

**Southeastern Estuarine Research Society
Est. 1974**

Semi-annual Meeting

February 13 – 15, 2014

**Celebrating 40 years of estuarine and coastal research and
management in the southeast**

**Coastal Georgia Center
Savannah, GA**



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

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Georgia Southern University Department of Biology
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Savannah State University
Georgia Southern University Institute of Coastal Plain Science
Ogeechee Riverkeeper
Southbound Brewing Company**

Our Local Host:

Loren Mathews, Georgia Southern University

Session Chairs and Anonymous Judges

The Program Chair would like to thank:

Michele Sherman and Sugeiry Rivera of
Savannah State University for their assistance with the program

Chair of Student Promotions Committee (Travel Awards):

Robert Virnstein

SEERS Congratulates our Student Travel Award Winners:

John Brooker, College of Charleston
Amanda Croteau, University of Florida
Geoffrey Smith, University of Florida
Lauren Hehman, University of South Carolina
Alexandra Norelli, University of South Carolina

**Please be sure to check out the SEERS merchandise
Sales help to support student awards**

Special 40th anniversary T-shirts available!!!!

**SEERS T-shirts and stainless steel water bottles will be available for purchase during
all registration times, lunch and breaks. They make great Valentine's Day gifts!**



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This program has been provided courtesy of the College of Science and Technology at Savannah State University





**Southeastern Estuarine Research Society
February 13 – 15, 2014
Coastal Georgia Center
305 Fahm Street; Savannah, GA 31401**

All events are at the Coastal Georgia Center except the dinner social Friday evening

Schedule at a Glance

Thursday, February 13

- | | |
|-----------------------|---|
| 4:30 p.m. – 5:30 p.m. | Registration check-in and poster setup |
| 5:30 p.m. – 7:30 p.m. | Poster session and social with finger food and beverages
(Presenters should stand by their posters during this time—
especially students being judged for presentation award) |

Friday, February 14

- | | |
|-------------------------|--|
| 7:45 a.m. | Registration Opens |
| 8:15 a.m. | Welcome and Announcements |
| 8:30 a.m. – 9:45 a.m. | Session I |
| 9:45 a.m. – 10:15 a.m. | Break |
| 10:15 a.m. – 11:15 a.m. | Session II |
| 11:15 a.m. – 1:00 p.m. | Poster Session and Lunch
(Presenters should stand by posters from 11:15-11:45 a.m.) |
| 1:00 p.m. – 1:45 p.m. | Session II (continued) |
| 1:45 p.m. – 2:05 p.m. | Break |
| 2:05 p.m. – 4:20 p.m. | Special Session |
| 4:30 p.m. – 5:30 p.m. | Business Meeting (Student Travel Awards Presented) |
| 6:30 p.m. – 9:00 p.m. | Dinner Social
(<i>Trolleys depart starting 6:15 p.m. from the Embassy Suites</i>) |

Saturday, February 15

8:00 a.m.	Registration Opens
8:15 a.m.	Welcome and Announcements
8:30 a.m. – 9:30 a.m.	Session III
9:30 a.m. – 10:00 a.m.	Break
10:00 a.m. – 11:00 a.m.	Session IV
11:05 a.m.	Closing Remarks, Presentation Awards, and Announcements

PLATFORM PRESENTATIONS

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

Friday 8:15 Welcome: Robert Virnstein – SEERS President, Loren Mathews – Local Host, and Carla Curran – SEERS Program Chair

Friday 8:30 – 9:45 a.m. Session I Marsh Vegetation

Moderators: Brigitte Brinton, Savannah State University; Eric Koepfler, Coastal Carolina University

- 8:30 Interactive effects of increasing ammonium and salinity concentrations on nitrogen uptake and growth of *Spartina alterniflora***
*Rachel MacTavish**, Georgia Southern University; Risa A. Cohen, Georgia Southern University
- 8:45 Is stimulation of *Spartina alterniflora* growth by alginate influenced by sediment organic matter content?**
*Donald Schneider**, Georgia Southern University; Risa Cohen, Georgia Southern University
- 9:00 Wrack disturbance in salt marsh communities**
Merryl Alber, University of Georgia; Karrie Bulski, Skidaway Institute of Oceanography; Zane Cress, Georgia Southern University
- 9:15 Shoreline armoring and upland connectivity in salt marsh ecosystems**
*Natalie McLenaghan**, University of Georgia; Merryl Alber, University of Georgia; Clark Alexander, University of Georgia
- 9:30 Intertidal marsh vegetation monitoring in the Guana Tolomato Matanzas National Estuarine Research Reserve**
Nikki Dix, GTMNERR; Jason Lynn, GTMNERR; Pamela Marcum, GTMNERR

BREAK 9:45 – 10:15 a.m.

(Consider buying a Tshirt to commemorate the 40th anniversary of SEERS!)

Friday 10:15 – 11:15 a.m. Session II Macrofauna

Moderators: Natalie McLenaghan, University of Georgia; Erik Smith, USC Baruch Marine Field Laboratory

10:15 The influence of environmental pH/hypercapnia on the shell strength of the eastern oyster, *Crassostrea virginica*

Evan Sherer*, College of Charleston; Derk Bergquist, South Carolina Department of Natural Resources

10:30 Effects of antimicrobial exposures on grass shrimp, *Palaemonetes pugio*, and associated *Vibrio* bacterial density and development of antibiotic resistance

Marie DeLorenzo, National Oceanic and Atmospheric Administration; Kenzie Kelly**, College of Charleston; John Brooker**, College of Charleston; Juita Martinez**, Humboldt State University; Millie Thomas**, College of Charleston; Jan Moore, National Oceanic and Atmospheric Administration; Katy Chung, National Oceanic and Atmospheric Administration; Pete Key, National Oceanic and Atmospheric Administration; Mike Fulton, National Oceanic and Atmospheric Administration

10:45 The effect of host intermolt variability on the reproduction of the bopyrid isopod parasite *Probopyrus pandalicola*

Brigette A. Brinton*, Department of Marine and Environmental Sciences, Savannah State University; Mary Carla Curran, Department of Marine and Environmental Sciences, Savannah State University

11:00 Age determination of coastal longnose gar *Lepisosteus osseus* populations using otoliths and branchialstegal rays

Virginia Shervette, University of South Carolina Aiken; Meredith Smylie*, College of Charleston; Paul Thomas**, University of South Carolina Aiken

POSTER SESSION AND LUNCH 11:15 a.m. – 1:00 p.m.

(Presenters should stand by their posters from 11:15-11:45)

Friday 1:00 – 1:45 p.m. Session II Macrofauna (continued)

Moderators: Mary Grace Tucker, University of North Carolina Wilmington; Joe Staton, University of South Carolina Beaufort

1:00 Potential predatory impacts of pike killifish, a non-native fish, on juveniles of a native, estuarine-dependent species, the common snook

Geoffrey Smith*, University of Florida; Debra Murie, University of Florida

1:15 Temporal and spatial patterns in abundance and diversity of fish assemblages at estuarine and coastal sites near the mouth of the Savannah River, Georgia
*Jennifer A. Gut**, Savannah State University; Mary Carla Curran, Savannah State University

1:30 Terrapins prefer nesting at syzygy
Matthew Draud, Department of Biology, Armstrong Atlantic State University

BREAK 1:45 – 2:05 p.m.

2:05 p.m. – 4:20 p.m. Special Session: Forty years of SEERS – four decades of estuarine and coastal science in the southeast

Presentations will be followed by a panel Q/A and Discussion

Introduction to session and a brief history of SEERS
Geno Olmi, National Oceanic and Atmospheric Administration

Advances in our understanding of estuarine and coastal condition over the past 40 years
Bob Van Dolah, South Carolina Department of Natural Resources (retired)

Changing perspective on estuarine research: A personal account of a convoluted trail toward a global scale – but does anyone still know about fiddler crabs?
Clay Montague, University of Florida

Research in North Inlet estuary, SC: 19,000 tides worth of revelations, puzzles, and projections
Dennis Allen, University of South Carolina

Long-term research in southeastern estuaries: 40 years and beyond
Merryl Alber, University of Georgia

4:30 p.m. – 5:30 p.m. Announcements and Business Meeting

6:30 p.m. – 9:00 p.m. Social at Southbound Brewing Company (107 E Lathrop Ave.)
TENTATIVE (listen to announcements): Trolleys leave every 15 minutes from outside the Embassy Suites starting at 6:15 through 6:45. Shuttles leave Southbound Brewing Company every 15 minutes starting at 8:00 p.m. The last shuttle will be at 9 p.m. and might be able to drop passengers off in town.

Saturday 8:15 a.m. Welcome:

8:30 – 9:30 a.m. Session III Water Quality, Primary Production, and Climate Change

Moderators: Christopher Murry, Savannah State University; Amanda K. Dickens University of North Carolina Wilmington and Cape Fear Academy

8:30 Analysis of plankton population (Chl-a) and water quality by Structural Equation Modeling: Long term data in the Indian River Lagoon

C.E. Proffitt, Florida Atlantic University-Biological Sciences

8:45 The effects of aeration on primary production in stormwater detention ponds near Myrtle Beach

Lauren M. Hehman, University of South Carolina; Erik M. Smith, Belle W. Baruch Institute for Marine and Coastal Sciences; Tammi L. Richardson, University of South Carolina; James L. Pinckney, University of South Carolina*

9:00 Determining volume sensitive waters in Beaufort County, SC tidal creeks

D. Sanger, S.C. Department of Natural Resources (SCDNR); J. Leffler, SCDNR; E. Montie, University of South Carolina-Beaufort; A. Blair, NOAA-Hollings Marine Laboratory; A. Turner, S.C. Sea Grant Consortium; J. Brunson, SCDNR; G. Riekerk, SCDNR; K. Pitts, SCDNR

9:15 Effects of climate signals on freshwater delivery to four Georgia riverine estuaries

Joan E. Sheldon, University of Georgia; Adrian Burd, University of Georgia; Merryl Alber, University of Georgia

BREAK 9:30 – 10:00 a.m.

(Last Chance! Buy a Tshirt to commemorate the 40th anniversary of SEERS)

10:00 – 11:00 a.m. Session IV Information Dissemination and Outreach

Moderators: Donald Schneider, Georgia Southern University; Loren Mathews, Georgia Southern University

10:00 Tales of Landings and Legacies: African Americans in Georgia's Coastal Fisheries

*D. L. Hoskins, NOAA Fisheries/Savannah State University; M. Murphy**, Savannah State University; N. Hawthorne; Savannah State University*

10:15 Connecting research scientists and educators- Developing a community of practice

Amanda K. Dickens, University of North Carolina Wilmington; Andy Gould, North Carolina Aquarium at Fort Fisher

10:30 From charismatic megafauna to parasites: incorporating scientific research into K12 activities

Mary Carla Curran, Carolyn Kovacs, Tara M. Cox, Savannah State University; Laela S. Sayigh, Woods Hole Oceanographic Institution

10:45 Experiential learning for undergraduate marine science students at Coastal Carolina University: The plankton monitoring internship

*Eric Koepfler, Coastal Carolina University, Marine Science Department; Taylor Burkett**, Coastal Carolina University, Marine Science Department; Diana O'Shea**, Coastal Carolina University, Marine Science Department; Erica Stone**, Coastal Carolina University, Marine Science Department; Jessica Rodes**, Coastal Carolina University, Marine Science Department; Katelyn McGlothlin**, Coastal Carolina University, Marine Science Department; Alexander Bogdanoff*, Coastal Carolina University, Coastal Marine & Wetland Studies Program*

11:05 Closing Remarks, Presentation Awards, and Announcements

POSTER PRESENTATIONS (in order by number)

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

POSTER PRESENTATIONS (By poster number)

1. Assessing the ability of an in situ fluorescence probe to monitor dissolved organic carbon dynamics in estuarine waters

Alexandra Norelli^{**}, Marine Science Program, University of South Carolina; Erik Smith, Baruch Marine Field Laboratory, University of South Carolina.

2. Accumulation of litter left behind by visitors before and after weekends on a beach on Tybee Island, GA

Kelsey R. Cramer^{**}, Department of Marine and Environmental Sciences, Savannah State University; Mary Carla Curran, Department of Marine and Environmental Sciences, Savannah State University

3. Sediment transport on an energetic sandy ebb tidal delta offshore of Hilton Head Island, South Carolina before and after Hurricane Sandy

P. Ansley Wren-Key, Coastal Carolina University; Kehui Xu, CCU/LSU; Denise Sanger, SCDNR; George Riekerk, SCDNR

4. An oyster reef as a living shoreline: Effects on sediment particle size distribution

Kristy B. Payne^{**}, Flagler College; Jessica J. Veenstra, Flagler College; Melissa W. Southwell, Flagler College

5. Evaluation of restoration efforts in Robinson Preserve, an estuary in Tampa Bay, Florida

Amanda Croteau^{*}, University of Florida; Charles Cichra, University of Florida

6. Osmotic partitioning in the pickleweed, *Salicornia virginica*

Robert A. Player^{**}, USCB; Stephen A. Borgianini, USCB; Joseph L. Staton, USCB

7. Seasonal changes in the morphology and anatomy of *Spartina alterniflora*

Tiffany Bostick, Amy Schuler, Davielle Drayton, and Chandra Franklin, Department of Natural Sciences, Savannah State University

8. 'Brown Mosaic'-- an early symptom of small-scale marsh dieback

Chandrasekaran (Chandra) I. Franklin, Department of Natural Sciences, Savannah State University; Amy L. Schuler, Department of Natural Sciences, Savannah State University; Davielle N. Drayton, Department of Natural Sciences, Savannah State University; Tiffany S. Bostick, Department of Natural Sciences, Savannah State University

9. Enhancing a middle school curriculum with research and technology, the importance of integrating scientists in education

Brittany L. Hoffnagle*, Coastal Carolina University; Amy E. Grogan*, Coastal Carolina University; Sharon L. Gilman, Coastal Carolina University; Craig Gilman, Coastal Carolina University

10. A long-term sampling regime for grass shrimp as a foundation to promote student research in the salt marsh

Katherine R. Doyle, Department of Marine and Environmental Sciences, Savannah State University; Mary Carla Curran, Department of Marine and Environmental Sciences, Savannah State University; Tracey M. Modeste, University of Connecticut School of Medicine

11. Establishment of a research, monitoring, and exploration program on the lower Ogeechee River Estuary, GA (ERM EXPLORE)

Sue C. Ebanks, Savannah State University

12. Changes in distribution of diatoms with abiotic parameters in the Savannah River estuary

Brian Murry*, Savannah State University; Carol Pride, Savannah State University

13. A comparison of the diatom communities of the Savannah and Altamaha River estuaries (Georgia)

Ashton Arnold*, Savannah State University; Carol Pride, Savannah State University

14. Parasitic castration of the daggerblade grass shrimp *Palaemonetes pugio* by the bopyrid isopod *Probopyrus pandalicola*

Michele B. Sherman, Department of Marine and Environmental Sciences, Savannah State University; Mary Carla Curran, Department of Marine and Environmental Sciences, Savannah State University

15. Spring-neap variation in clutch size correlations and embryonic development for the daggerblade grass shrimp *Palaemonetes pugio*

Renee Smith**, Savannah State University; Sue C. Ebanks, Savannah State University

16. Tide-dependent predation patterns of piscivorous fishes in shallow estuarine creeks

Matthew R. Helms*, Coastal Carolina University; Robert F. Young, Coastal Carolina University; Dennis M. Allen, Belle W. Baruch Institute, University of South Carolina

17. Feeding behaviors of spotfin mojarra in relation to tidal cycles

Annabella Panaro**, Flagler College; Edward McGinley, Flagler College

18. Tidal and diel movement patterns of the Atlantic Stingray *Dasyatis sabina* along a stream-order gradient

Cameron Brinton*, Department of Marine and Environmental Sciences, Savannah State University; Mary Carla Curran, Department of Marine and Environmental Sciences, Savannah State University; and Charles F. Cotton, Florida State University Coastal and Marine Lab

19. Determining residency patterns of the Atlantic Stingray *Dasyatis sabina* in two tidal creeks in Savannah, Georgia using acoustic telemetry

Sarah Ramsden*, Department of Marine and Environmental Sciences, Savannah State University; Mary Carla Curran, Department of Marine and Environmental Sciences, Savannah State University; Charles F. Cotton, Florida State University Coastal and Marine Laboratory

ABSTRACTS (in order of presentation)

ORAL PRESENTATIONS

Friday 8:30 – 9:45 a.m. Session I Marsh Vegetation

Interactive effects of increasing ammonium and salinity concentrations on nitrogen uptake and growth of *Spartina alterniflora*

Rachel MacTavish*, Georgia Southern University; Risa A. Cohen, Georgia Southern University

Dominant salt marsh macrophytes, such as *Spartina alterniflora* play a critical role in uptake and transformation of inorganic nitrogen before it reaches coastal waters. Although nitrogen typically limits *S. alterniflora* growth, it may be possible to overwhelm the nitrogen uptake capacity of *S. alterniflora* particularly under elevated nutrient and salinity conditions. Investigating the interactive effects of nutrients and salinity on *S. alterniflora* is important given that increases in inorganic nitrogen supply to surface waters from agriculture and urbanization occur simultaneously with freshwater withdrawals that reduce flow and increase salinity. *Spartina alterniflora* nitrogen uptake and growth responses to inorganic nitrogen (ammonium) (no addition, 10 M, and 100 M), and salinity (20 psu, 30 psu, and 40 psu) treatments in a fully crossed factorial design were measured biweekly in greenhouse microcosms with tidal simulation from April through October, 2013. Preliminary results revealed both above and belowground biomass were reduced by high salinity (40 psu) with no effect of ammonium at any concentration tested. However, short-term ammonium uptake rates were typically highest in 20 psu salinity regardless of ammonium concentration with the exception of the rate in the highest salinity (40 psu) and ammonium treatment (100 M). That *S. alterniflora* nitrogen uptake rates decrease as salinity concentrations increase suggests alteration of coastal salinity may influence nitrogen retention services of *S. alterniflora* dominated salt marshes.

Is stimulation of *Spartina alterniflora* growth by alginate influenced by sediment organic matter content?

Donald Schneider*, Georgia Southern University; Risa Cohen, Georgia Southern University

Salt marshes provide nursery habitat for economically important fish species and high levels of primary production and nutrient cycling. These critical habitats are increasingly altered by coastal development necessitating restoration to regain lost habitat. Insufficient sediment nutrients (i.e. nitrogen) can limit growth of temperate salt marsh grasses, thus nitrogen fertilizer is often added to restored sediments to accelerate plant establishment and growth. However, tidal flushing can export excess nitrogen from the marsh, potentially triggering algal blooms in adjacent coastal waters. Alternatively, adding organic matter to sediment can stimulate microbial nitrogen fixation and organic matter mineralization, thereby increasing nitrogen availability. However, if the sediment organic matter content of the sediments is high, addition of a labile carbon source (e.g. a polysaccharide) may not enhance microbial activity. To test the hypothesis that sediment organic content affects the amount of *S. alterniflora* growth stimulation following addition of the polysaccharide alginate, 40 plots were established with sediment organic matter ranging from 3.4-8.2% at the Skidaway Institute of Oceanography Salt Marsh Ecosystem Research Facility in May 2013. Plots were randomly assigned to alginate addition or control treatments (n=20) and biweekly measurements of *S. alterniflora* stem density and height were conducted. Over nine months, plants grew similarly in both alginate and control treatments regardless of sediment organic matter content. Given the high within plot variation in sediment organic content encountered, a manipulative experiment may be useful to determine if sediment organic matter content affects alginate's utility as a tool to enhance *Spartina alterniflora* growth.

Wrack disturbance in salt marsh communities.

Merryl Alber, University of Georgia, Karrie Bulski, Skidaway Institute of Oceanography; Zane Cress, Georgia Southern University

This study evaluated the effects of wrack accumulation on salt marshes. The work was motivated by concerns that the pilings and pylons associated with docks tend to trap wrack, potentially to the detriment of the underlying plants. We established experimental plots in each of the different vegetation zones in a salt marsh in the Duplin River adjacent to Sapelo Island, GA. Treatment plots were covered with wrack and sampled over the course of a year. We found that 1) Wrack is a source of disturbance to the marsh. Some effects on plant density could be seen within 1-2 mo, and if kept in place for 8-12 mo the wrack killed essentially all of the underlying vegetation. Loss of plants was accompanied by a reduction in the densities of the periwinkle snail,

Littoraria irrorata. 2) There were not large differences in the effects of wrack in the different vegetation types, but plants in the *Spartina* zones were affected more rapidly than those in the high marsh (*Juncus*, marsh meadow). A larger effect was seen in the timing of wrack application: when applied in the spring vegetation loss proceeded more rapidly than when it was applied in the fall. 3) Recovery is occurring most rapidly in *Spartina* zones, and appears to be following an elevation gradient. Recovery is taking longer for plots exposed in the fall as compared to the spring. Plots exposed for less than 12 mo are recovering more quickly.

Shoreline armoring and upland connectivity in salt marsh ecosystems

Natalie McLenaghan*, University of Georgia; Merryl Alber, University of Georgia; Clark Alexander, University of Georgia

At the land-sea interface, engineered structures such as bulkheads are a commonplace defense against erosion along developed shorelines. These features may interrupt hydrological and ecological processes at the boundary between coastal uplands and adjoining salt marshes, thereby resulting in altered connectivity across this critical ecotone. In our study, we conducted field surveys in the state of Georgia to assess whether conditions in the high-marsh zone differ in the presence or absence of bulkheads. To account for confounding effects of development, our survey design employed three categories of upland classes, with sites in close proximity: 1) residential with armoring, 2) residential without armoring, and 3) forested without armoring (n = 20 each). We recorded lower elevations near bulkheads at corresponding plot distances (2, 4, and 8 m) beyond the upland edge. Surprisingly, porewater salinity did not vary as a function of armoring nor development. Porewater ammonium concentrations were greatest at forested sites, whereas porewater nitrate reached substantial levels (> 600 micromolar) at both forested and unarmored sites, but only at higher elevations in the marsh. Near the upland boundary, vegetation (in particular, *Spartina alterniflora*) was densest and most verdant at armored sites. In addition, marsh adjacent to bulkheads exhibited the least coverage by wrack. Ongoing analyses of soil and plant properties may further elucidate differences between the upland classes. As coastal landscapes become further modified by development and an encroaching sea, it will be important to characterize potential changes in marsh ecosystem structure and function in response to shoreline stabilization.

Intertidal marsh vegetation monitoring in the Guana Tolomato Matanzas National Estuarine Research Reserve

Nikki Dix, GTMNERR; Jason Lynn, GTMNERR; Pamela Marcum, GTMNERR

Intertidal marsh habitats are of particular importance in estuarine ecosystems because they link marsh and subtidal habitats during periods of tidal inundation. The extensive and direct land-water interactions created by these habitats make them vulnerable to impacts from such forces as climate change, pollution, and erosion. A monitoring program has recently been established in the Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR) as part of a NERR system-wide effort to understand how emergent marsh vegetation changes in response to various environmental factors. Monitoring was conducted during summer and fall of 2012 and 2013. In accordance with NERRS protocols, vegetation species cover and canopy height were estimated within 90 plots throughout the Reserve (six sites, three platforms at each site, and five 1-m² plots at each platform). The first questions to be addressed by this emerging dataset include 1) What are the structural characteristics of these plant communities in terms of species composition, abundance, and canopy height?; and 2) What are the short-term patterns in vegetation community structure over time and space? In the future, results will be related to complementary work in progress, including marsh elevation monitoring via deep rod Surface Elevation Tables (SETs) and feldspar clay accretion plots, surveys of vegetation and elevation sites into local elevation networks, and mangrove monitoring along the salt marsh-mangrove ecotone. Through such efforts, the GTMNERR will help the NERRs serve as a network of sentinel sites for the detection of natural and anthropogenic impacts in estuaries nationwide.

Friday 10:15-11:15 a.m. Session II Macrofauna

The influence of environmental pH/hypercapnia on the shell strength of the eastern oyster, *Crassostrea virginica*.

Evan Sherer*, College of Charleston; Derk Bergquist, South Carolina Department of Natural Resources

Increasing atmospheric CO₂ concentration is leading to a decrease in mean ocean pH. Studies indicate that pH levels predicted for the future will have detrimental effects on bivalves, including reduced calcification and

shell strength. Estuaries, while home to many species of bivalves, currently experience pH levels far below those predicted for the future global ocean. The objective of this study was to observe if existing natural pH variation caused a response in the mechanical properties of the adult eastern oyster *Crassostrea virginica*. Oysters were collected at six sites along the pH gradient of the Wando River, Charleston, SC. Sites were chosen to capture the full pH range of the river with higher pH (~7.7) at sites near the mouth of the river and lower pH (~7.0) at sites up river. The breaking strength of the middle and edge region of the right valve from each oysters was measured with a digital force gauge. The strength of the middle region of the valve varied among the sites, but did not show a declining trend with decreasing pH along the river. With one exception the breaking strength for the edge region of the valve showed no significant differences among the sites. Thus, there was no apparent correlation between habitat pH and shell breaking strength in adult oysters. Future studies on acidification in estuaries should consider the fact that these environments are already highly variable in pH and that other environmental factors may work alone or synergistically to influence shell strength.

Effects of antimicrobial exposures on grass shrimp, *Palaemonetes pugio*, and associated *Vibrio* bacterial density and development of antibiotic resistance

*Marie DeLorenzo, National Oceanic and Atmospheric Administration, Kenzie Kelly**, College of Charleston, John Brooker**, College of Charleston, Juita Martinez**, Humboldt State University, Millie Thomas**, College of Charleston, Jan Moore, National Oceanic and Atmospheric Administration Katy Chung, National Oceanic and Atmospheric Administration Pete Key, National Oceanic and Atmospheric Administration, Mike Fulton, National Oceanic and Atmospheric Administration*

Although seldom thought of as pollutants, antimicrobials are widespread in the aquatic environment and may threaten ecosystem and human health. To study the impact of antimicrobials, grass shrimp were exposed to individual and mixtures of four different antimicrobials (triclosan, sulfamethoxazole, erythromycin, and oxytetracycline) in multiple 96-hour toxicity tests. The effects of antimicrobial treatments on grass shrimp were measured using mortality and two bioassays of cellular stress: lipid peroxidation and glutathione. The effects of antimicrobial treatments on the bacterial community of the shrimp were assessed by measuring presumptive *Vibrio* species density and testing bacterial isolates for antibiotic resistance. Triclosan (0.33 mg/L) and a mixture of triclosan and sulfamethoxazole (0.33 mg/L and 60 mg/L respectively) caused significant shrimp mortality and significant increases in lipid peroxidation activity. Glutathione activity was not significantly altered by antimicrobial exposure. Triclosan significantly increased *Vibrio* density compared to control but sulfamethoxazole and the sulfamethoxazole/triclosan mixture decreased *Vibrio* density. An increased *Vibrio* antibiotic resistance was observed for all antimicrobial treatments except for the three-antibiotic mixture of sulfamethoxazole, erythromycin, and oxytetracycline. Greater than 80% of *Vibrio* isolates displayed resistance to triclosan in the control treatment suggesting a high level of triclosan resistance in natural *Vibrio* species. Increased *Vibrio* densities and increased resistance associated with antimicrobial treatments suggest the presence of triclosan in coastal waters may preferentially increase the resistance and abundance of pathogenic bacterial species. The results of this study indicate the need for further study into the potential harm of antimicrobials in the environment.

The effect of host intermolt variability on the reproduction of the bopyrid isopod parasite *Probopyrus pandalicola*

Brigette A. Brinton, Department of Marine and Environmental Sciences, Savannah State University; Mary Carla Curran, Department of Marine and Environmental Sciences, Savannah State University*

The bopyrid isopod *Probopyrus pandalicola* is an ectoparasite that infests at least 16 palaemonid shrimp, including the daggerblade grass shrimp *Palaemonetes pugio*. Parasite reproduction is thought to occur synchronously with host molting because the brood is unviable if molting occurs before the larvae are free swimming and capable of seeking a host. Temperature affects the length of the molting cycle for shrimp, and therefore may also affect the timing of isopod brood development. The purpose of the present study was to determine the duration of each developmental stage of the young as a function of temperature, as well as the fecundity of *Probopyrus pandalicola*. Organisms were monitored at 15C and 23C within environmental chambers. Brood incubation time and shrimp intermolt period were significantly longer at the lower temperature of 15C (34.6 d and 33.1 d, respectively) than at 23C (11.1 d and 12.1 d, respectively). The epicaridium larvae remained in the parasite marsupium for 3.2 times longer at 15C (8.7 d) than at 23C (2.7 d). After brood release, the marsupium remained empty and unused for 15% (3.8 d) of the intermolt period at 15C, compared to only 5% (0.6 d) at 23C. Brood size ranged from 391 to 4,596 young, and was positively

correlated with both parasite and host size. Brood development progressed more rapidly with increasing temperature, suggesting that a potential effect of warming climate could be the increased prevalence of *Probopyrus pandalicola* parasites.

Age determination of coastal longnose gar *Lepisosteus osseus* populations using otoliths and branchialstegal rays

Virginia Shervette, USCA; Meredith Smylie*, College of Charleston; Paul Thomas**, USCA

Estimating age in fishes provides important information concerning individuals, populations, and species. Age information contributes greatly to our understanding of basic ecological and environmental questions in addition to providing essential life history information to fisheries scientists. Many structures are used in estimating fish age including scales, vertebrae, spines, and otoliths. One of the problems in age and growth assessment of a species is the selection of the most suitable structure. One important factor in selecting an aging structure is the ease in obtaining it and processing it for age estimation. However, the easiest structure to obtain is not always the most appropriate one to use. Longnose gar *Lepisosteus osseus* is a relatively long-lived, primitive carnivorous fish species common throughout much of the southeastern region of the U.S. In many aquatic ecosystems, longnose gar is at the top of the foodweb and is an important component in those fish communities. For gar species the most common aging technique is to utilize the branchialstegal rays although no study has previously compared the accuracy or precision of branchialstegal rays of longnose gar to otoliths. We collected 300+ longnose gar from two tidal river systems in South Carolina and estimated age for those populations using branchialstegal rays and otoliths. We found that rays underestimate age by up to ten years in older fish and do not provide consistent age estimates for this species. Additionally, we found that the time it takes to obtain and section otoliths is not greater than the time it takes to pull, boil, and clear rays. We recommend that future studies concerning longnose utilize sectioned otoliths in obtaining age estimates.

Friday 1:00-1:45 p.m. Session II Macrofauna (continued)

Potential predatory impacts of pike killifish, a non-native fish, on juveniles of a native, estuarine-dependent species, the common snook.

Geoffrey Smith*, University of Florida; Debra Murie, University of Florida

Pike killifish is an established non-native fish species in Florida that is found in both fresh and estuarine waters. It was first established in south Florida in 1957 with a secondary establishment occurring in the Tampa Bay area in 1994. Negative ecological impacts, related to decreases in small-bodied fish abundances, have been linked to pike killifish in both of these regions. Recent increases in the range and abundance of pike killifish in Tampa Bay and overlap in habitat usage has led to concerns about potential competition with and predation on early-juvenile common snook (≤ 100 mm SL). Predation of pike killifish on early-juvenile snook was investigated through stomach content analysis and predation trials, which preliminarily suggested that large adult (>90 mm SL) pike killifish were capable of consuming snook up to approximately 50 mm SL in lab conditions, but in the wild they may rarely consume snook (no snook found in 128 pike killifish stomachs examined to date). Predation trials also showed that mosquitofish, a common prey item of pike killifish of all sizes, were always preyed upon significantly more than snook, regardless of prey size. This indicated that snook were either a less preferred prey or that snook possessed some feature(s) that reduced pike killifish predation. However, it does not appear that the snook's enlarged anal spine significantly deters pike killifish predation as there was no significant difference in the predation rates of similar-sized snook with and without their anal spine removed.

Temporal and spatial patterns in abundance and diversity of fish assemblages at estuarine and coastal sites near the mouth of the Savannah River, Georgia

Jennifer A. Gut*, Savannah State University; Mary Carla Curran, Savannah State University

Estuaries and surf zones along the East Coast of the United States are dynamic environments that serve as crucial nursery habitats for many marine fish species. Approximately 60% of the commercial species in the North Atlantic are dependent on estuaries at some point during their life cycle. Accurate assessments of fish abundance and patterns of habitat use are necessary for the development of better management practices for commercially and recreationally important species. The purpose of this study was to characterize fish assemblages of estuarine and shallow surf-zone areas near the mouth of the Savannah River over a temporal and spatial scale. Three different types of sampling gear were used: a seine net, beam trawl, and zooplankton

net. More species ($n=12$) in the family Sciaenidae were collected than any other group, and they were found mostly at the estuarine sites. Juvenile carangids were the most abundant group with 6,337 individuals (86.3% of total catch), and they were found mostly at the surf-zone area. The Bay Anchovy *Anchoa mitchilli* was the most abundant larval species collected in the zooplankton net, representing 88.5% and 100.0% of the total catch at Cockspur Island ($n=77$) and Tybee Island ($n=5$), respectively. According to the Shannon-Wiener diversity index, the estuarine area was more diverse (1.11 ± 0.07) than the surf-zone area (0.57 ± 0.30). Overall, this work supports the findings of previous studies in which it is reported that sciaenids are very common in estuaries on the East Coast, and that surf zones are important nursery areas for some carangids.

Terrapins prefer nesting at syzygy

Matthew Draud, Department of Biology, Armstrong Atlantic State University

The diamondback terrapin is an estuarine chelonian that specializes in intertidal marsh habitats along the Atlantic and Gulf Coasts. They nest in coastal areas that are prone to tidal flooding. We predicted that there would be selective pressure favoring nesting during the highest high tides. Nesting during the highest high tides would reduce the distance a female travels to find flood-free nesting habitat. Shorter walking distances would lower the risk of overheating, desiccating and predators. Since the highest high tides of the season occur during syzygy (i.e., full and new moons), we predicted that a greater number of nesting events would be concentrated around these times. We used nesting data from a long-term study of terrapins in Oyster Bay, Long Island. We discovered a significant non-linear correlation between the number of nesting females captured on a given date and the percentage of the moon illuminated on that capture date. More nesting females were captured during new and full moon conditions than were captured during moon conditions. Using autocorrelation analysis (all four years combined), we expected nesting peaks during the season to be separated by approximately 14 days, since that corresponds to the number of days between new and full moons. As expected, we found the strongest autocorrelation at 15 days.

Saturday 8:30-9:30 a.m. Session III Water Quality, Primary Production, and Climate Change

Analysis of plankton population (Chl-a) and water quality by Structural Equation Modeling: Long term data in the Indian River Lagoon

C.E. Proffitt, Florida Atlantic University-Biological Sciences

Often in complex, multivariate real world field ecology, controlled experiments cannot be done at the proper spatial or temporal scales necessary to adequately address questions of interest. Further simple logistics limits numbers of variables possible in experiments. However, structural equation modeling can test alternative proposed multivariate hypotheses formulated a priori as directed graphs or path diagrams. I used SEM to test hypotheses about what affects trajectories and rates of change of Chl-a using >13,000 data points (1990-2013) from 76 water quality stations ranging from Jupiter Inlet northward to Ponce Inlet. Analyses showed that (among other things) the driving nutrients changed not only spatially in the IRL but also with Chl-a concentration, that feedbacks existed between Chl-a and light penetration, that total nitrogen varied with distance from inlets, and that Chl-a and temperature were strong drivers of dissolved oxygen.

To bubble or not to bubble? The effects of aeration on primary production in stormwater detention ponds near Myrtle Beach

Lauren M. Hehman, University of South Carolina; Erik M. Smith, Belle W. Baruch Institute for Marine and Coastal Sciences; Tammi L. Richardson, University of South Carolina; James L. Pinckney, University of South Carolina

Stormwater detention ponds are a common management practice to control stormwater runoff from developed land. They can often be the sites of intense algal blooms resulting from excess nutrient input. This can lead to water quality degradation in downstream coastal receiving waters and potential health concerns from harmful algal blooms (HABs) within the ponds. The most common approach to ridding ponds of excess algal biomass is the addition of copper-based algaecides and while temporarily effective they require regular re-application. Aerators are proposed as an alternative to control algal growth. This study employed a Before-After-Control-Impact (BACI) experimental design to quantify the effects of aeration on water quality in stormwater ponds typical of coastal South Carolina. A pair of similar ponds in each of two residential developments were sampled for nutrient concentrations and algal production, biomass and community composition over the course of two years, with aerators installed in one randomly-selected pond of each pair after the first year. We

hypothesized: 1) an increase in bottom water dissolved oxygen concentrations from aeration would increase nutrient retention in sediments and lead to decreased algal growth; and 2) increased turbulence due to aeration shifting the phytoplankton community composition from potentially harmful cyanobacteria and dinoflagellates towards diatoms. While aeration did increase mixing and bottom water dissolved oxygen concentrations, it had no significant effect on nutrient concentrations, primary production, or community composition. This research has important implications for developing best management practices and improving coastal water quality in South Carolina.

Determining volume sensitive waters in Beaufort County, SC tidal creeks

D. Sanger, S.C. Department of Natural Resources (SCDNR); J. Leffler, SCDNR; E. Montie, University of South Carolina-Beaufort; A. Blair, NOAA-Hollings Marine Laboratory; A. Turner, S.C. Sea Grant Consortium; J. Brunson, SCDNR; G. Riekerk, SCDNR; K. Pitts, SCDNR

Non-point source pollution from stormwater runoff associated with rapid coastal human population growth and large-scale land use changes threaten the integrity of ecologically and economically valuable estuarine ecosystems worldwide. Beaufort County, SC has implemented some of the toughest stormwater runoff regulations in the country. The county continues to be cautious and is interested in understanding what portions of their tidal creeks are most sensitive to freshwater stormwater runoff or “volume sensitive”. Scientists and managers have been working together to implement a research project with the goal of developing this science-based information for the county. Through a facilitated process, five watersheds of critical interest to the county and municipalities have been identified and are being instrumented with rain gauges and salinity sensors to understand the translation of freshwater down the length of these five systems. Sampling sites in each creek system have been established from the headwaters to a downstream location that should extend into what is expected to be volume “insensitive” waters based on existing data. Stormwater runoff will also be modeled using the Stormwater Runoff Modeling System (SWARM) to estimate the expected watershed runoff. The methodology is being developed to assess how to evaluate the freshwater due to the complexity of tidal systems and varying amounts of rainfall. This information will permit Beaufort County to rank its watersheds in terms of volume sensitive areas and to focus policy and regulatory decisions on those locations that are most critical.

Effects of climate signals on freshwater delivery to four Georgia riverine estuaries

Joan E. Sheldon, University of Georgia; Adrian Burd, University of Georgia; Merryl Alber, University of Georgia

Freshwater delivery helps to determine estuarine characteristics and may be influenced by large-scale climate oscillations. Variability in precipitation and river discharge to the Ogeechee, Satilla, and St. Marys River estuaries (GA) was examined in relation to several climate signal indices and compared to earlier results for the Altamaha River estuary. Empirical orthogonal function (EOF) analysis showed that monthly precipitation can be largely described by a temporal signal that is spatially uniform across each watershed (EOF 1), modulated by spatial patterns along (EOF 2) and across (EOF 3) the long axes of the watersheds, although analysis of three EOFs was not supported in all watersheds. The time series (principal components, PCs) associated with each precipitation EOF was best correlated with a different climate signal, and the dominance of climate signals changed seasonally: PC 1 with the Bermuda High Index in summer-fall, and PC 1 and PC 2 with El Niño/Southern Oscillation in fall-winter. Atlantic Multidecadal Oscillation (AMO) correlation patterns differed across watersheds, in part due to data availability for discerning spatial patterns. In the Altamaha, the AMO was correlated with PC 3, altering the seasonality of freshwater delivery. In the other watersheds, PC 3 could not be evaluated but AMO was correlated with PC 1 in winter. No correlations were found with the North Atlantic Oscillation. Correlations between climate signals and river discharge mirrored those with precipitation, with additional lags. Seasonal switching of climate signal dominance could lead to differential propagation of climate signals through ecosystems depending on critical seasons for keystone species.

Saturday 10:00-11:00 a.m. Session IV: Information Dissemination and Outreach

Tales of landings and legacies: African Americans in Georgia’s coastal fisheries

*D. L. Hoskins, NOAA Fisheries/Savannah State University; M. Murphy**, Savannah State University; N. Hawthorne; Savannah State University*

Post-civil war African Americans developed communities in Georgia where traditional fishing practices were passed down and the proceeds created family fleets, processing plants, and other self-sustaining fisheries

work. However, African Americans are now scarce in fisheries and the decline has been attributed to increased fishing costs, little access to capital, and a reluctance to have children work in labor-intensive fisheries professions (Blount 2006). Additionally, fluctuations in commercial landings may have negatively influenced African American participation in fisheries. The objective of this study was to test these theories by comparing first-hand accounts from African American fishing families with trends in landings data. Oral histories recorded from current and former fishermen and families of fishermen in Chatham and McIntosh counties were transcribed and analyzed using NVivo 10 software (QSR International). Georgia fisheries data (1950-2012) were obtained from the NOAA Office of Science and Technology. Themes, species, and time periods were identified in the histories and compared to landings trends during those years. Histories and landings data indicate that African Americans were fishing the most abundant species (blue crabs, shrimps, whiting, and oysters) during the years described by the participants (1950-1985) and that reasons for fishing or not fishing could be classified into 8 major categories: Traditional Knowledge/Culture, Fisheries Productivity, Fishery Work, Formal Education, Generation, Geography, Gender/Racial Roles, and Non-fisheries Work.

Connecting research scientists and educators- Developing a community of practice

Amanda K. Dickens, University of North Carolina Wilmington; Andy Gould, North Carolina Aquarium at Fort Fisher

We have developed a community of practice (CoP) between scientists at the University of North Carolina Wilmington and outreach educators at the North Carolina Aquarium at Ft. Fisher, NC. This CoP was developed after connecting through the Center for Ocean Sciences Education Excellence Southeast (COSEE) Research Education Exchange Forum (REEF). These NSF and Sea Grant-sponsored workshops connect regional research scientists with formal and informal educators. This is a vital relationship to develop that connects the public to their regional ecosystems and in turn promote stewardship of their local environments. I will be presenting my experience designing and implementing various public outreach events at the aquarium.

From charismatic megafauna to parasites: incorporating scientific research into K12 activities

Mary Carla Curran, Carolyn Kovacs, Tara M. Cox, Savannah State University; Laela S. Sayigh, Woods Hole Oceanographic Institution

The creation of educational activities based on scientific research helps disseminate information to a wider audience and allows students to be engaged in the work. In addition, students who utilize actual data are able to apply mathematics, science, and geography to real-world situations. We created several K-12 interdisciplinary activities based on cetacean research methods. In one activity, students used data from sightings of common bottlenose dolphins, *Tursiops truncatus*, to calculate association indices. The students then hypothesized about the relationships of the dolphins based on the derived association indices and the background information provided on social bonds. The second activity focused on analyzing the spatial patterns of cetaceans. Students mapped sighting locations of common bottlenose dolphins using latitudinal and longitudinal coordinates and then examined the data for spatial patterns. We also designed an activity to teach students about marine mammal communication and vocal mimicry. In particular, we played recordings of dolphin whistle mimicry and then implemented an interactive activity in which students attempted to imitate the whistles, which we recorded and discussed. Visually impaired students listened to examples of vocal mimicry and were able to differentiate small variations in the whistles. Lastly, parasite research was incorporated into several K12 activities. We described the role of parasites in influencing host behavior and food webs. We also devised an activity that demonstrated the value of estimation. K-12 activities based on actual research can increase the reach of scientific findings, improve ocean literacy, and enhance educational opportunities for students. The quality of these activities was strengthened because of collaborations among scientists, NSF GK12 fellows, teachers, and informal educators.

Experiential learning for undergraduate marine science students at Coastal Carolina University: The Plankton Monitoring Internship

Eric Koepfler, Coastal Carolina University, Marine Science Department; Taylor Burkett**, Coastal Carolina University, Marine Science Department; Diana O'Shea**, Coastal Carolina University, Marine Science Department; Erica Stone**, Coastal Carolina University, Marine Science Department; Jessica Rodes**, Coastal Carolina University, Marine Science Department; Katelyn McGlothlin**, Coastal Carolina University, Marine Science Department; Alexander Bogdanoff*, Coastal Carolina University, Coastal Marine & Wetland Studies Program

The experiential learning course, "*Plankton Monitoring Internship*" which was developed 2 years ago and has since involved the participation of several graduate students and 40 undergraduate student interns is described. The Plankton Monitoring Internship was designed to provide an experiential learning activity for students by; a) Applying fairly simple methods to collect, process, and analyze phytoplankton community composition. Methods involved include using various sampling devices to obtain water samples, the concentration of samples by sieving, the use of a microscope to identify and enumerate plankton species, and maintaining a database. b) Comparing and contrasting their expected learning to their actual learning derived from these activities. It is expected that students will discover that the diversity of sizes and shapes of phytoplankton and their sensitivity to changing environments will be greater than their preconceptions, and c) Reflecting upon the learning process as it applied to their own abilities to learn techniques and identify phytoplankton and how this same process can be promoted in future coursework / research, as well as reflecting on how changing environmental conditions can influence this rapid growing community both locally and at broader scales. This activity has potential to add to the scientific understanding of coastal plankton processes as the weekly sampling occurs at three piers in the Grand Strand (middle Long Bay) region that are also instrumented with surface and bottom multisondes associated with longer term hypoxia studies. The poster describes the internship program with various facets including, core activities, results of assessment, and data trends.

POSTER PRESENTATIONS (By Poster Number)

POSTER PRESENTATIONS (By poster number)

1. Assessing the ability of an in situ fluorescence probe to monitor dissolved organic carbon dynamics in estuarine waters

*Alexandra Norelli***, Marine Science Program, University of South Carolina; Erik Smith, Baruch Marine Field Laboratory, University of South Carolina.

Dissolved organic carbon (DOC) is by far the largest pool of reduced carbon in all aquatic environments. As such, DOC measurements are critical to quantifying aquatic carbon budgets and their response to environmental, anthropogenic or climate changes. The advent of in situ fluorescent dissolved organic matter (FDOM) sensors offer the potential to quantify the temporal dynamics of DOC at time-scales not previously possible with traditional grab-sampling techniques. In particular, the new multi-parameter water quality sonde from YSI, the EXO2, allows for the collection of FDOM measurements together with the standard suite of water quality parameters in a single integrated instrument. The objective of this study was to determine potential sources of interference to YSI's new FDOM probe and assess the ability of FDOM measurements to serve as a reliable and quantitative proxy for DOC concentrations in estuarine waters. This was accomplished through a series of laboratory and field-based testing to assess the effects of temperature, turbidity, salinity, chlorophyll and sources of DOC on probe performance and its ability to predict DOC concentrations in the estuarine waters of North Inlet, South Carolina. Results revealed that FDOM probe performance is highly temperature dependent and susceptible to substantial interference by turbidity. These effects can be appropriately corrected for, however, such that in situ FDOM measurement can reliably predict DOC concentrations in these waters. Time-series measurements of FDOM measurements at 15-minute intervals revealed substantial DOC variability in North Inlet at tidal, seasonal, and stochastic (rain-event) time-scales.

2. Accumulation of litter left behind by visitors before and after weekends on a beach on Tybee Island, GA

*Kelsey R. Cramer***, Department of Marine and Environmental Sciences, Savannah State University; Mary Carla Curran, Department of Marine and Environmental Sciences, Savannah State University

People often leave litter behind on beaches, and the shores of Tybee Island, GA are no exception. Approximately 899,000 trips are made by visitors to Tybee Island beach annually. The purpose of this study was to determine the influence of weekend visitors and improper waste disposal on the amount of litter on the beach. Sampling was conducted on Fridays and the following Mondays during May-October 2013. Transect lines measuring 80 m in length were placed perpendicular to the water. A 0.25 m² quadrat was placed every 10 m along each transect and the litter inside the quadrat was counted and separated into categories based on its composition. There was no significant difference ($p=0.8475$) in the amount of litter collected before the weekend (3.0 ± 1.16 pieces/m²) versus after the weekend (3.1 ± 1.14 pieces/m²). The most common type of litter was cigarette butts, with 1.4 ± 0.53 pieces/m². Other common categories of litter were plastic (0.7 ± 0.30 pieces/m²) and paper (0.6 ± 0.33 pieces/m²). While we did not find a difference in the amount of litter collected, we only sampled the beach for 8 weekends. Other researchers have reported a direct relationship between the number of visitors and litter density. Additional sampling and estimates of beach visitor densities are necessary to determine whether the amount of litter on Tybee Island is influenced by the number of visitors to the beach.

3. Sediment transport on an energetic sandy ebb tidal delta offshore of Hilton Head Island, South Carolina before and after Hurricane Sandy

P. Ansley Wren-Key, CCU; *Kehui Xu*, CCU/LSU; *Denise Sanger*, SCDNR; *George Riekerk*, SCDNR

Bottom-mounted instrumentation was deployed at two study sites that were located on a portion of a large linear ebb-tidal delta shoal feature on the eastern side of the Port Royal Sound (PRS) ebb tidal delta platform in South Carolina, USA. At the inshore site a large borrow pit was dredged for beach nourishment on Hilton Head Island. The borrow site is located approximately 5 km east-northeast from the end of Hilton Head Island (Fig. 1). The "reference site" was used as comparison to the impacted dredged site and was similar in size, depth, and orientation to the borrow site, but was more seaward at approximately 10 km offshore. The main tasks of this study are to: 1) observe time-series of sea bed elevation changes under the influence of tides and storm events, 2) investigate the physical mechanisms resulting in sediment transport and 3) quantify frequency and magnitude of sediment flux on the sandy shoal environment. The overall goal of this SC Sea Grant funded project is to reliably predict borrow pit infill rate and refill sediment composition based on expected

borrow area placement and design. Hydrodynamics and the relative contribution of the physical forcing processes at each location that result in sediment transport have been completed. Additionally, suspended sediment flux magnitude, direction, and frequency of transport and infilling have been determined and these data will also be used within a ROMS 3-D model to look at spatial changes around the borrow pit area.

4. An oyster reef as a living shoreline: effects on sediment particle size distribution

Kristy B. Payne^{**}, *Flagler College*; Jessica J. Veenstra, *Flagler College*; Melissa W. Southwell, *Flagler College*

The Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR) is currently restoring an Oyster Reef in order to protect shorelines from erosion. Oyster reefs are thought to have biological benefits as well as provide physical protection to the shoreline. We hypothesize that these physical and biological benefits will lead to an accumulation of finer sediment just behind the reef. To test this hypothesis we took sediment cores from three areas around the reef (in front of the reef, just behind the reef, and 5 m behind the reef) and determined the particle size distribution for depths of 0-2 cm, 2-5 cm, and 5-15 cm. The most significant changes in particle size distribution occurred at the shallow depths (0-5 cm) just behind the reef. We can conclude that the Oyster Reef is having an effect on sediment particle size distribution. This is likely due to the buildup of fine grained particles and oyster excrement behind the reef. Over time the accumulation of this finer sediment and excrement may yield an increase in marsh vegetation and a more stable shoreline.

5. Evaluation of restoration efforts in Robinson Preserve, an estuary in Tampa Bay, Florida

Amanda Croteau^{*}, *University of Florida*; Charles Cichra, *University of Florida*

Florida's coastal habitats have been severely impacted by development, with some areas experiencing mangrove habitat loss of over 80%. In the past 100 years, Tampa Bay has lost over 44% of its mangrove and salt marsh habitats. 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, over 450,000 m³ of soil were moved to restore tidal flow. While upland and salt marsh vegetation were planted, aquatic flora and fauna were left to colonize from neighboring populations. The waters of Robinson Preserve were divided into four regions based on water flow and connectivity to surrounding water bodies, and sampled quarterly from 2007-2013. Within each region, water quality, plankton, invertebrates, fish, and aquatic macrophytes were sampled at multiple locations to estimate community composition and size structures. Temperature, dissolved oxygen, salinity, and conductivity were measured. Water samples were analyzed for nitrogen, phosphorus, color, chlorophyll-a, phytoplankton, and zooplankton. Sediment samples were taken for benthic algae. Ichthyoplankton and meroplankton were sampled using a modified light trap. Fish and invertebrates were sampled using multiple methods to effectively sample benthic and pelagic species across a variety of size classes and habitat features. Two models will be used to compare Robinson Preserve to both virgin ecosystems and surrounding water bodies, to evaluate the success of the restoration efforts and predict the outcomes of future restoration strategies: habitat suitability modeling and ecosystem modeling using Ecopath with Ecosim.

6. Osmotic partitioning in the pickleweed, *Salicornia virginica*

Robert A. Player^{**}, *USCB*; Stephen A. Borgianini, *USCB*; Joseph L. Staton, *USCB*

Anecdotal evidence suggests that *Salicornia virginica* uses a mechanism of shedding of its tips, with sequestered excess ions, for ridding itself of these ions, instead of secreting ions to its surface as happens in other halophytes. It is hypothesized that the succulent stem with united leaves in the *S. virginica* package the ions into vacuoles and these are somehow able to transport salt to the stem tips. To test this, osmotic concentrations of plant tissues from the central and tip regions of plants were gathered from marshes on Tybee Island in May and November of 2010. Statistical analysis of the samples collected in May revealed a higher osmotic concentration in the central tissues while the converse was true for the November samples; however, both regions' means in November were lower than those in May. These findings do not support the previously suggested mechanism of salt-tip exclusion of sequestered osmotically active substances.

7. Seasonal changes in the morphology and anatomy of *Spartina alterniflora*

Tiffany Bostick, *Amy Schuler*, *Davielle Drayton*, and *Chandra Franklin*, *Department of Natural Sciences, Savannah State University*

Smooth cord grass *Spartina alterniflora* is the dominant primary producer in salt marshes of eastern and gulf coasts of United States. An on-going study in the Marsh Vegetation Research Laboratory at Savannah State University is focused on documenting the periodic changes in plant morphology and rhizome anatomy of *S.*

alterniflora in response to seasonal changes on a monthly basis. Data on physical and biological parameters were collected on a monthly basis from two salt marsh sites in Savannah, Georgia. Results from this project and that of the long-term study indicate that carbohydrate is stored in the form of starch grains in the rhizome during late fall and are broken down for energy needed to support new growth during early spring. In this report, correlations between changes in physical parameters and morphological as well as anatomical characteristics in response to seasonal changes are discussed. In addition, the phytochrome-mediated physiological mechanism that controls changes in plant characteristics in response to changes in the season is discussed.

8. 'Brown Mosaic' -- an early symptom of small-scale marsh dieback

Chandrasekaran (Chandra) I. Franklin, Department of Natural Sciences, Savannah State University; Amy L. Schuler, Department of Natural Sciences, Savannah State University; Davielle N. Drayton, Department of Natural Sciences, Savannah State University; Tiffany S. Bostick, Department of Natural Sciences, Savannah State University

Marsh dieback also known as 'dead marsh', 'brown marsh' or 'marsh balding' refers to the unexplained death of vegetation primarily composed of smooth cord grass (*Spartina alterniflora*) and black needle rush (*Juncus roemerianus*). In 2002, approximately 2,000 acres of salt marshes turned into mudflats in the state of Georgia. Similar large-scale dieback phenomena were observed in 2011 and 2012 as well. While such large-scale dieback events are infrequent, several small-scale (5 acres or less) dieback episodes have been observed at a higher frequency in our monitoring sites. Results from our studies indicate that the presence of scattered brown patches in *S. alterniflora* dominated marsh (that is otherwise healthy) giving the appearance of a mosaic is an early symptom of small-scale marsh dieback. For lack of a better term, we refer to these patches as 'Brown Mosaic' (not to be confused with mosaic symptoms of certain plant diseases). Our data indicate that 'Brown Mosaic' symptom precedes the loss of *S. alterniflora* resulting in small-scale dieback. The 'Brown Mosaic' symptom is the outcome of loss of apical growth (LAG) caused by stem borer larva. Analysis of affected plants indicated that the destruction of apical meristem by the larva resulted in the cessation of apical growth. In this report, biological mechanisms involved in LAG- induced plant death and subsequent loss of marsh vegetation resulting in small-scale marsh dieback are presented.

9. Enhancing a middle school curriculum with research and technology, the importance of integrating scientists in education

Brittany L. Hoffnagle*, Coastal Carolina University; Amy E. Grogan*, Coastal Carolina University; Sharon L. Gilman, Coastal Carolina University; Craig Gilman, Coastal Carolina University

The Coastal Carolina University GK-12 Fellowship program is a grant funded by the National Science Foundation that gives students from the Coastal Marine and Wetland Studies graduate program and Horry County schools in South Carolina the unique opportunity to partner in science education. This partnership aims to promote a stronger understanding of science and math for middle and high school students as well as increasing their knowledge of their coastal environment. Graduate Fellows are encouraged to incorporate aspects of their thesis research into the curriculum, giving them the ability to introduce new concepts and technologies which students may have never encountered in a traditional classroom setting, as well as experience communicating science to a lay audience. Two Fellows developed an 8th grade lesson about maps using GIS technology and the application of various maps developed in the ESRI programs ArcMap and ArcGIS to teach middle school students about the Carolina Bays, a unique geological feature found in the eastern Carolinas. The students used hard copy aerial maps and an ArcGIS application available on the iPad to perform a scientific investigation of the Carolina Bays. The use of this technology enabled the students to measure the size, shape, and orientation of the Bays, as well as examine the geologic structure, hydrographic landscape, soil composition, and vegetation coverage. The practical use of this technology and application of such programs is typical in professional and scientific work, but the GK-12 program was able to bring this knowledge to 8th grade students.

10. A long-term sampling regime for grass shrimp as a foundation to promote student research in the salt marsh

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Long-term data sets are invaluable resources that enable analysis of historical trends including changes over time. Often the protocols or tools implemented to collect long-term data are designed to answer one specific

question. Since 2006 we have employed a sampling regime that targets multiple grass shrimp species in shallow creeks allowing several variables to be examined while also providing the basis for multiple student projects. We sampled a maximum of 4 estuarine creeks each month, with a 0.25 m² weighted throw trap. Concurrent physical parameters were also measured. In the results to date, 93% of grass shrimp collected were daggerblade grass shrimp (*Palaemonetes pugio*), while only 6% were the common grass shrimp (*P. vulgaris*). There were large differences in mean shrimp abundance across sites. A tidal creek on Burnside Island, GA consistently yielded over half of all *P. pugio* caught, with the highest catches occurring between June and August. Peak ovigerity for *P. pugio* occurred in early spring and late summer. Approximately 3% of *P. pugio* were parasitized by the isopod *Probopyrus pandalicola*. The presence of the isopod parasite has been shown to obstruct reproduction in *P. pugio*, which potentially impacts the life history for this species.

11. Establishment of a research, monitoring, and exploration program on the lower Ogeechee River Estuary, GA (ERM EXPLORE)

Sue C. Ebanks, Savannah State University

In the wake of an extensive fish kill event in May 2011 on the relatively pristine Ogeechee River in Southeast Georgia, there has been an increased awareness of the need for regular monitoring activities along the river and within its watershed. This proposed two-year project has a primary objective of establishing a research, monitoring, and exploration program for the Lower Ogeechee River Estuary. The objectives will be to monitor the chemical and biological conditions in the region initially through assessments of water and sediment, microbial community, invertebrates, and selected fish species. A component of the project will target raising awareness of the need and opportunities for local communities to be involved with monitoring of the river as well as engage and mentor undergraduate and graduate students in ecological and toxicological research. Additionally, underprivileged middle and high school youth will be given the opportunity to explore this waterway in their nearby community while learning about point and non-point source pollution.

12. Changes in distribution of diatoms with abiotic parameters in the Savannah River estuary

Brian Murry*, Savannah State University; Carol Pride, Savannah State University

The purpose of this study was to examine the upstream variation of diatom abundance along the Savannah River estuary. Bi-monthly cruises were conducted along the Savannah River estuary from August 2009 to August 2012 aboard the *R/V Savannah*. Samples were taken at salinities ranging from >32 to < 3 PSU. In contrast, CDOM concentrations averaged 34.49 mg/m³ at 5 PSU and 5.32 mg/m³ at salinities > 32 PSU. On average, chlorophyll-a concentrations were highest in the outer-estuary (15.60 micrograms/L) at 25 PSU, and declined both upstream and downstream. Overall, *Skeletonema*, *Coscinodiscus*, and *Chaetoceros* were common throughout the estuary regardless of salinity. When present, *Rhizosolenia* and *Thalassionema* were common at salinities greater than 20 PSU. On average, total diatom standing stocks were greater at oceanic salinities (11,001 cells/L) than at 5 PSU (2,375 cells/L). Further work will investigate the influence of nutrients on the diatom community. These results improve our understanding of diatom distribution in the Savannah River estuary and baseline conditions prior to the planned harbor deepening.

13. A comparison of the diatom communities of the Savannah and Altamaha River estuaries (Georgia)

Ashton Arnold*, Savannah State University; Carol Pride, Savannah State University

Diatom communities are affected by salinity, light availability, and nutrient concentrations, which can differ between environments. The purpose of this study was to compare the diatom communities of the Savannah and Altamaha River estuaries. These rivers are similar in size, but the Altamaha is considered more pristine. During October 2011 surface water samples were collected from three lower estuary stations in each river at target salinities of 20, 25, and 30 ppt. Individual diatoms were identified and counted in each sample. The mean standing stock for the Savannah River estuary was 4604.08 ± 2766.03, while the Altamaha River mean standing stock was 3007.71 ± 685.00. *Coscinodiscus* was the most common genus in both rivers. The lower standing stock in the Altamaha River could be due to the high CDOM concentrations blocking light and limiting photosynthesis. The dominance of *Coscinodiscus* could be due to seasonal conditions. The study is being repeated with samples collected in December 2013.

14. Parasitic castration of the daggerblade grass shrimp *Palaemonetes pugio* by the bopyrid isopod *Probopyrus pandalicola*

Michele B. Sherman, Department of Marine and Environmental Sciences, Savannah State University; Mary Carla Curran, Department of Marine and Environmental Sciences, Savannah State University

Bopyrid parasites can have several negative effects on their crustacean hosts, including decreased molting frequency and growth, and parasitic castration. The purpose of this study was to determine if the daggerblade grass shrimp *Palaemonetes pugio* was castrated by the bopyrid *Probopyrus pandalicola*, and if male and/or female shrimp were able to reproduce after the parasite was removed. A 4-wk study was conducted during which male and female shrimp were placed into one of four treatments: parasitized males with unparasitized females; deparasitized males with unparasitized females; parasitized females with unparasitized males; or deparasitized females with unparasitized males. A separate 10-wk study was conducted using an additional treatment of deparasitized females and unparasitized males. Parasitized and deparasitized males were able to fertilize the eggs of unparasitized females, with $18.9 \pm 7.1\%$ and $42.7 \pm 5.2\%$ of the females becoming ovigerous by the end of 4 wk, respectively. Parasitized females were unable to reproduce, as 0.0% was ovigerous. In contrast, at least 10.3% of the deparasitized females were able to reproduce, but only 6 wk after the parasite was removed. Based on the results of this study, we know that the parasitic castration of female *P. pugio* by the bopyrid is not permanent; however, a recovery period of ≥ 6 wk is needed after the parasite is removed before the shrimp can return to the reproductive population. Though individuals are able to reproduce when no longer parasitized, the fecundity of deparasitized females may be negatively impacted by the parasite.

15. Spring-neap variation in clutch size correlations and embryonic development for the daggerblade grass shrimp *Palaemonetes pugio*

Renee Smith**, Savannah State University; Sue C. Ebanks, Savannah State University

The daggerblade grass shrimp *Palaemonetes pugio* is found throughout the Atlantic and Gulf coasts. It serves as a vital food source for many invertebrate and fish species that have significant economic importance to fisheries and marine life. In this study, we sought to determine possible relationships between weight (g) and clutch size, length (mm) and clutch size, and developmental stage of *P. pugio* over the monthly tidal (spring-neap) cycle in Country Club Creek (Wassaw Sound Estuary, GA, USA). A developmental stage scoring rubric was derived, grouping the 11 published embryonic development stages into 6 stages from fertilized egg (group 1) to post-nauplius with visible eye condensation (group 6). Thirty shrimp were collected by dip net at low tide during two spring and two neap tides from May 31 to October 25, 2013. Based on data collected, a correlation between length or weight and the number of eggs was determined. By using the regression percentage (R^2 -value) and regression equation, we were able to determine a mathematical (quantitative) method for predicting egg count in grass shrimp for use in future toxicological studies.

16. Tide-dependent predation patterns of piscivorous fishes in shallow estuarine creeks

Matthew R. Helms*, Coastal Carolina University; Robert F. Young, Coastal Carolina University; Dennis M. Allen, Belle W. Baruch Institute, University of South Carolina

The distribution and foraging behavior of predatory salt marsh fishes is likely related to the availability of prey which move in and out of shallow intertidal areas, including creeks, with the tides. We hypothesized that the distribution of piscivorous fishes in marsh creek channels would differ throughout the tidal cycle, with more predation occurring near intertidal creek mouths during certain stages. Custom-built trotlines baited with live mummichogs (*Fundulus heteroclitus*) were deployed during four discrete tidal stages in main creek channels either adjacent to intertidal creek mouths or to straight banks in North Inlet, South Carolina. Catch-per-unit-effort of predatory fishes was significantly higher (Wilcoxon signed-rank tests, $p < 0.05$) near creek mouths during all tidal blocks except for the period between slack high tide and mid-ebb. Piscivores were captured at the greatest relative abundance at creek mouths during the period between low tide and mid-flood ($p < 0.01$). We infer that these predators were attempting to intercept prey species that enter small creeks seeking refuge with the rising tide. A total of 176 piscivores representing 14 species were captured, with Atlantic sharpnose sharks (*Rhizoprionodon terraenovae*), Atlantic stingrays (*Dasyatis sabina*), ladyfish (*Elops saurus*), and red drum (*Sciaenops ocellatus*) comprising the greatest portion of the catch. The ability to predict spatial and temporal distributions for these and other piscivores improves our understanding of trophic and ecosystem function and may aid in the management of recreational fisheries.

17. Feeding behaviors of spotfin mojarra in relation to tidal cycles

Annabella Panaro^{**}, *Flagler College*; Edward McGinley, *Flagler College*

Spotfin mojarra (*Eucinostomus argenteus*) are a common seasonal fish in the rivers and estuaries of eastern Florida. Their primary diet consists of worms, crustaceans, isopods, and gastropods that inhabit the substrate. Specimens were collected over a complete tidal cycle and measured, weighed, and then euthanized and dissected. The stomach contents were removed and identified to order level using a microscope. The stomach contents are able to determine when in relation to tide level the mojarra are eating. This information can provide valuable information when constructing food webs for estuarine systems that have large populations of generalist consumers like mojarra.

18. Tidal and diel movement patterns of the Atlantic Stingray *Dasyatis sabina* along a stream-order gradient

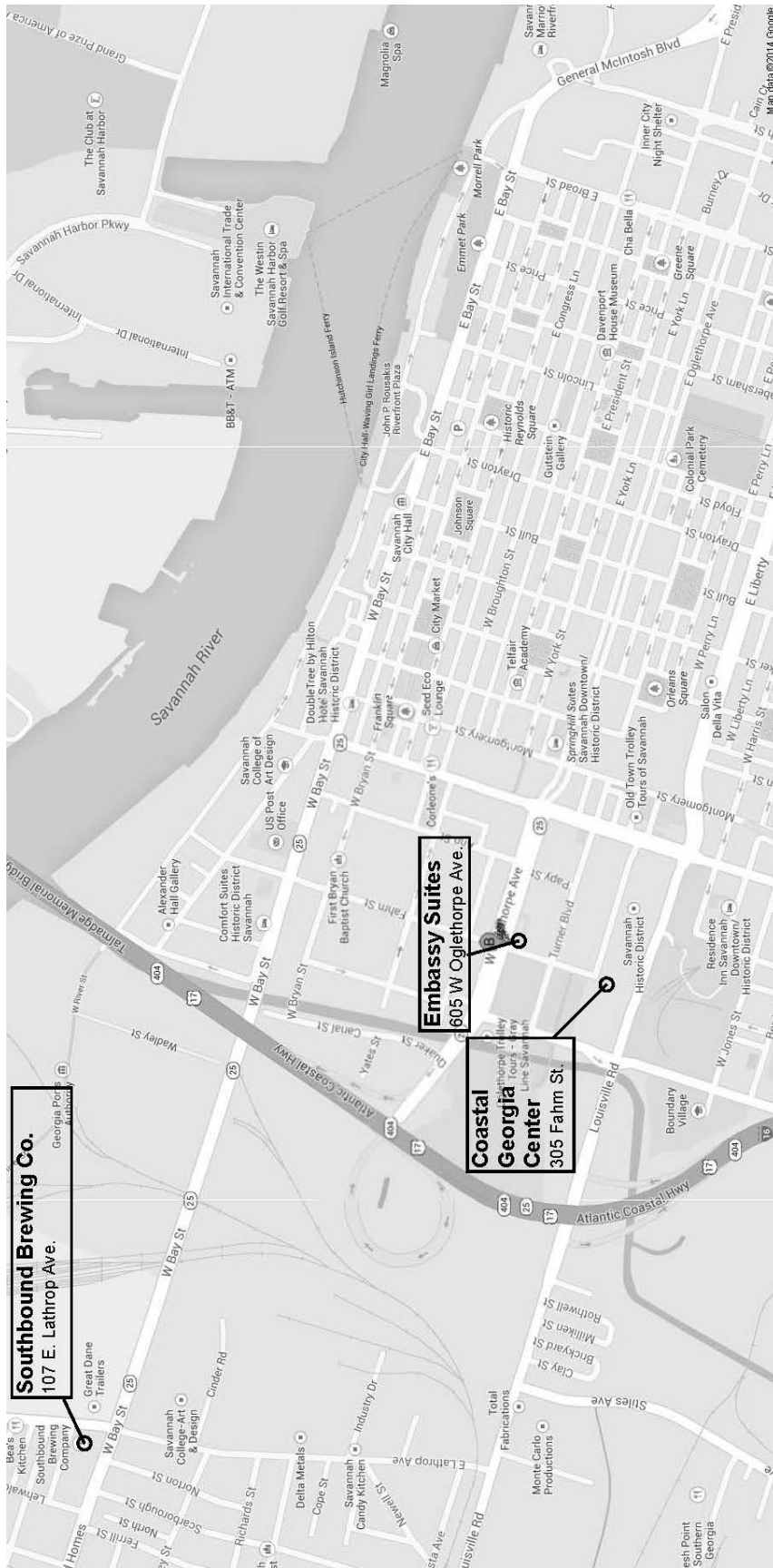
Cameron Brinton^{*}, *Department of Marine and Environmental Sciences, Savannah State University*; Mary Carla Curran, *Department of Marine and Environmental Sciences, Savannah State University*; and Charles F. Cotton, *Florida State University Coastal and Marine Lab*

Stingray behavior can be affected by external cues in the environment such as tide. Stream geomorphology may further influence how stingrays respond to stimuli. The purpose of this study was to determine how tidal stage and diel period affected the movement patterns of the Atlantic Stingray *Dasyatis sabina* in tidal creeks along a stream-order gradient. Twenty-two stingrays were tagged internally with VEMCO coded-acoustic transmitters and were tracked in Romerly Marsh and Country Club creeks near Savannah, GA. Creeks were classified using the Horton concept of stream orders, which assigns unbranched streams to the first order. In Romerly Marsh Creek, 57.2% of upstream movement and 62.3% of downstream movement occurred at night, but stingray movements were evenly distributed throughout the diel cycle in Country Club Creek. Stingray movements were not clearly correlated with tidal stage in Romerly Marsh Creek. In Country Club Creek, stingray movements were oriented with tidal currents; the majority of downstream movements occurred at the beginning of the ebb tide (39.2%) and the majority of upstream movements occurred at the end of the flood tide (31.7%). Tidal stage and diel period did not consistently influence stingray behavior in Romerly Marsh Creek (4th-5th order streams) and Country Club Creek (1st-4th order streams); thus, stingrays may be altering their behavior based on additional environmental factors such as creek geomorphology.

19. Determining residency patterns of the Atlantic Stingray *Dasyatis sabina* in two tidal creeks in Savannah, Georgia using acoustic telemetry

Sarah Ramsden^{*}, *Department of Marine and Environmental Sciences, Savannah State University*; Mary Carla Curran, *Department of Marine and Environmental Sciences, Savannah State University*; Charles F. Cotton, *Florida State University Coastal and Marine Laboratory*

The Atlantic Stingray *Dasyatis sabina* is a demersal elasmobranch that is commonly found in coastal habitats. *Dasyatis sabina* is reported to be a seasonal resident of some regions but a year-round resident of others. The residency pattern of this species in Georgia tidal creeks is currently unknown. The purpose of the present study was to determine the residency pattern of *D. sabina* near Savannah, Georgia. Atlantic Stingrays were surgically implanted with acoustic transmitter tags in Romerly Creek (n=8) starting in December 2012 and in Country Club Creek (n=15) starting in April 2013. The percentage of animals detected each month within the passive acoustic receiver arrays was calculated for each creek system. Presence of Atlantic Stingrays in Romerly Creek was consistently high, with 60-100% (n=2-6) of the tagged stingrays detected throughout the study period. Atlantic Stingray presence in Country Club Creek was high only from April-October, with 88-100% (n=2-11) of the tagged stingrays detected. There was a decline in Atlantic Stingray presence in this creek throughout the fall, and only 20% (n=3) of the tagged stingrays were detected in December. Data from trawl surveys have been used as evidence that Atlantic Stingrays are not year-round residents of many regions, but our use of acoustic telemetry enables stingrays to be detected even if they moved into deep holes or near-shore waters that are difficult to trawl. We are continuing to monitor our tagged animals to determine if temperature or season plays a role in Atlantic Stingray residency.



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