Stormy Seas and Water Quality
12:45 p.m. – 2:00 p.m.	Lunch
2:00 p.m. – 3:15 p.m.	Session 3: Water Quality
3:25 p.m. – 4:00 p.m.	Break
4:00 p.m. – 5:30 p.m.	Poster Reception (presenters should stand by their posters – judging will take place at this time)
5:45 p.m.	Shuttles to GTMNERR and Dinner Banquet
6:00 p.m. – 9:00 p.m.	Dinner Banquet
9:00 pm	Shuttles return to TRYP and Flagler College

Saturday, March 10

7:45 a.m. – 8:30 a.m.	Breakfast (for all meeting attendees)
8:30 a.m. – 9:45 a.m.	Session 4: Hydrodynamics and Sediments
9:45 a.m. – 10:15 a.m.	Break
10:15 a.m. – 11:00 a.m.	Session 5: Special Session, Part 2 Stormy Seas and Organismal Responses
11:00 a.m. – 12:00 p.m.	Closing Remarks CERF Presentation, Hilary Neckles Business Meeting and Award Presentations

During registration times, breaks, and lunch, Please be sure to check out the SEERS gear available for purchase. They make great gifts!

Sales help to support student travel awards

SEERS would like to thank the following for their contributions to this meeting:

Our Sponsors:

Flagler College Coastal Environmental Science
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Our Local Host:

Jessica Veenstra, Ph.D., Associate Professor
Department of Natural Sciences, Flagler College

Session Moderators and Anonymous Judges

SEERS Congratulates our Student Travel Award Winners:

Bailey Harding – Coastal Carolina University
Ashlyn Henning – Georgia Southern University
Ashley Holmes – Augusta University
Logan Masterson - Coastal Carolina University
Emeline Ward – Coastal Carolina University

Be sure to stop by the sponsor exhibition tables and say thank you to all our sponsors for their support of the Spring 2018 Meeting!

Thanks to our generous sponsors for their support!

FLAGLER COLLEGE
COASTAL ENVIRONMENTAL SCIENCE

Many thanks to Flagler College's College of Coastal Environmental Science for their donation of meeting spaces, Thursday night's Welcome Reception, and in-kind staff support.


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North Carolina

Directions to conference locations on Flagler College's campus

Thursday Meeting Registration & Welcome Reception:
The Thursday night reception for off-campus guests will be in the first floor of the Markland House (#21 on Campus Map). Enter the building from the north side. If you are arriving from King Street, it is what appears to be the rear of the building.

Thursday Opening Plenary Session:
The Thursday evening plenary session is in the Flagler Room, in the main campus building, the historic Ponce De Leon Hall (#3 on Campus Map). If you are entering from King Street pass through the courtyard, enter through the main front doors, step into the Rotunda, and the Flagler Room is through the large doors to your left, on the west side of the building.

Oral and Poster Presentations:
Friday and Saturday's oral presentations will be in the Gamache Koger Theatre on the first floor of the Ringhaver Student Center (#18 on Campus Map). If you enter the building from Sevilla Street, the theatre is at the back of the building, and there will be signs directing you from the main entrance to the theatre. Friday's poster session will be held in the lobby area near the entrance to the Gamache Koger Theatre.

1. **Hanke Hall**
   - Office of Enrollment Management
   - Office of Admissions
   - Office of Financial Aid
2. **Ponce de Leon Hall**
   - Office of the President
   - Academic Affairs
   - Flagler's Legacy
   - Residence Hall
   - Courtyard
   - Health Services (near Breezeway)
   - Learning Resource Center (near Breezeway)
   - Mailroom (near Breezeway)
3. **Dining Hall**
4. **Kenan Hall**
   - Classrooms & Faculty Offices
   - Educational Media Services
   - Maintenance
5. **Molly Wiley Art Building**
   - Art Department
   - Studios & Faculty Offices
6. **Wiley Hall**
   - Business Department
   - Classrooms & Faculty Offices
   - Office of Study Abroad and International Students
7. **Arbizzani Studio**
8. **Pollard Hall**
   - Classrooms & Faculty Offices
9. **65 Cuna Street**
   - Communication Department
   - WFCF 88.5 FM Radio Station
10. **66 Cuna Street**
    - Communication Department & Faculty Offices
11. **Palm Cottage**
    - Honors Program Office
12. **Thompson Hall**
    - Law Program Director
    - Faculty Offices
13. **Lewis House**
    - Residence Hall
14. **Business Services**
    - Student Accounts
    - Campus Planning
    - Human Resources
15. **Proctor Library**
    - Library Services
    - Computer Labs/Classrooms
    - Office of Services for Students with Disabilities
    - Information Technology
    - Office of News and Information
    - Office of Web Services
    - Office of Marketing and Communication
    - Public Administration Program
    - Faculty Offices
16. **West Lawn**
17. **Palm Garden**
18. **Ringhaver Student Center**
    - Office of the Registrar
    - Office of Student Services
    - Office of Student Success and Advising
    - The Bistro
    - Gamache-Koger Theatre
    - Virginia Room
    - Flagler College Bookstore
    - Classrooms
19. **Crisp-Ellert Art Museum**
20. **Anderson Cottage**
    - Alumni Relations
    - Career Development Center
21. **Markland House**
    - College Relations
    - Enactus
22. **74 Riberia Street**
    - Sport Management Faculty Offices
    - Business Department Faculty Offices
23. **Flagler College Tennis Center**
24. **65 Valencia Street**
    - Counseling Services
    - Young Life
    - Youth Ministry Program
25. **170 Malaga Street**
    - Office of Campus Safety and Security
    - Office of Institutional Advancement
26. **The Complex**
    - Parking Garage
    - The Commons
    - **Florida East Coast Railway Building:**
      - Residence Halls
    - **Abare Hall:**
      - Residence Halls
27. **Cedar Hall**
    - Residence Hall
28. **Gymnasium**
    - Athletic Department
    - Coaching Staff
    - Fitness Center
29. **Flagler College Auditorium**
    - Theatre Department
    - Faculty Offices
    - Main Stage and Rahner-Gibbs 2nd Stage
30. **Lightner Museum**
    - Athletic Offices
31. **Florida Public Archaeology Network**

Thursday Keynote Speaker:

Hans Paerl, Ph.D., *University of North Carolina-Chapel Hill, Institute of Marine Sciences*

Keynote Address: *Two decades of tropical cyclone impacts on North Carolina's estuarine ecosystems: Implications for water and habitat quality in a stormier world*

Biosketch: Hans Paerl received his PhD in ecology from the University of California, Davis. He is the Kenan Professor of Marine and Environmental Sciences at UNC-Chapel Hill's Institute of Marine Sciences, Morehead City, NC. His research addresses aquatic nutrient cycling and primary production dynamics, environmental controls and management of harmful algal blooms, and assessing effects of human and climatic alterations of water quality and sustainability of inland and coastal waters worldwide. He has published over 260 refereed article and book chapters on these research topics. He received the 2003 G. Evelyn Hutchinson Award from the Association of the Sciences of Limnology and Oceanography, the 2011 Odum Award from the Coastal and Estuarine Research Federation for addressing the causes, consequences and controls of eutrophication in aquatic ecosystems, and in 2015 was named a Fellow of the American Geophysical Union. Email: hpaerl@email.unc.edu; Phone: 252-726-6841, Ext. 133

PLATFORM PRESENTATIONS

- **Presenting author is underlined**
- **Graduate student authors (*)**
- **Undergraduate student authors (**)**

Friday, March 9

9:00 a.m. – 10:45 a.m. Session 1: Water Quality

Moderator: Ashley Holmes, Augusta University

9:00 **Variations in flatfish assemblages over a twelve-year period in a subtidal salt marsh creek near Savannah, GA**
Mary Carla Curran, Savannah State University; and Dara H. Wilber, College of Charleston

9:15 **Sand compaction and ghost crab burrows: an analysis of morphology and volume**
*Bailey Harding**, Coastal Carolina University*

9:30 **Seagrass wasting disease: the infection dynamics of a *Labyrinthula* sp. turtlegrass pathosystem**
Cliff Ross, Paige Duffin, Dan Martin, University of North Florida; and Katrina Lohan, Smithsonian Environmental Research Center

9:45 **Mitigating eutrophication in the Indian River Lagoon: how effective were the fertilizer bans?**
Rachel A. Brewton, Lynn E. Wilking, Laura W. Herren, and Brian E. Lapointe; Harbor Branch Oceanographic Institute at Florida Atlantic University

10:00 **Eutrophication, N:P stoichiometry, and climate change impact Looe Key reef in the Lower Florida Keys, USA.**
Brian E. Lapointe, Laura W. Herren, and Rachel A. Brewton; Harbor Branch Oceanographic Institute at Florida Atlantic University

10:15 **Microbial source tracking of bacterial pollution in the North Fork of the St. Lucie Estuary, Southeast Florida**
Lynn E. Wilking, Rachel A. Brewton, and Brian E. Lapointe; Harbor Branch Oceanographic Institute at Florida Atlantic University

10:30 a.m. – 11:00 a.m. BREAK (coffee/snacks)

Friday, March 9, continued

11:00 a.m. – 12:45 p.m. Session 2: SPECIAL SESSION Stormy Seas, Part 1

Moderator: Hans Paerl, University of North Carolina Institute of Marine Sciences

11:00 **Rapid acquisition of surface water observations to detect hurricane impacts on the St. Lucie Estuary, FL**
Sarah Bornhoeft, Cassondra Thomas, Christopher Buzzelli, Zhiqiang Chen, and Amanda Kahn; South Florida Water Management District

11:15 **Interannual variability in the Indian River Lagoon, Florida, measured by a network of environmental sensors**
M. Dennis Hanisak, and Kristen S. Davis, Harbor Branch Oceanographic Institute at Florida Atlantic University

11:30 **An investigation of water quality associated with the Summerhaven River Restoration Project in northeast Florida**
*Matthew Brown, Alicia Castle**; Flagler College; Nikki Dix, GTMNERR; Todd Osborne, University of Florida; and Joel Steward, DMCS*

11:45 **Living shorelines were more resilient to Hurricane Matthew (2016) than bulkheads and natural marshes**
Carter Smith, UNC-CH Institute of Marine Sciences; Brandon Puckett, NC National Estuarine Research Reserve; Rachel Gittman, East Carolina University; Charles Peterson, UNC-CH Institute of Marine Sciences*

12:00 **Rapid organic matter deposition in sediments at a constructed oyster reef: effects of hurricanes and oyster mortality**
Melissa Southwell, Jessica Veenstra, Cody Burns, Jillian Hudson-Jackson, Tim Mullen, Charlie Lewis, and Chris Blanco; Flagler College

12:15 **Phytoplankton responses to extreme weather events at North Inlet Estuary, SC**
James L. Pinckney and Erik Smith; Baruch Institute, University of South Carolina

12:30 **Storm surge and sea level rise are not just coastal phenomena**
Robert Virnstein, Seagrass Ecosystems Analysts

12:35 **Discussion/Closing Remarks**

Friday, March 9, continued

12:45 LUNCH (for all meeting attendees)

2:00 p.m. – 3:15 p.m. Session 3 Water Quality

Moderator: Shannon Gregory, Clemson University

2:00 Water Quality Changes in Relation to Restoration Efforts of Robinson Preserve
Amanda Croteau, University of Florida*

2:15 Spatial water quality distribution in the Pamlico River (1990-2016): effects of phosphorus mining effluents.
Enrique Reyes, East Carolina University

2:30 A simple water quality box model and its applications in the St. Lucie and Caloosahatchee River Estuaries in Florida
Detong Sun, South Florida Water Management District

2:45 An investigation of groundwater quality, subsurface characteristics, and spatial extent of a marsh dieback near St. Simon's Island, Georgia
Jacque L. Kelly, Christine M. Hladik, and Montana L. Carter; Georgia Southern University

3:00 Remote live tracking of water flow in Satilla River Estuary to examine changes due to human alterations
*Ashley R. Holmes**, Courtney Morrison**, J. A. Hauger, and Jessica Reichmuth, Augusta University*

3:15 Closing Remarks/Announcements

3:20 p.m. – 4:00 p.m. BREAK

4:00 p.m. – 5:30 p.m. POSTER SESSION

6:00 p.m. – 9:00 p.m. DINNER BANQUET/SOCIAL

Saturday, March 10

7:45 BREAKFAST/COFFEE (for all meeting attendees)

8:20 Welcome and Announcements
Erik Smith, SEERS President; Jessica Reichmuth, SEERS Program Chair

Saturday, March 10 – Continued

8:30 a.m. – 9:45 a.m. Session 3, Hydrodynamics and Sediments

Moderator: Jennie Wiggins, Savannah State University

8:30 **Relationships between dissolved nutrients, environmental variables, and acidification in the Indian River Lagoon**
Bret Kaiser and Brian Lapointe; Harbor Branch Oceanographic Institute at Florida Atlantic University*

8:45 **Effectiveness of living shorelines as an erosion control method in North Carolina**
Mariko A. Polk and Devon O. Eulie; University of North Carolina Wilmington*

9:00 **What was up is down and what was down is up…how do we regain the balance in the Indian River Lagoon?**
Lori Morris, Robert Chamberlain, Chuck Jacoby, and Margie Las; St Johns River Water Management District

9:15 **Patterns of phytoplankton biomass related to hydrology and changes in salinity in a manipulated estuary**
A.Loren Mathews, Risa A. Cohen, Georgia Southern University; and Jessica M. Reichmuth, Augusta University

9:30 **Examining regional trends in shoreline erosion and mitigation strategies: Lower Cape Fear River Estuary, North Carolina**
Devon Eulie, E. York, A. Weide*, E.Hill**, University of North Carolina Wilmington; K. Potlock*, Newcastle University; and M. Polk*, University of North Carolina Wilmington*

9:45 **BREAK (coffee/snacks)**

10:15 a.m. – 11:15 a.m. Session 5: SPECIAL SESSION Stormy Seas, Part 2

Moderator: Eilea Knotts, University of South Carolina

10:15 **Ghosts in the storm: shifts in ghost crab population patterns following tropical storms in South Carolina 2016-2017**
Eric Rosch, Coastal Carolina University

10:30 **Ornate diamondback terrapin (*Malaclemys terrapin macrospilota*) responses to Hurricane Hermine in the Cedar Keys National Wildlife Refuge, Florida**
*Benjamin K. Atkinson, Flagler College; Coleman M. Sheehy III, Florida Museum of Natural History; and Laura C. Sanchez**, University of Florida, Gainesville*

Saturday, March 10 – Continued

10:45 Location and timing matter: storm freshet effects on oyster (*Crassostrea virginica*) populations in North Inlet, SC
Juliana M. Harding, Coastal Carolina University

11:00 a.m. – 12:00 p.m. BUSINESS MEETING & AWARD PRESENTATIONS

POSTER PRESENTATIONS (in alphabetical order by number)

- **Presenting author is underlined**
- **Graduate student authors (*)**
- **Undergraduate student authors (**)**
- **Special Session: Stormy Seas (≈)**

POSTER PRESENTATIONS (by poster number)

1 Temporal changes in submarine groundwater discharge in a Georgia salt marsh
*Tanner C. Avery** and Jacque L. Kelly; Georgia Southern University*

2 Relationship between groundwater and vegetation of a dieback marsh on St. Simons Island, Georgia
*Montana L. Carter**, Jacque L. Kelly, and Christine M. Hladik; Georgia Southern University*

3 Prevalence of plastic microfibers in atmospheric deposition and crab stomachs
*Racheal Cecil** and Ed McGinley; Flagler College*

4≈ Estimating food habits of a coastal population of gopher tortoises in the GTMNERR
*Rosemary Rice**, Silvia Chero**, Amanda Aydlett**, Kerri Smetana**, Mac Byram**, Lee Newsom, and Carrie Grant; Flagler College*

5 A comparison of fish and crab communities: do marinas act as biodiversity hotspots?
*Devyn Corrales**, Alexis Taylor**, and Ed McGinley; Flagler College*

6 Evaluating georeferenced video as a citizen science tool for shoreline habitat monitoring.
*William Ellis, St. Leo University.; Jock Mackenzie, James Cook University; Sergio Napoletano**, Caitlin Bly**, Jenevieve Bly**, Isabella Jacus**, Gregory Nobles**, and Paola Soto-Alvarez**; St. Leo University*

7 Physical controls of hypoxia in an open embayment
*Diane Bennett Fribance, Sarah E. Wessinger**, Roi Gurka, and Erin E. Hackett; Coastal Carolina University*

8 Oyster reef restoration and living shoreline stabilization: impacts on infaunal communities in Mosquito Lagoon
*Katherine Harris**, Aiesha Stevens**, Linda Walters, and Melinda Donnelly; University of Central Florida*

9 **Show me what you're made of: an initial investigation of shark populations and diets in the Satilla River Estuary**
*Ashlyn Henning**, Georgia Southern University; Jessica Reichmuth, Bruce Saul, Augusta University; and A. Loren Mathews, Georgia Southern University*

10 **Protecting shorelines with constructed oyster reefs: evidence in the sediment**
*Colin Herbert**, Jessica Veenstra, and Melissa Southwell; Flagler College*

11 **Sea level rise and habitat change at Carolina Beach State Park**
*Evan Hill** and Devon Eulie; University of North Carolina—Wilmington*

12 **Effects of carbaryl insecticide on an estuarine community**
*Samantha Iliff**, Florida Atlantic University; Elizabeth Stoner, Bentley University; Rachel Harris, Loxahatchee River District*

13 **A conceptual ecological model for the Northern Estuaries and Southern Coastal Systems Regions of the Comprehensive Everglades Restoration Plan (CERP) REstoration, COordination, VERification (RECOVER) Program**
Phyllis Klarmann, SFWMD; Gretchen Ehlinger, USACE; Patricia Gorman, SFWMD; Amanda McDonald, SFWMD; Michael Simmons, USACE; Patrick Pitts, USFWS; Dave Rudnick, Everglades National Park

14 **Carbonic anhydrase regulation of plankton community structure in estuarine systems**
Eilea R. Knotts and James L. Pinckney; University of South Carolina*

15 **Oyster reef monitoring within the GTMNERR: a pilot study**
Pamela Marcum and Nikki Dix; GTMNERR

16 **An examination of living shoreline design along a salt marsh shoreline in Wilmington, North Carolina**
*Frank Marshall**, Mark Moore*, and Lynn Leonard; University of North Carolina Wilmington*

17 **Ontogenetic changes in ghost crab behavior: size and gender effects**
*Logan Masterson** and Eric Rosch; Coastal Carolina University*

18 **PCR amplification and comparison of Bermuda's diamondback terrapin DNA sequences**
*Madeline L. Musante**, Lydia C. Logan**, Benjamin K. Atkinson, Flagler College; Mark E. Outerbridge, Bermuda Department of Environment and Natural Resources; and Terri J. Seron; Flagler College*

19 **Microplastic accumulation in spat and adult oysters in Mosquito Lagoon**
*Megan Robbins** and Linda Walters; University of Central Florida*

20 Histological analysis of limb bud development during regeneration in fiddler crabs
*Emeline Ward**, Eric Rosch, and Scott Parker; Coastal Carolina University*

21 Water quality investigation at the St. Augustine Marina: fecal coliform and ammonium
*Westly Woodward**, Allison Hartnett**, and Matthew Brown; Flagler College*

ABSTRACTS FOR ORAL PRESENTATIONS
(in alphabetical order by presenting author's last name)

Ornate diamondback terrapin (*Malaclemys terrapin macrospilota*) responses to Hurricane Hermine in the Cedar Keys National Wildlife Refuge, Florida

*Benjamin K. Atkinson, Flagler College; Coleman M. Sheehy III, Florida Museum of Natural History,; and Laura C. Sanchez**, University of Florida*

Ornate Diamondback Terrapins are estuarine turtles with a range restricted to Florida's Gulf coast. Since 2014, we have been investigating resident terrapins in the Cedar Keys National Wildlife Refuge. We analyzed mark-recapture data from 65 recaptures of 57 individual terrapins to examine site fidelity on a continental island during a three-year period that included pre- and post-Category 1 Hurricane conditions. During the high point of Hurricane Hermine's storm surge, the island was under ~4 meters of water for several hours. Of terrapins marked prior to the hurricane, 56% were recaptured after the storm. There was no significant difference in mass between females captured before and after the hurricane. However, males recaptured after the storm had larger mass than males captured prior. We are unable to determine whether terrapins hunkered down and remained on the island during the storm surge, or if they left and returned. Overall, there was no significant difference between terrapin sex and frequency of recapture. In 2016, prior to the hurricane, we observed 48 young-of-the-year terrapins on the island. Following the hurricane, we encountered only a solitary post-hatchling at this site, suggesting the storm may have nearly wiped out an entire recruitment cohort. However, gravid females are returning to the island, presumably to nest. Terrapins are known to exhibit high site fidelity in many parts of their range. Multiple clutching and high site fidelity are life history traits that may allow terrapins to persist in insular habitats where they are periodically exposed to extremely harsh environmental conditions.

Rapid acquisition of surface water observations to detect hurricane impacts on the St. Lucie Estuary, FL

Sarah Bornhoeft; Cassondra Thomas, Christopher Buzzelli, Zhiqiang Chen, Amanda Kahn;South Florida Water Management District

Understanding the influence of watershed and Lake Okeechobee freshwater inflows on the highly modified St. Lucie estuary remains a challenge for water managers. Algae blooms, hypoxia and large freshwater discharges from hurricanes make understanding this estuary's water quality gradients even more complex. Employing a readily deployed flow-through system for routine and event-based sampling provide data useful for accessing fluctuating estuary dynamics. Using this innovative sampling system, an ecosystem-scale snapshot of surface water quality data were collected in the St. Lucie Estuary prior to and after Hurricane Irma. Surveys were conducted from the St. Lucie Inlet to the S-80 control structure, including the North Fork, in March, July, October and November of 2017 and January of 2018. Total freshwater inflow increased approximately six-fold after Hurricane Irma as the relative contribution of the watershed increased from 47 to over 66%. These increased freshwater inputs dramatically altered the salinity, chromophoric dissolved organic matter, and turbidity characteristic of the estuary, but had little effect on the chlorophyll a dynamics. These data were useful in monitoring the restoration of typical estuary gradients post-hurricane and may inform water manager of the potential impacts of extreme events to the ecosystem.

Mitigating eutrophication in the Indian River Lagoon: How effective were the fertilizer bans?

Rachel A. Brewton, Lynn E. Wilking, Laura W. Herren, and Brian E. Lapointe; Harbor Branch Oceanographic Institute at Florida Atlantic University

Since 2011, 37 local fertilizer bans were implemented along the Indian River Lagoon (IRL) in an effort to improve water quality. To assess effects of these bans, water samples and macroalgae were collected from 5 segments of the IRL spanning from Ponce Inlet to Jupiter Inlet (20 sites). Samples were collected in the wet and dry seasons (2016/2017), and were compared to "pre-ban" data (2011/2012). Water samples were analyzed for total nitrogen (TN), total phosphorus, ammonium (NH_4), nitrate + nitrite, phosphate, and chlorophyll *a* (CHLA). Macroalgae were analyzed for stable carbon and nitrogen isotopes, as well as elemental composition (C:N:P). Dry season TN decreased in Mosquito Lagoon and the central IRL (CIRL), while in the wet season Banana River (BR) increased ($p>0.001$).

NH^4 increased in BR and the northern IRL, while CIRL decreased ($p<0.001$). CHLA decreased at all segments for both seasons. During the dry season, there was an increase in $\delta^{15}N$ values at all segments, except the southern IRL, indicating a stronger wastewater signal. The largest increase in $\delta^{15}N$ occurred in Brevard County, where brown tide (*Aureoumbra lagunensis*) blooms occurred in 2012 and 2016. Nutrient concentrations and $\delta^{15}N$ from the brown tides indicated the 2016 bloom was more P-limited than the 2012 bloom, and $\delta^{15}N$ increased from the range of fertilizers in 2012 (< +3 o/oo), to enriched values (> +7 o/oo) in 2016 characteristic of wastewater. The data suggests effects of the bans are detectable, but that nutrient loading from other sources, particularly wastewater, is affecting the IRL.

An Investigation of water quality associated with the Summerhaven River Restoration Project in northeast Florida

*Matthew Brown, Alicia Castle**, Flagler College; Nikki Dix, GTMNERR; Todd Osborne, University. of Florida; and Joel Steward DMCS*

As coastal populations and development pressure increase, it is critical that coastal waters are monitored for potential changes in water quality due to any excavation or sediment removal project. In Spring 2016 the state of Florida approved $2.8M in funding to restore the Summerhaven River (south of Matanzas Inlet in northeast Florida) nearly eight years after a series of tropical storms and hurricanes breached the dune line and filled it with sand. The project began in January 2017 and as of late September 2017 the Summerhaven River was opened and flowing once again. The primary objective of this study was to collect water quality data in order to monitor for potential changes in water quality parameters as the Summerhaven River restoration project was undertaken and completed. As part of a funded, collaborative research effort between the GTMNERR, the U. of Florida, and Flagler College, a bimonthly water quality sampling program was initiated at six sites in November 2016, two months prior to the start of the river restoration. While the monitoring project is still on-going, a comparison of potential water quality impacts associated with the Summerhaven River restoration project to impacts associated with natural processes occurring over the study period, such as Hurricane Irma and a multiple day nor'easter, will be made.

A comparison of fish and crab communities: do marinas act as biodiversity hotspots?

*Devyn Corrales**, Alexis Taylor**, Spencer Henley-Beasley**, Trinity Hopkins**, Savanna Mathis**, Savannah Fann**, Tristen Utic**, and Ed McGinley, Flagler College*

Research has shown that marinas can act as a unique habitat for aquatic species in an estuary, but can also serve as a way station for invasive species as well. The community dynamics at these structures can be unique when compared to adjacent areas because the manufactured structures provide a three-dimensional habitat that otherwise might not be available to these species. Marina sampling occurred from January – August 2017 and from January – March 2018. Cylindrical metal habitat baskets (0.3 m length) with openings (area 6.5 cm2) were filled with oyster shell and deployed at three local marinas and checked monthly. Random dip net (0.11 m2 area) samples were performed monthly at each marina as well. Length of the sampling transect was measured to calculate volume sampled. A total of 37 species were recorded during this study: 30 (13 unique species) from the habitat baskets and 23 (6 unique species) from dip net sampling. When compared to a monthly seine net sampling that took place at two sites adjacent to marinas, marinas accounted for 13 species that were never encountered in four years of sampling. Preliminary data indicate that February and March are period of high density due to juvenile fish seeking refuge at the marinas. Results suggest that marinas provide unique habitat compared to natural areas within the estuary and measures should be taken to account for habitat when marinas are designed.

Water quality changes in relation to restoration efforts of Robinson Preserve

Amanda Croteau, University of Florida*

Salt marshes and mangroves provide vital juvenile habitat for many marine species. Florida's coastlines have been severely impacted by development, with some areas experiencing losses of over 80%. Tampa Bay has lost over 44% of its mangroves and salt marshes over the past 100 years. Robinson Preserve is a 197-hectare preserve, located on the southern shore of Tampa Bay. Originally a coastal wetland, the property was ditched, drained, and used for agriculture. In 2006, tidal flow was

restored, and upland and salt marsh vegetation were planted. However, aquatic flora and fauna were left to colonize from neighboring populations and water quality was expected to naturally stabilize. Robinson Preserve was sampled quarterly from 2007-2013 to evaluate the success of restoration activities. Robinson Preserve was divided into four sampling regions based on water flow and connectivity to neighboring water bodies. Samples for total nitrogen, total phosphorus, chlorophyll, color, dissolved oxygen, salinity, temperature, and Secchi readings were taken at stations within each sampling region. Benthic samples were collected to analyze chlorophyll levels of benthic microalgae. Observations on the species and relative coverage of macrophytes were noted. Data were analyzed over the time-series for the whole preserve, as well as by region and season. Within preserve samples were compared with data from surrounding water bodies monitored by local agencies. A number of the parameters monitored were within expected ranges and similar to surrounding water bodies. There were also distinct trends within each region based on its location and connectivity to other water bodies.

Variations in flatfish assemblages over a twelve-year period in a subtidal salt marsh creek near Savannah, GA

Mary Carla Curran, Savannah State University; and Dara H. Wilber, College of Charleston

Subtropical flatfish are not well studied, although these species are important residents of subtidal marsh creeks in southeastern USA estuaries. We examined seasonal and interannual variations in flatfish abundance, body size, and species composition over a twelve-year study conducted in Wylly Creek, a tertiary tidal creek in undisturbed salt marsh habitat near Savannah, Georgia. Monthly samples were collected during ebb tide from January 2004 to February 2016 using 3-replicate, 2-minute tows of a 1 m-wide beam trawl with a 3-mm mesh net. Six flatfish species, comprising over 1,880 individuals, were collected throughout the study: blackcheek tonguefish *Symphurus plagiusa*, bay whiff *Citharichthys spilopterus*, fringed flounder *Etropus crossotus*, summer flounder *Paralichthys dentatus*>, southern flounder *Paralichthys lethostigma*, and the ocellated flounder *Ancylopsetta quadrocellata*. The blackcheek tonguefish was numerically dominant and was present year-round, with peak abundances during summer. Bay whiff dominated flatfish assemblages during winter and was the only species consistently collected as new recruits [less than 20 mm TL], accounting for 83% of all recruits collected in the study. All other species except the ocellated flounder were collected as recruits, with significant seasonal differences in the taxonomic composition of recruit assemblages. There was an effect of season on flatfish distributions. In addition, relatively high total abundances of bay whiff and fringed flounder occurred after mild winters and high abundances occurred after cold winters for the other 4 species. Potential shifts in tidal creek occupancy patterns by flatfish may result from climate change given the documented effect of temperature.

Examining regional trends in shoreline erosion and mitigation strategies: Lower Cape Fear River Estuary, North Carolina

Devon Eulie E. York, A. Weide*, E.Hill**, University of North Carolina Wilmington; K. Potlock*, Newcastle University; and M. Polk*, University of North Carolina Wilmington*

As part of a regional effort to understand natural and human impacts on the lower Cape Fear River estuary, as well as prioritize habitat restoration projects, measures of shoreline erosion, sea-level rise inundation, and ecosystem transition (SLAMM), and other parameters were mapped. Additionally, specific sites within the lower estuary have been targeted for more in-depth study at a greater spatial and temporal resolution. The entire shoreline of the estuary was mapped in ArcGIS 10.3 using orthoimagery from 1983 and 2016. The existing Estuarine Shoreline Mapping Project (ESMP) data created for the NC Division of Coastal Management in 2010 was also utilized. This study followed the same methodology as the ESMP. Case study sites were additionally mapped over timesteps ranging from 1936 to 2017 using a combination of aerial imagery and in-situ RTK-GPS surveys. Results indicate that rates of shoreline erosion and driving factors vary considerably between sites. However, several common issues have been highlighted across the estuary, such as storm events and vessel traffic. Traditional strategies employed to mitigate the impact of some of these factors have focused on shoreline protection. However, more recently living shorelines are being utilized to both mitigate erosion and provide habitat restoration. Living shoreline projects at the case study sites vary widely in design and in their development process. They also involve many different stakeholders and collaborations between NGOs, state government, the private sector, and academia. This study

presents an overview of the regional mapping effort and highlights several of the individual site case studies.

Interannual variability in the Indian River Lagoon, Florida, measured by a network of environmental sensors

M. Dennis Hanisak and; Kristen S. Davis, Harbor Branch Oceanographic Institute at Florida Atlantic University

The Indian River Lagoon Observatory Network of Environmental Sensors (IRLON). IRLON has 10 sites in the Indian River Lagoon (IRL) and St. Lucie Estuary (SLE) that provide real-time, high-accuracy, and high-resolution water quality and weather data through an interactive website (http://fau.loboviz.com/). This presentation will contrast two years (2016-2017) of water quality conditions in the IRL and SLE. 2016 was a very “wet” year, including nine months of freshwater releases from Lake Okeechobee and the nearby passage of Hurricane Matthew, which caused much shorter-term impacts in water quality. 2017 was a “dry” year, with Florida experiencing a significant drought early in the year; major water quality parameters were substantially different than in 2016, until the nearby passage of Hurricane Irma. IRLON enables scientists, managers, educators, students, and the public to directly observe both long-term ecosystem changes and those driven by events, such as freshwater discharges, droughts, storms, and algal blooms.

Remote live tracking of water flow in Satilla River Estuary to examine changes due to human alterations

*Ashley R. Holmes**, Courtney Morrison**, J. A. Hauger, and Jessica Reichmuth; Augusta University*

Human alteration to estuaries commonly affect tidal creek water flow, often resulting in detrimental effects on wildlife habitats. The Satilla River Estuary (SRE) in Georgia is one such estuary that has experienced several modifications throughout the 1900s, including several commercial cuts through tidal creeks. These cuts are suspected as the cause of changes in salinity and shoaling within the area. This study focuses on tidal flow within the most notable cut in the SRE system, Noyes Cut. Using a low-power sonde and teensy microcontroller, remote live tracking of tidal flow has been achieved. Results from this controller show that water flow runs in the opposite direction than expected on an outgoing tide. Excess sediment collection has been documented at affected inlets downstream of Noyes Cut in Umbrella and Dover Creeks.

Sand compaction and ghost crab burrows: an analysis of morphology and volume

*Bailey Harding**, Coastal Carolina University*

Beaches are areas of high levels of human activity, resulting in fluctuations of sand compaction. This alternation of the substrate may have a major effect on beach organisms, particularly ones that construct burrows. Ghost crabs, *Ocypode quadrata*, are a well-described indicator of beach health and environmental quality. However, there is still little known about how sand compaction, which is often affected by level of human activity, affects the construction of the burrows. The penetration depth (PD), shape, volume and length of burrows created by the ghost crabs were measured on three wave-dominated beaches along the coast of South Carolina. Two beaches had high levels of human traffic, and one beach was private with highly restricted access. Burrows were randomly chosen from the base of the dunes and the mid-beach zone above the high tide line. Plaster of paris was mixed and poured into the burrow and left to set for approximately 45min to 1 hour. The PD of the burrows was found to correlate with the shape of the burrow, however, the PD did not correlate with the volumes or lengths. Complex burrow morphologies displayed a bimodal distribution in relation to PD, while simple morphologies correlated with intermediate levels of PD.

Location and timing matter: Storm freshet effects on oyster (*Crassostrea virginica*) populations in North Inlet, SC

Juliana M. Harding, Coastal Carolina University

Eastern oysters (*Crassostrea virginica*) are ecosystem engineers and keystone species in southeastern salt marsh tidal creek estuaries. While oysters can survive short-term exposure to salinity < 5, salinities >5-7 delineate oyster habitat. Seasonal and/or extreme rain events that depress salinities below an oyster's physiological tolerance may cause local extinction depending on freshet amplitude, duration, and timing. North Inlet, SC is a relatively pristine tidal estuary whose southern portion receives

freshwater discharge from Winyah Bay, SC during extreme storm events. Both estuaries experienced a "millenial" storm in 10/2015 and Hurricane Matthew in 10/2016. Winyah Bay discharge into southern North Inlet reduced salinity to < 5 for multiple days and consecutive tidal cycles after both storms. Oyster populations in northern North Inlet did not experience extreme freshet conditions in 2015 or 2016 and offer an internal baseline for descriptions of freshet effects on southern North Inlet oyster populations. Oyster population metrics including density, demographics, and biomass will be used to evaluate northern and southern North Inlet oyster populations post-disturbance.

Relationships between dissolved nutrients, environmental variables, and acidification in the Indian River Lagoon

*Bret Kaiser*and Brian Lapointe; Harbor Branch Oceanographic Institute at Florida Atlantic University*

In the eutrophic waters of the Indian River Lagoon (IRL), reported decreases in overall shellfish size may be related to coastal acidification. To better understand the relationship between acidification and eutrophication, water samples from 20 sites spanning the IRL were collected and analyzed for dissolved nutrients and acidity (omega values) in spring (dry season) and fall (wet season), 2016. Additionally, three sites were sampled weekly to observe temporal variability of nutrients and acidity. For the IRL-wide dry season, sites with a higher nitrogen concentration were more acidic (some with omega values <2) with a slight negative relationship ($p=0.09$; $r^2=0.12$). The time series data showed temporal variability in salinity and acidity with an overall positive linear relationship ($p=<0.0001$; $r^2=0.52$). This preliminary work suggests that salinity and dissolved nutrients have implications for acidification in the IRL and underscore the importance of water quality restoration to shellfish production.

An investigation of groundwater quality, subsurface characteristics, and spatial extent of a marsh dieback near St. Simon's Island, Georgia

Jacque L. Kelly, Christine M. Hladik and Montana L. Carter; Georgia Southern University

Marsh dieback is characterized by a rapid senescence of salt marsh vegetation leading to plant death and loss of valuable coastal ecosystems and their services. Since 2014, we have monitored dieback of the marsh platform of a *Spartina alterniflora*-dominated marsh near St. Simon's Island, GA. We have mapped a 92% decrease in the spatial extent of the dieback using differential GPS. Periodic shore-perpendicular electrical resistivity (ER) profiles of ~165 m of the platform show that the bulk resistivity underneath the marsh remained fairly consistent through time. As inferred from bulk resistivity, the ER profiles showed no apparent differences in subsurface materials or groundwater composition underneath dieback and healthy areas of the marsh. Time-series ER profiles at ebbing- and low-tide conditions suggest minor movement of groundwater underneath the platform. Porewater/groundwater depth profiles were collected quarterly at 10-cm intervals to a depth of 90 cm using a push-point piezometer and peristaltic pump from dedicated monitoring plots in healthy, transitional edge, and dead marsh at the site. Generally speaking, water salinity was variable across the plots and throughout the seasons, varying from ~27 to ~38. There were no apparent differences in salinity between the healthy and dead plots. However, the dead plots had higher concentrations of orthophosphate, ammonium, total phosphorous, and total nitrogen compared to the healthy and transitional edge plots.

Eutrophication, N:P stoichiometry, and climate change impact Looe Key reef in the Lower Florida Keys, USA.

Brian E. Lapointe, Laura W. Herren, and Rachel A. Brewton; Harbor Branch Oceanographic Institute at Florida Atlantic University

Increased loadings of land-based nitrogen from sewage, fertilizers, and stormwater runoff are well known to cause eutrophication – enhanced phytoplankton and macroalgae biomass – on coral reef ecosystems in enclosed bays and nearshore waters. However, such ecological effects are unresolved for bank-barrier coral reefs in offshore coastal waters. Here we report significant increases in dissolved inorganic nitrogen (DIN = ammonium and nitrate) concentrations and chlorophyll *a* over the past three decades at Looe Key reef in the lower Florida Keys. Metadata analysis showed significant DIN enrichment in the early 1990s concurrent with increased discharges from Shark River Slough. This DIN enrichment correlated with increased chlorophyll *a*, DIN:SRP ratios in seawater, and N:P ratios in macroalgae tissue at Looe Key. The stoichiometric shift coincided with a surge in coral disease, as well as three mass coral bleaching events over the past three decades at Looe Key. Coral reef monitoring

showed that the annual loss of living coral at Looe Key increased from ~ 1%/yr to 4-8%/yr following wet years and major freshwater releases in both the 1980s and 1990s. An overall increase in benthic algal diversity, especially cyanobacteria and algal turfs, as well as the encrusting zoanthid *Palythoa caribaeorum*, followed the dramatic loss of live coral and reef complexity at Looe Key. These data indicate that DIN enrichment, eutrophication and altered N:P ratios can pose myriad direct and indirect impacts to offshore coral reef communities.

Patterns of phytoplankton biomass related to hydrology and changes in salinity in a manipulated estuary

A.Loren Mathews, Risa A. Cohen, Georgia Southern University; and Jessica M. Reichmuth, Augusta University

Eight artificial cuts were made through the marshlands of the Satilla River Estuary, Georgia (USA) in the early 1900s to improve navigation and facilitate timber transport, although they are no longer maintained for their original purposes. Of these, Noyes Cut has been identified as the likely cause of increased sedimentation, disturbed salinity gradients, and decreased water quality in the Dover-Umbrella-Parsons Creek system that it connects to the Satilla River. These hydrological and physical-chemical changes likely influence the abundance and distribution of phytoplankton, which serve as an important food source for commercially and recreationally valued fish, crabs, and shrimp. The goal of this study was to identify spatial and temporal patterns in phytoplankton abundance (as chlorophyll a concentration) at sites impacted by the artificial cuts and compare them to an unimpacted reference site. Monthly integrated water samples have been collected and analyzed fluorometrically since June 2014. Preliminary data indicate that phytoplankton abundance is higher on average in the summer and fall with the largest peaks coinciding with increased salinities. This study is part of a collaborative holistic assessment of the ecological effects of Noyes Cut, which is being considered for closure and restoration by state and federal agencies.

What was up is down and what was down is up…how do we regain the balance in the Indian River Lagoon?

Lori Morris, Robert Chamberlain, Chuck Jacoby, and Margie Lasi; St Johns River Water Management District

We've always considered seagrass as the indicator of the health of the Indian River Lagoon, but now the system is out of balance. With seagrass loss beyond historical levels, the slower growing, stable seagrasses have been replaced by the faster growing phytoplankton and drift macroalgae. These latter primary producers may compete with seagrasses for light and nutrients, making natural recovery more difficult. Decades old diagrams showing regime shifts from seagrass to macroalgae and phytoplankton predicted our new reality. To reverse this situation, nutrient loads may have to be reduced lower than pre-bloom conditions and hands-on seagrass restoration may be required. Fortunately, data indicate that seagrasses can recover when supportive conditions persist long enough. Hopefully, this response combined with the counties' herculean efforts and sustained commitments to decreasing nutrient loads will restore the former balance among primary producers.

Phytoplankton responses to extreme weather events at North Inlet Estuary, SC

James L. Pinckney and Erik Smith; Baruch Institute, University of South Carolina

In most estuaries, phytoplankton abundance at a fixed location varies over a tidal cycle due to different water masses and sediment resuspension. This feature presents a problem when trying to determine long-term trends due to the extreme within-tidal variation. In this study, we apply a methodology for removing much of the intertidal variability to assess phytoplankton responses to Hurricane Matthew and an extreme rainfall event in October 2015 that impacted the North Inlet – Winyah Bay NERRS near Georgetown, SC. ISCO water samplers were used to collect discrete water samples at 2 h 4 min intervals for 24 h 50 m (2 tidal cycles) at 20 day intervals in 2015. Phytoplankton abundances were determined based on extracted chl a concentrations for each sample. Phytoplankton inventories (integrated area under the chl a vs. time curve) were calculated for each sampling date. Average monthly inventories for a 13 year period were then used to estimate the monthly phytoplankton inventory anomaly to determine differences from long-term trends in phytoplankton abundance and assess responses to these two extreme weather events.

Effectiveness of living shorelines as an erosion control method in North Carolina

Mariko A. Polk and Devon O. Eulie; University of North Carolina Wilmington*

Living shorelines are becoming a popular shoreline stabilization method, which encompass a range of vegetative and structural components,that serve as an alternative approach to the use of hardened structures like bulkheads, which are known to aggravate erosion. Living shorelines are often installed with little to no monitoring for biological or morphological effectiveness, particularly as method to reduce erosion. This study sought to assess the erosion protection performance of living shorelines by determining shoreline change rates (SCR) using geospatial applications. Modern shoreline surveys were conducted using a real-time kinematic (RTK)-GPS unit at a total of 17 living shoreline projects and nine control segments at 12 sites along the coast of North Carolina. Modern shoreline position was compared to historic (pre-installation) shoreline positions obtained from aerial imagery. The average SCR among northern sites before installation was -0.45 ±0.49 m yr-1 and in southern sites it was -0.21 ±0.52 m yr-1. After installation, average SCR was significantly lower at northern and southern sites with living shorelines, 0.17 ±0.47 m yr-1 and -0.01 ±0.51 m yr-1, respectively. Of the 17 living shoreline project segments, 12 exhibited a reduction in the rate of erosion; of those 12, six were observed to be accreting. The findings support convention that living shorelines can reduce the rate of erosion and potentially restore lost shore zone habitat making living shorelines a valid and important shoreline stabilization method in North Carolina.

Living shorelines were more resilient to Hurricane Matthew (2016) than bulkheads and natural marshes

Carter Smith, UNC-CH Institute of Marine Sciences; Brandon Puckett, NC National Estuarine Research Reserve; Rachel Gittman, East Carolina University; Charles Peterson, UNC-CH Institute of Marine Sciences*

Nature-based solutions, such as living shorelines, have the potential to enhance coastal sustainability, increase resilience to natural disasters, and restore critical ecosystems; however, their efficacy during storm events compared to traditional hardened shorelines is largely untested. This is a major impediment to their implementation and promotion to policy-makers and homeowners. To address this knowledge gap, we evaluated rock sill living shorelines as compared to natural marshes and hardened shorelines (i.e. bulkheads) in North Carolina, USA for changes in elevation, vegetation, and structural damage from 2015-2017, including before and after Hurricane Matthew (2016). Our results show that living shorelines exhibited better resistance to landward erosion during Hurricane Matthew than bulkheads and natural marshes. Additionally, they were more resilient than hardened shorelines, as they maintained landward elevation over the two-year study period without requiring any repair. Finally, rock sill living shorelines were able to maintain *S. alterniflora* stem densities over time when compared to natural marshes. Our results suggest that living shorelines have the potential to enhance coastal resilience while supporting important coastal ecosystems.

Spatial water quality distribution in the Pamlico River (1990-2016): effects of phosphorus mining effluents.

Enrique Reyes East Carolina University.

A study of the PCS Phosphate effluent discharged into the Pamlico River estuary begun in 1990 with the objective to monitor water-column phosphorus and fluoride concentrations along four transects radiating outward from the mouth of the PCS Phosphate outfall on the south shore of the estuary. Prior to the initiation of this study, there were only general indications of elevated water-column and sediment chemical concentrations around the PCS Phosphate outfall. Bi-weekly monitoring during the 1970s and 1980s had shown that phosphorus concentrations about 500 meters off the outfall were sometimes noticeably higher than those at other stations in this region of the estuary. During the first two and one-half years of the on-going study (i.e., 1990-1992), high phosphorus and fluoride levels were detected close to the outfall, but since September 1992, when PCS began to recycle its wastewater, phosphorus and fluoride levels near the outfall have decreased significantly. A review of the 1990-2016 data shows that a wastewater recycling program that begun in the fall of 1992 by PCS Phosphate continues to result in major reductions in concentration and associated plume areas for phosphorus and fluoride in the estuary. Total phosphorus measured in the PCS Phosphate effluent before wastewater recycling began ranged between 0.20 and 17.89 mg L-1, compared to a background range of 0.023 - 0.07 mg L-1. Since then, TP in the effluent has decreased about 97%, (e.g., in 2016

the range was between 0.10 mg L-1 and 0.93 mg L-1. The TP plume area sizes have also decreased markedly. The area of the TP plume during the length of this study has ranged between 0 and 8.51 km2. For example, the average area of detectable TP plumes in 2016 was 0.42 km2. Before recycling, plumes averaged 1.30 1.47 km2, compared to 0.51 1.47 km2 after recycling began, a 60% reduction.

Ghosts in the storm: shifts in ghost crab population patterns following tropical storms in South Carolina 2016-2017

Eric Rosch, Coastal Carolina University

Large storms can have major impacts on coastal ecosystems. Determining the magnitude and duration of these effects remains poorly understood. The ghost crab, *Ocypode quadrata*, is a commonly used bioindicator of beach health. By examining how ghost crab populations are modified by strong tropical storms, an assessment of ecosystem recovery status can be made. This study examined surveys of ghost crabs before and after two major storm systems in South Carolina: Hurricane Matthew in October 2016 and Tropical Storm Irma in September 2017. Burrow densities showed major declines following both storms and eventually showed signs of recovery prior to colder temperatures setting in at the end of the year. A shift of relative abundances of burrows to the dunes from the backshore area of the beach was also a consistent pattern after both storms. As a proxy for crab size, burrow diameter measurements showed a marked increase immediately following the storms but eventually returned to pre-storm levels after several weeks. Post-storm burrow depths were significantly shallower but did eventually recover and surpass average depths measured before the storms. These results demonstrate that ghost crab populations display a marked shift in density, distribution, animal size, and burrow depths that are likely due to the effects of strong tropical storms. Recovery to pre-storm conditions took place on a timescale of weeks to months, implying that beach ecosystems may require a similar timeframe to show signs of recovery.

Seagrass wasting disease: the infection dynamics of a *Labyrinthula* sp. – Turtlegrass pathosystem

Cliff Ross, Paige Duffin, Dan Martin, University of North Florida; and Katrina Lohan, Smithsonian Environmental Research Center

Increasing evidence demonstrates that on a global level, emerging diseases are coupled with climate change and anthropogenic activity. While the importance of pathogens in terrestrial ecosystems has long been documented, the role of diseases in marine habitats has not been as well studied, as demonstrated by the paucity of information on the effects of climate change on marine host-pathogen interactions. Opportunistic pathogens of the genus *Labyrinthula* have been identified as the cause of 'wasting disease' in seagrass beds in both temperate and subtropical biogeographical regions. This presentation will provide an overview of the current state of knowledge on wasting disease in *Thalassia testudinum* (turtlegrass). Current work on establishing methodologies for pathogen detection and host immunity biomarkers, with respect to environmental stressors, will be discussed.

Rapid organic matter deposition in sediments at a constructed oyster reef: effects of hurricanes and oyster mortality

Melissa Southwell, Jessica Veenstra, Cody Burns, Jillian Hudson-Jackson, Tim Mullen, Charlie Lewis, and,Chris Blanco; Flagler College

Vegetated coastal systems have been shown to store large amounts of organic carbon in sediments due to their ability to accrete vertically, reduce sediment resuspension, and deposit fresh organic matter to the surface sediments. Oyster reefs exhibit these same characteristics, and may therefore serve as carbon sinks on a similar scale to vegetated coastal ecosystems. A constructed oyster reef was established at the GTM NERR in Ponte Vedra, FL starting in 2012, and we have monitored changes in sedimentary deposition since that time. We identified a layer of distinctly finer, more organic-rich sediment in the intertidal area shoreward of the reef. Here we estimate the total amount of carbon stored in this newly deposited layer and examine down-core and cross-shore changes in OM and particle size. In its first 4 years of existence, the sediments at our site exceeded areal C storage rates reported for vegetated intertidal systems. We further investigated the response of this system to two recent hurricanes in 2016 and 2017. For reefs with high live oyster coverage, the fine sedimentary layer appears largely unaffected by the hurricanes. However, reefs that were more degraded exhibit

substantial losses in the upper layer. The causes of this oyster decline are uncertain, but it appears that the burial of organic carbon in this system and the stability of previously buried carbon is dependent on the health of oyster reef.

A simple water quality box model and its applications in the St. Lucie and Caloosahatchee River Estuaries in Florida

Detong Sun, South Florida Water Management District

A water quality model was developed using a simple box model approach. The model describes the mass balance of nutrients (nitrogen and phosphorus and chlorophyll a.) An empirical linear relationship between daily phytoplankton production and the product of chlorophyll biomass, photic depth, and incident irradiance (the BZI formulation) was used to simulate algae growth in this model. The model was applied to two shallow estuaries: the St. Lucie River Estuary (SLE) and the Caloosahatchee River Estuary (CRE) in South Florida. Data collected from water quality monitoring stations over more than 10 years were used for model calibration and verification. The results indicated that seasonal variations in nutrients were well represented by the model for both estuaries, explaining the majority of variation (> 50%). The model was also able to predict very well algal in the SLE but not adequate for the CRE, suggesting different behavior in the two estuaries. The success of some of applications suggests the importance of simplification in water quality modeling. It points to the potential of a different strategy that includes simplifying some of the water quality processes while retaining more complicated formulations as necessary in other water quality variables.

Storm surge and sea level rise are not just coastal phenomena

Robert Virnstein, Seagrass Ecosystems Analysts

When we think storm surge and sea level rise, we think of the open coast, right? But estuaries up to the “head of tide” are also impacted. One local example: the St. Johns River. Tides extend 200 km upriver into Lake George. Consider the implications for your estuary.

Microbial source tracking of bacterial pollution in the North Fork of the St. Lucie Estuary, Southeast Florida

Lynn E. Wilking, Rachel A. Brewton, and Brian E. Lapointe; Harbor Branch Oceanographic Institute at Florida Atlantic University

The North Fork of the St. Lucie Estuary (SLE hereafter) in Southeast Florida has experienced degraded water quality, including high nutrient loading and bacterial pollution, leading to multiple closures of the water body for recreational use. Widespread blooms of *Microcystis* sp. in the SLE occurred in 2016, resulting in negative financial impacts for the local economy and potential health issues for exposed individuals. To determine the sources of the bacterial impairment, a microbial source tracking (MST) study was conducted through a collaborative effort with the City of Port St. Lucie, St. Lucie County, and Florida Department of Environmental Protection (FDEP). MST studies target host-specific gene fragments and source-specific chemicals, including sucralose and acetaminophen, as indicators to determine the source of bacterial pollution. Nutrient analysis was also included in this study. The results showed consistently high bacteria and sucralose concentrations at many sites, often exceeding FDEP standards and demonstrating the prevalence of wastewater in the North Fork. Acetaminophen was detected sporadically at different sites during different seasons, indicating the presence of septic effluent. Seasonal effects were observed, with higher bacteria, sucralose, and nutrient concentrations generally observed during the wet season, reflecting the influence of stormwater runoff and septic effluent on surface water quality. The results strongly indicate that wastewater is negatively influencing water quality and suggest focusing on septic-to-sewer programs on waterfront areas and investing in wastewater infrastructure to help mitigate the water quality issues in the North Fork.

ABSTRACTS FOR POSTER PRESENTATIONS
(in alphabetical order by presenting author's last name)

Temporal changes in submarine groundwater discharge in a Georgia salt marsh
*Tanner C. Avery** and Jacque L. Kelly; Georgia Southern University*
Submarine groundwater discharge (SGD) is a proven source of many vital nutrients for marine and terrestrial ecosystems, and has been shown to vary spatially and temporally. Variations of SGD in environments like the *Spartina alterniflora* dominated salt marsh near St. Simons Island, GA is an area in need of further study. The objective of my study is to quantify seasonal variation of SGD in a salt marsh estuary from July 2016 through October 2017. We conducted three separate continuous radon surveys to measure SGD fluxes from the creek bank and two separate marine electrical resistivity (ER) tomography surveys to locate SGD from the creek bed. Generally, the overall discharge of the study site was greatest in October according to the Rn data. The ER data showed highest Ohm-m readings in October, supporting a freshening of the materials underneath the estuary, which would be caused by an increase in SGD. Additionally, the total precipitation from two to three months preceding each survey was greatest in October. Using this data, a positive correlation can be seen between total SGD occurring at the study site and total precipitation at the field site. This correlation can be seen during the time periods two and three months before the survey. These results show that ER and Rn surveys can be used together to provide a more accurate model of SGD in salt marsh dominated estuaries.

Relationship between groundwater and vegetation of a dieback marsh on St. Simons Island, Georgia
*Montana L. Carter**, Jacque L. Kelly, and Christine M. Hladik; Georgia Southern University*
Salt marshes are beneficial for buffering against storms, filtering out pollutants, and providing a place for plants and animals to live. In Georgia, *Spartina alterniflora* is dying off resulting in dieback marsh. The purpose of this study is to examine the degree to which plant health is affected by tidal inundation and drainage, and the effect inundation has on the composition of groundwater and soil along a salt-marsh lined creek bank near St. Simons Island, GA that has experienced dieback. This project has connected soil quality parameters (salinity, redox potential, and organic matter) and groundwater parameters (redox, salinity, dissolved oxygen) to plant health (plant height and plant density). We gathered soil and water samples during different tide stages at ebbing-tide, low-tide, and flood-tides from six 1 m2 plots along the upper and lower portions of the creek bank. We also collected similar samples from nine 1 m2 plots on the platform denoted by *S. alterniflora* health separated into healthy zone, edge zone, and affected zone. This study will bring about further understanding to scientists and coastal communities about the relationships between soil and water variables that may lead to dieback or help with marsh recovery.

Prevalence of plastic microfibers in atmospheric deposition and crab stomachs
*Racheal Cecil** and Ed McGinley; Flagler College*
Microplastics are fragments or fibers smaller than 5mm that are found in the marine environment. Plastic does not decompose and is only broken down into smaller pieces by weathering processes and photodegradation, it has the ability to stay in the marine environment for a long time. Studies demonstrate marine vertebrates and invertebrates consume plastic and suggest the possibility of bioaccumulation in higher trophic level animals. Contamination in controls has been a recurring issue with the studies that have been done. The goal of this study was threefold: 1) Develop a method to reduce contamination in our lab, and 2) Catalog the microplastic presence in the Indo-Pacific swimming crab (Charybdis hellerii), and 3) Quantify the atmospheric deposition of microfiber particles in Saint Augustine, Florida. Preliminary results indicate a 1 to 2 fiber contamination in our controls which agrees with the global average in microplastic research. Fibers were found in our reagents and when they were prefiltered and we saw a dramatic decrease in number of fibers in the controls after filtering indicating reagents themselves may be a source of contamination in microplastic studies. Plastic fibers >5 mm and <5mm have been found inside the stomachs of Indo Pacific Swimming Crabs but no micro fragments have been found. Fibers in the air inside the building have ranged from 2 fibers (in a room with little foot traffic) to 49 (in a stairwell with heavy foot traffic). Fibers in the air outside have been recorded but additional research is in progress.

A comparison of fish and crab communities: do marinas act as biodiversity hotspots?
*Devyn Corrales**, Alexis Taylor**, and Ed McGinley; Flagler College*
Research has shown that marinas can act as a unique habitat for aquatic species in an estuary, but can also serve as a way station for invasive species as well. The community dynamics at these structures can be unique when compared to adjacent areas because the manufactured structures provide a three-dimensional habitat that otherwise might not be available to these species. Marina sampling occurred from January – August 2017 and from January – March 2018. Cylindrical metal habitat baskets (0.3 m length) with openings (area 6.5 cm2) were filled with oyster shell and deployed at three local marinas and checked monthly. Random dip net (0.11 m2 area) samples were performed monthly at each marina as well. Length of the sampling transect was measured to calculate volume sampled. A total of 37 species were recorded during this study: 30 (13 unique species) from the habitat baskets and 23 (6 unique species) from dip net sampling. When compared to a monthly seine net sampling that took place at two sites adjacent to marinas, marinas accounted for 13 species that were never encountered in four years of sampling. Preliminary data indicate that February and March are period of high density due to juvenile fish seeking refuge at the marinas. Results suggest that marinas provide unique habitat compared to natural areas within the estuary and measures should be taken to account for habitat when marinas are designed.

Evaluating georeferenced video as a citizen science tool for shoreline habitat monitoring.
*William Ellis, St. Leo University.; Jock Mackenzie, James Cook University.; Sergio Napoletano**, Caitlin Bly**, Jenevieve Bly**, Isabella Jacus**, Gregory Nobles**, and Paola Soto-Alvarez**; St. Leo University*
A key to maximizing the participation of citizen scientists is to equip them with sampling tools that are easy to use, inexpensive, and readily available. It is essential, however, that these tools are appropriately accurate and precise enough to ensure that reliable data are collected. In this study, we evaluated the performance of a relatively inexpensive means of shoreline habitat monitoring that employs volunteer-collected georeferenced video footage. Replicate video recordings were made of urban and mangrove-forested shoreline in Tampa Bay (Florida, USA) using a consumer quality video camera (Sony Handycam). The footage was then georeferenced using four alternative methods, with image position provided by either a recreational grade GPS unit (Garmin GPSmap 62) or a cell phone-integrated GPS receiver (Lenovo Moto G5 Plus), both with and without supplemental azimuth information gathered by cell phone-integrated magnetometers. The accuracy and precision of the match between video frames and shoreline position was evaluated by ground truthing and comparative image analysis. Preliminary results indicate that the recreational grade GPS unit not supplemented by azimuth data was the most accurate method of image location assignment (within 3 m of true) followed by that produced with the cell phone-integrated GPS receiver alone (within 5 m of true). These results suggest that, depending upon the application, either method can serve as a reliable and inexpensive citizen science tool for shoreline monitoring.

Physical controls of hypoxia in an open embayment
*Diane Bennett Fribance, Sarah E. Wessinger**, Roi Gurka, and Erin E. Hackett;*
CoastalCarolina University
Coastal hypoxia is a topic of concern for many coastal regions, with eutrophication a common underlying factor in the development and persistence of low dissolved oxygen (DO) in bottom waters. While many estuaries and enclosed basins have the physical setup for nutrient trapping to fuel primary productivity, Long Bay off the coast of the Carolinas has experienced episodic summer hypoxic episodes despite being an open embayment. There are multiple potential causes for the low DO in this region, including upwelling-favorable winds, vertical and/or horizontal density gradients, sediment oxygen demand, and the presence of groundwater. Here we present some of the known physical conditions that co-occur with hypoxic episodes, utilizing time-series data at one location collected over more than a decade, and more recent data covering a broader spatial scale. The possible implications for physical forcings of the hypoxia in this type of system are discussed.

Oyster reef restoration and living shoreline stabilization: impacts on infaunal communities in Mosquito Lagoon

*Katherine Harris**, Aiesha Stevens**, Linda Walters, and Melinda Donnelly; University of Central Florida*

Infaunal organisms are critical to aquatic food webs and are consumed by many species including, threatened/endangered wading birds and commercially important fishes and crabs. Oyster reefs and living shorelines are important estuarine ecosystems that provide habitat to many organisms, including infauna. Over the past century 85% of oyster reef habitats have been lost, while erosion and sea level rise continuously degrade shorelines, making restoration of these areas vital. As a base of the food web, infauna was predicted to be a strong indicator taxa to document the transition from dead to restored/living intertidal oyster reefs and eroded to stable shorelines. Research was conducted in Mosquito Lagoon. Six replicate samples were collected from 12 intertidal oyster reefs (4 dead, 4 natural, 4 restored), and 7 shoreline sites (3 control, 4 restored). Samples were collected 1-week pre-restoration and 1 week, 1 month, and 6 months post-restoration. Infauna was sorted and identified to the lowest possible taxonomic level. Species density, species diversity, and biomass data were analyzed. Results on oyster reefs suggest that natural reefs had the highest species density and diversity, followed by restored reefs. Dead reefs had the lowest species density and diversity. Natural reefs contained larger infauna than restored and dead reefs. Living shorelines showed a similar trend; stabilized shorelines had higher species density and larger infauna than unstabilized sites. The data suggests that restored reefs and stabilized shorelines are more productive than their dead/eroded counterparts, showing restoration is positively impacting numerous infaunal species and their associated food webs.

Show me what you're made of: an initial Investigation of Shark Populations and Diets in the Satilla River Estuary

*Ashlyn Henning**, Georgia Southern University; Jessica Reichmuth, Bruce Saul, Augusta University; and A. Loren Mathews, Georgia Southern University*

The Satilla River Estuary (SRE) lies between Jekyll and Cumberland Islands on the Georgia coast. This ecosystem is home to a variety of shark species in both juvenile and adult life stages. The purpose of this study is to gain a better picture of the species and distribution of sharks within the system. Sharks were sampled monthly at 4 sites using gill nets and trawl nets. The length, sex, and species were recorded for each individual except for some individuals from which volunteers were unable to attain information beyond species. In total, over the 2 year sampling period, 7 species and 86 individuals were caught. No obvious differences in seasonality were observed between different species or between the 4 sites. However, overall seasonality was apparent showing that the Satilla is a preferred habitat during spring and summer months. Preference of sites was also observed. Fish and crab were noted so that food distribution could be taken into account. The sites preferred by sharks seem to be correlated with fish site preference. This trend was not observed in crab numbers. The differences in seasonality and site preferences help us to gain a better picture of the makeup of the shark population of the SRE and what could make it a preferred habitat for summer months. More long-term investigation of shark and prey population dynamics combined with water quality trends would be needed to gain information that could provide more definitive statements about this population but initial data has shed some light on what the SRE is made of.

Protecting shorelines with constructed oyster reefs: evidence in the sediment

*Colin Herbert**, Jessica Veenstra, and Melissa Southwell; Flagler College*

Shoreline erosion is becoming an increasingly important issue in many coastal communities. Constructed oyster reefs, or “living shorelines”, can help protect against erosion by dissipating wave energy. When a wave or boat wake encounters a reef, the wave energy is minimized, and finer sediment particles should settle out and accumulate behind the reef. In addition to mitigating shoreline erosion, these constructed oyster reefs and their associated fine sediments can provide important intertidal habitat for a variety of organisms. In 2012, the GTM Research Reserve constructed a series of intertidal oyster reefs using bagged shell near Wright’s Landing on the Tolomato River. In 2016, we collected sediment core samples 0.5 m landward of three of the constructed reef sites, and three control core samples 25 m, 50 m, and 75 m south of, and at the same elevation as the constructed reef sites. Core samples ranging in depth from 20-50 cm were split into 2 cm increments. For each 2 cm subsample, we determined sediment particle

size by dry sieving for coarse (2 mm-500 µm), medium (500 µm-250 µm), fine (250 µm-125 µm), and very fine (125 µm-63 µm) sands, and by wet sieving for silt and clay (<63 µm). If the constructed reefs are effectively reducing wave energy, we expect to find finer sediments near the surface in the constructed reef sites and coarser sediments in the control sites. Our initial data analysis supports that hypothesis. The three reef sites have accumulated 16 cm of fine sediment with an average of 32% silt and clay, as compared to an average of 5% silt and clay in the control sites.

Sea level rise and habitat change at Carolina Beach State Park

*Evan Hill** and Devon Eulie; University of North Carolina Wilmington*

Sea level rise threatens coastal development and habitat throughout the world, and the issue will only become more problematic with increasing levels of greenhouse gas emissions. Proactive planning is needed in order to address this expansive issue in order to abate the potential effects of sea level rise in the coming years. Carolina Beach State Park is located in New Hanover County, NC, and is situated in the estuarine area of the lower Cape Fear River. Between 2010 and 2045, sea level is expected to increase between 6.1 centimeters and 17.3 centimeters in the study area. This increase in sea level will impact coastal vegetation since it is restricted to ranges dependent on the frequency of inundation from the tides. This will cause marsh migration and habitat change in the nearshore environment. The Sea Level Affecting Marshes Model was utilized to predict the extent of sea level rise, as well the change in coastal habitat. These data will inform park managers as to the potential impacts of sea level rise and the habitat change that will be associated with it.

Effects of carbaryl insecticide on an estuarine community

*Samantha Iliff**, Florida Atlantic University; Elizabeth Stoner, Bentley University; Rachel Harris, Loxahatchee River District*

Small benthic invertebrates are well known to be a key link in the transfer of energy between primary producers and secondary consumers. Because of their small size, it is difficult to manipulate these organisms in the field, making it hard to obtain data on their other ecological roles. New techniques, implementing cage-free exclusion and slow dissolution of deterrent chemicals, have been used to study the impact of small benthic crustaceans on community structure within a few habitats such as seagrass beds and algal assemblages. However, little is known about the ecological roles of these animals in other coastal marine habitats. Using chemical-exclusion experiments in the Loxahatchee River Estuary, we were able to study how small benthic invertebrates impacted the community composition of an artificial hard-bottom microhabitat simulating an oyster reef. Preliminary findings indicate that the insecticide used to deter arthropods had a significant impact on the crustacean community composition as well as a particularly negative effect on *Americorophium ellisi* abundance. Insecticide pollution in estuaries could result in a shift of benthic community composition, potentially indirectly influencing other higher level organisms and valuable estuarine species such as the eastern oyster *Crassostrea virginica*.

A conceptual ecological model for the Northern Estuaries and Southern Coastal Systems Regions of the Comprehensive Everglades Restoration Plan (CERP) REstoration, COordination, VERification (RECOVER) Program

Phyllis Klarmann, SFWMD; Gretchen Ehlinger, USACE; Patricia Gorman, SFWMD; Amanda McDonald, SFWMD; Michael Simmons, USACE; Patrick Pitts, USFWS; Dave Rudnick, Everglades National Park

The Comprehensive Everglades Restoration Plan (CERP) REstoration, COordination, VERification (RECOVER) Program is responsible for the coordination and application of science to support CERP project implementation. RECOVER finalized its 2017-2021 Five-Year Plan (FYP), and identified several major tasks to review the science program. One task in the FYP is to update regional conceptual ecological models (CEMs) first published by RECOVER scientists in a special edition of the journal Wetlands in 2005. CEMs as applied to CERP are non-quantitative planning tools to identify ecological and anthropogenic drivers and stressors on systems, the ecological effects of stressors, and the biological attributes or indicators affected. The RECOVER Northern Estuaries (which includes Southern Indian River Lagoon) and Southern Coastal Systems regions combined efforts to create a single Everglades Coastal Systems (ECS) CEM. Next steps include finalizing the CEM, developing hypotheses of cause-effect relationships affecting RECOVER ecological indicators, and a vulnerability analysis of RECOVER system attributes.

Carbonic anhydrase regulation of plankton community structure in estuarine systems

Eilea R. Knotts and James L. Pinckney; University of South Carolina*

Carbon concentrating mechanisms (CCMs) are used by phytoplankton to concentrate dissolved inorganic carbon (DIC) within their cells for use in photosynthesis. However, CCMs which involve carbonic anhydrase (CA) may become redundant in the future due to increasing surface water CO2(aq) concentrations. Most of our knowledge of the CA enzyme is based on single species phytoplankton cultures or oligotrophic water samples. Few studies have examined the consequences of CA activity on competitive interactions in estuarine phytoplankton communities or measured the long-term effects on community composition. Using bioassays of natural phytoplankton communities, our research explored two different estuarine systems and determined how community composition was altered when the CA enzyme was removed. Using the CA inhibitor - ethoxyzolamide (EZ), our results demonstrate that communities are altered when the inhibitor is present and CA activity is suppressed. Diatoms were the dominant taxonomic group in all samples following three days exposure of the community to EZ. However, our findings suggest that diatom growth was both stimulated and inhibited, depending on the salinity of the location where samples were collected. Furthermore, microscopy of the high salinity phytoplankton community indicated that centric diatom genera (e.g. *Guinardia*, *Skeletonema*, *Rhizosolenia*) were severely reduced in treatments that removed the competitive advantage of CA, while pennate diatom genera (e.g. *Asterionellopsis*, *Cylindrotheca*, *Thalassionema*) dominated these same treatments. These shifts in community structure suggest that phytoplankton composition is affected by carbon acquisition using CA and some diatom genera may depend on the competitive advantage of this CCM to maintain high abundances in estuarine environments.

Oyster reef monitoring within the GTMNERR: a pilot study

Pamela Marcum and Nikki Dix; GTMNERR

The Eastern Oyster, *Crassostrea virginica*, is a keystone species throughout estuaries of the southeastern United States and beyond. The bar-built estuaries of Northeast Florida contain large expanses of intertidal oyster reefs which provide numerous ecosystem services. Despite their importance, little is known about oyster population structure and overall resource condition in northeast Florida. The Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR) conducted a pilot study on oyster reefs to assess abundance and population structure, reef condition, associations with other sessile fauna, and environmental drivers. During the 2014-2016 study, over 200 reefs were sampled biannually throughout the estuaries of the Guana, Tolomato, and Matanzas Rivers and surrounding tributaries. Results indicated that both regional- and seasonal-scale drivers influence oyster reef structure and provide an important baseline to assess change in the future.

An examination of living shoreline design along a salt marsh shoreline in Wilmington, North Carolina

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As anthropogenic activates continue to increase in estuarine environments, so does the need to find management approaches that minimize the loss of valuable coastal wetlands. One such approach is the use of living shorelines, a conservation strategy employed to stabilize the edge of a coastal wetland and provide benefits to the local habitat. Living shorelines typically make use of natural features such as oyster reefs and/or salt marsh grass to attenuate erosive wave energy and create conditions conductive to sediment deposition and vegetation growth. In contrast to conventional erosional control structures like seawalls and bulkheads, living shorelines provide important ecosystems services and can be constructed at less cost. While numerous studies have addressed the ecosystem impacts associated with living shoreline construction, fewer efforts have quantified the physical changes resulting from their construction. In a previous study, oyster reef and marsh grass treatments were constructed and deployed along the open water edge of a *Spartina alterniflora* marsh in Wilmington, North Carolina. The goal was to determine if the combined use of oyster + grass could influence wave attenuation and resultant sediment deposition. Results showed that the oyster reef significantly attenuated wave energy and resultant sediment deposition were seen on both the oyster reef and salt marsh treatments. In the current study, the goal is to determine how the oyster reef and salt marsh treatment affect wave energy and sediment deposition when used independently of each other, and how this affects the marsh directly behind the treatment areas.

Ontogenetic changes in ghost crab behavior: size and gender effects

*Logan Masterson** and Eric Rosch; Coastal Carolina University*

Animal behavior is often dependent on the gender, size, and maturity of the individuals involved. Territorial animals, such as ghost crabs, are particularly well-suited for investigation into how they respond to stimuli. In the current study, sub-adult and adult ghost crabs, *Ocypode quadrata* , were observed how they responded to a perceived threat in order to ascertain factors that influence their behavior. Factors analyzed were carapace width, handedness, cheliped size, sex, and approach direction. Crabs were extracted from their burrows and trials were performed in situ on the beach. After a few minutes of acclimation, crabs were approached from various angles and the subsequent responses recorded. The data were separated into three response categories, aggressive, neutral and defensive. Aggressive behaviors were more common in males, larger individuals, and crabs with larger claws relative to body size. These results suggest that threat responses in ghost crabs may be related to ontogenetic factors such as size and sex of individuals, and could be applied to other territorial organisms.

PCR amplification and comparison of Bermuda's diamondback terrapin DNA sequences

*Madeline L. Musante**, Lydia C. Logan**, Benjamin K. Atkinson, Flagler College; Mark E. Outerbridge, Bermuda Department of Environment and Natural Resources; and Terri J. Seron; Flagler College*

The Diamondback Terrapin, *Malaclemys terrapin* is an estuarine turtle found along the Atlantic and Gulf coasts of the United States from Cape Cod, Massachusetts to Corpus Christi, Texas. Additionally, a very small Mid-Atlantic population resides on the island of Bermuda. This population is carefully monitored due to the small number of individuals and limited habitat. The taxon was listed on Bermuda's Vulnerable Species Act in 2007. These terrapins are putatively native to Bermuda based on carbon dating of fossils found on the island in a cave. However, debate persists regarding the stateside origin of Bermuda's unique terrapin population. They may have arrived via rafting the Gulf Stream and spinoff eddies, and/or been historically transported by humans. DNA was extracted from 80 tail tip clippings from the Bermudian population. An established methodology was employed to PCR-amplify 12 microsatellite regions of the terrapins' genome. Several PCR products from these regions were sequenced and compared using a multiple sequence alignment tool. Sequence chromatograms were visualized to confirm sequence disparities. Very few sequence differences have been elucidated so far between Bermudian terrapin individuals. Sequence identity at all 12 microsatellite regions would reveal extremely low genetic diversity among the population and confirm a genetic bottleneck. This research supports ongoing conservation efforts for the terrapins of Bermuda and may be able to confirm their origin.

Estimating food habits of a coastal population of gopher tortoises in the GTMNERR

*Rosemary Rice**, Amanda Aydlett**, Sylvia Chero**,Kerri Smetana**, Mac Byram**,Lee Newsom, Blonder, and Carrie Grant; Flagler College*

The coastal strand ecosystem in Northeast Florida is home to a variety of species, including the gopher tortoise, *Gopherus polyphemus*. There is little available information on gopher tortoise dietary preferences for inland populations, while there is even less for coastal populations. Fecal samples were collected from the coastal strand foredune in the northern segment of the Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR). The samples were analyzed to determine the diet of *G. polyphemus*, and analyses of fecal matter were conducted with the help of plant experts and identification guides. Once identified, the masses of each vegetative families were used to determine the relative importance of specific vegetative groups in individuals' diets. The significance of understanding the diet of *G. polyphemus* can aid in future conservation efforts because they are a threatened keystone species.

Microplastic accumulation in spat and adult oysters in Mosquito Lagoon

*Megan Robbins** and Linda Walters; University of Central Florida*

An estimated 15- 51 trillion pieces of microplastics are floating around our oceans and growing by the day. Microplastics are less than 5 mm pieces of plastic that originate from larger pieces of plastic broken down into smaller pieces. Commonly encountered types of microplastics include microbeads, fibers, and fragments. Microplastics are synthetically made from materials such as polyethylene and polypropylene.

The eastern oyster *Crassostrea virginica* is a filter feeder that consumes microplastics which may affect reproduction, slow growth rates, and produce thinner shells. To determine if juvenile *C. virginica* were ingesting microplastics in Mosquito Lagoon, we collected spat at 1, 2, and 6 months from 4 restored reefs. Individuals were measured and weighed then placed into hydrogen peroxide to breakdown organic tissue and vacuum-filtered using NOAA protocols. For comparison, adult oysters were collected from 4 different live reefs on same days and water was collected from all reefs at time of adult oyster and spat collections. All were processed using NOAA protocols. 1-month old spat had an average of 7.3 microplastics per oyster and 2-month spat had an average of 13.3 per oyster. Fibers dominated collections by 85% and the most abundant color was clear in spat and adults. We need to better understand the abundance, distribution and impact of microplastics in all species, but especially organisms like oysters that are vital for water filtration in our estuaries.

Histological analysis of limb bud development during regeneration in fiddler crabs

*Emeline Ward**, Eric Rosch, and Scott Parker; Coastal Carolina University*

Regeneration is a common occurrence among many invertebrates, as their survival often depends upon their ability to regain locomotive and defensive capabilities lost during injury or autotomization. When these systems are lost there is often a rapid physiological response by the organism to regain functionality. Fiddler crabs, *Uca pugilator* and *Uca pugnax,* are well-studied in the hormones and growth factors involved in regeneration. This study focused on examining the tissue morphology of limb bud formation during regeneration. Crabs missing either an ambulatory leg or a cheliped were collected from local marshes, brought back to the lab and kept isolated from each other to prevent injury or further loss of limb by aggressive interactions. Every 48 hours, specimens were fed and morphological measurements recorded. Once a limb bud developed, it was closely monitored and then excised when it reached a predetermined size. For histological preparation, excised limb buds were submerged in formaldehyde, embedded in paraffin, and sectioned for staining. All limb buds shared three main characteristics: an abundance of mesenchymal cells in clusters, pinnate muscle tissue arrangement, and a double inward fold of the limb in development. Cheliped buds exhibited defined chela development with the carpus and merus showing a pattern more similar to the ambulatory leg buds being folded in on each other. Understanding the developmental qualities associated with regeneration may help further advances in injury repair and rehabilitation.

Water quality investigation at the St. Augustine Marina: fecal coliform and ammonium

*Westly Woodward**, Allison Hartnett**, and Matthew Brown; Flagler College*

Ammonium concentration and fecal coliform counts can be used as indicators of water quality. Ammonium concentrations can provide insight into nutrient availability and is also a byproduct of animal waste excretion. It is important to study nutrients in water bodies as it can offer evidence for productivity and health. Fecal coliforms serve as a microbiological index of water quality and can be indicative of sewage or leaking septic systems. The research presented herein was based on a semester-long water quality study (Fall 2017) at the Saint Augustine Municipal Marina in Saint Augustine, FL. The primary research objective was to examine temporal trends in fecal coliform abundance and ammonium concentrations in surface waters. Temporal trends will be discussed in terms of temperature, salinity, and rainfall. Triplicate surface grab samples were collected weekly from September 21 to November 16 membrane-filtered, and analyzed for both fecal coliform and ammonium. Upon analysis of the data collected at the St. Augustine Marina, it becomes clear that the relationship between ammonium and fecal coliform bacteria are helpful in determining overall water quality in the area observed.

NOTES