Southeastern Estuarine Research Society
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Semi-annual Meeting

March 10-12, 2016

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

Bluffton Campus of the University of South Carolina at Beaufort
Bluffton, South Carolina

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 10, 2016

It is my pleasure to welcome the SEERS Spring 2016 meeting to the University of South Carolina-Beaufort, the newest four-year degree granting institution in the state. USCB was founded in 1959 and became a comprehensive degree granting institution in 2004—but our roots extend back to the founding of Beaufort College in 1795. Our research roots go deep: Stephen Elliott, one of the original trustees of Beaufort College, a Beaufort native, a state senator, and Yale graduate, published his landmark book— *A Sketch of the Botany of South Carolina and Georgia* in the 1820s. Science magazine described Elliot as the "father of southern botany." Beaufort County, itself, has a rich history. It was settled early as the Port Royal Sound is the deepest natural port on the eastern US. Beaufort, founded in 1711, was once the wealthiest region in South Carolina, being sequentially the heart of the indigo, rice, and sea-island cotton production.

Beaufort County is an excellent natural setting to serve as a backdrop for marine and estuarine research. The county is comprised of vast expanses of salt marsh. I hope that we can enjoy some of these vistas at our banquet, hosted at the SC DNR Waddell Mariculture Center in Bluffton. The low relief coupled with the high tidal range leads to the locals saying that Beaufort County is 50% larger at low tide. The tidal system is a network of waterways that create a sprinkling of nearly 2000 hammock islands that serve as a seasonal haven for a vast number of local and migratory waterfowl that are sustained by this vast system. The system has low riverine input, so high salinity estuaries extend to the western edge of the county. Beaufort has been on the forefront of understanding this unique habitat. We were the first county to LIDAR map the entire county in great detail (greater than that of the subsequent state effort) and pass legislation in historic Beaufort limiting creation of impermeable surfaces to control storm water runoff into this precious resource.

We are proud of this beautiful region we call home and it is a continuing struggle to preserve the natural beauty while sustaining one of the highest population growth rates in the state. We are home to Hunting Island State Park, the most visited park in the state, Pinkney Wildlife Refuge, and Hilton Head Island, all of which attract more than 3 million visitors per year in a county hosting a permanent population of less than 200,000 people. Our piece of the lowcountry is in the heart of the traditional Gullah/Geechee corridor and is located between the ACE Basin and the Savannah National Wildlife Refuge, and on larger-scale centered between the tourist destinations of Charleston and Savannah, only a short but beautiful drive away.

Please enjoy our campus and hospitality. We hope that you come back to collaborate or just visit.

We're glad that you could come spend some time with us!

Joe

Joseph L. Staton, Ph. D.
Professor of Biology and Marine Science

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

Our Sponsors:
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South Carolina Sea Grant Consortium
Georgia Sea Grant
Port Royal Sound Foundation
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Additional Contributors:
University of North Carolina Wilmington
(for providing discounted printing services for the program book)
University of South Carolina at Beaufort
(for providing poster display boards and easels)
Bluffton Oyster Company
(for providing discounted catering services for the banquet)
River Dog Brewing Company
(for donating beverages for the reception and banquet)
Southern Barrel
(for donating beverages for the reception and banquet)

Our Local Host:
Joe Staton, University of South Carolina at Beaufort

Session Moderators and Anonymous Judges

Chair of Student Promotions Committee (Travel Awards):
Erik Smith, University of South Carolina, Baruch Institute for Marine & Coastal Sciences, North Inlet-Winyah Bay National Estuarine Research Reserve

SEERS Congratulates our Student Travel Award Winners:
Brooke Campbell, Coastal Carolina University
Amanda Croteau, University of Florida
Michelle Franco, College of Charleston
Adrienne Kambouris, Augusta University
Madison Polera, University of North Carolina Wilmington

Be sure to stop by the sponsor exhibition tables and say thank you to all our sponsors for their support of the Spring 2016 Meeting!

Special Session:
Sea Level Rise and Estuaries in the Southeast

Thursday Plenary Speaker:

Chris Marsh, LowCountry Institute, Spring Island Trust
Dr. Marsh has exploring coastal habitats of the southeastern US for over 45 years. After receiving his Ph.D. from Oregon State University under the tutelage of Bruce Menge and Jane Lubchenco, he was a biology professor at Coastal Carolina University for 14 years. For the past 17 years he has served as the Executive Director of two environmental non-profits based in Beaufort, SC. He is also a cofounder of the South Carolina Master Naturalist Program and the Port Royal Sound Foundation.

Friday Panel Speakers:

Jeremy Stalker, Jacksonville University
Dr. Jeremy Stalker is an Assistant professor in the Marine Science Department at Jacksonville University and the Director of the JU Stable Isotope Laboratory. He has a Ph.D. in Geological Sciences with a focus on Geochemistry from Florida International University, and a M.S. in Geophysics from the University of Montana. His research focuses on the use of chemical tracers and isotopes to study the interactions of water masses in coastal systems and coastal aquifer systems. He has worked with U.S. federal institutions on water scarcity issues and water resource management, and is researching the effects of sea level rise on saltwater intrusion in Northeast Florida. Recently his research has focused on using isoscapes to predict movements of various fauna by analyzing the ratios of isotopes in various slow growing tissues.

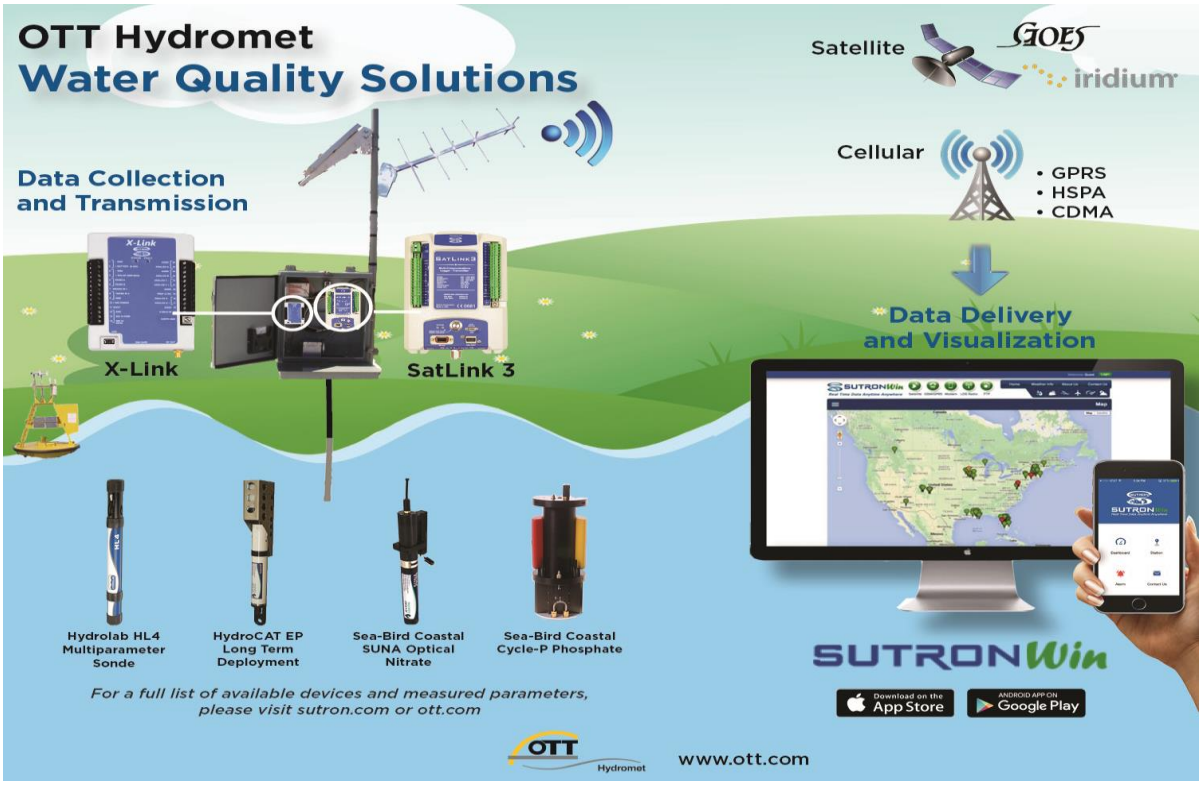
Lisa Chambers, University of Central Florida
Lisa Chambers is an Assistant Professor in the Biology Department at the University of Central Florida and the PI of the Aquatic Biogeochemistry Lab. Her research focuses on the impacts of sea level rise on coastal wetland biogeochemistry, the effects of urban development on coastal resilience, and the utility of wetlands to improve water quality. She holds a Ph.D. in Soil and Water Science from the University of Florida and an MS in Oceanography and Coastal Sciences from Louisiana State University.

Special Session
Sea Level Rise and Estuaries in the Southeast

Friday Panel Speakers (Continued):

James Morris, University of South Carolina
Dr. James Morris is the Director of the Belle Baruch Institute for Marine and Coastal Sciences, Professor of Biological Sciences, Class of ’32 Distinguished Professor of Marine Studies at the University of South Carolina, and a Fellow of the Society of Wetland Scientists and of the American Association for the Advancement of Science. He served as a Program Officer at the National Science Foundation from 2003-2005 and was a Visiting Professor at Aarhus University, Denmark in 1990. His academic background includes degrees in environmental sciences, (B.A., Univ. Virginia), biology (M.A., Yale) and forestry and environmental studies (Ph.D., Yale). Dr. Morris has a long history of research at North Inlet, SC on the effects of sea-level change on coastal wetlands. He is co-PI of the Plum Island LTER project is Massachusetts, and is the developer of the Marsh Equilibrium Model (MEM).

William Conner, Clemson University
Dr. Conner is Professor of Forestry and Assistant Director at Clemson University's Baruch Institute of Coastal Ecology and Forest Science in Georgetown, SC. He has been involved in forested wetland research for over 40 years and continues to do research throughout the Southeastern US. He received his B.S. degree in biology from Virginia Polytechnic Institute (1973), M.S. in marine sciences from Louisiana State University (1975), and Ph.D. in forestry from Louisiana State University (1988). From 1975-1990, William was a research associate in the Center for Wetland Resources at LSU. At Clemson since 1990, his main interests include recovery mechanisms of forested wetlands following disturbance, regeneration problems in forested wetlands, response of woody species to flooding and salinity, impact of water management on wetland productivity, and regional studies of wetland processes.



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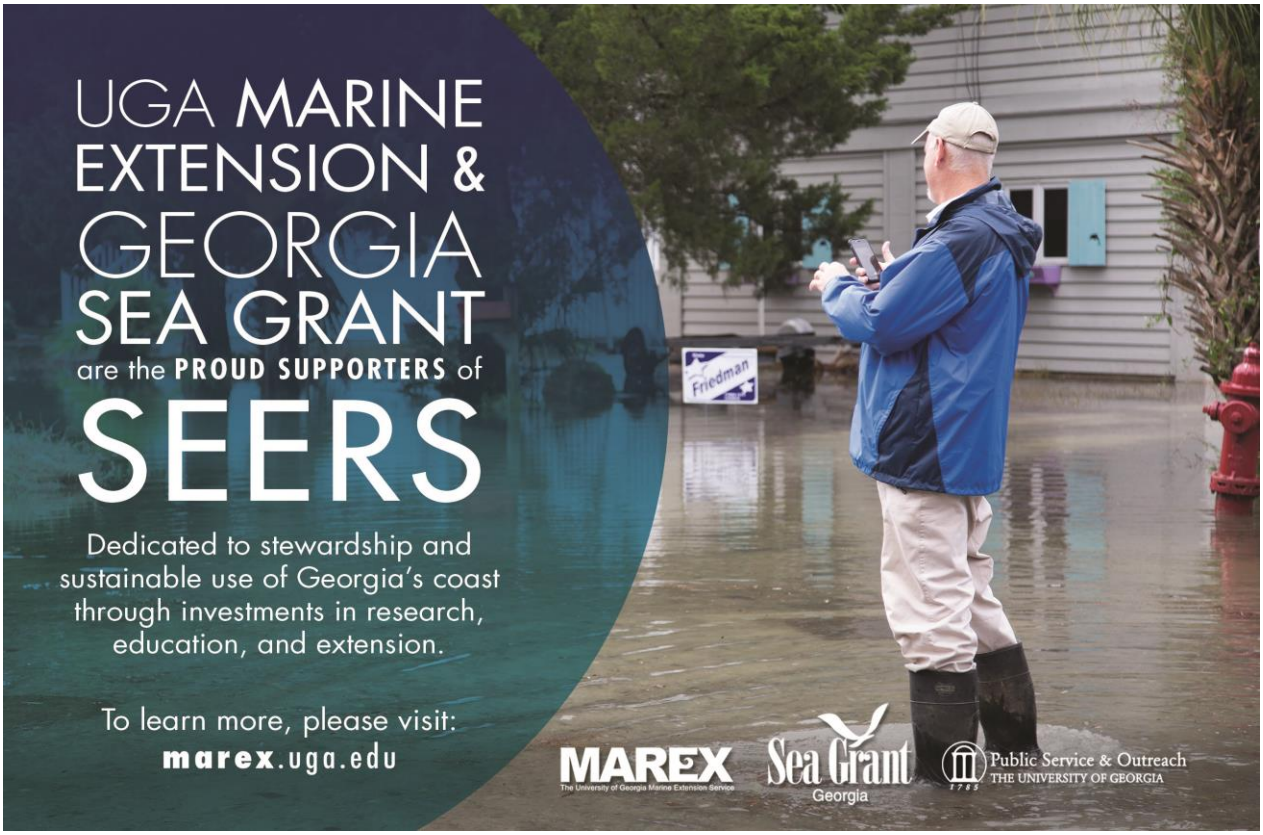

Port Royal Sound Foundation

The Port Royal Sound Foundation was established in 2011 as a 501(c)3 entity that is dedicated to the betterment and conservation of the waters and lands of our unique salt marsh ecosystem that is the Port Royal Sound. November 2014, the Foundation opened its Maritime Center on the Chechessee River in the center of Beaufort County. The Maritime Center is an educational resource for residents and visitors, celebrating the Port Royal Sound's ecology, history, culture, art and recreation. Developing a greater sense of appreciation for this amazing body of water will in turn create a wider network of people who care for and work to preserve the health of its waters.

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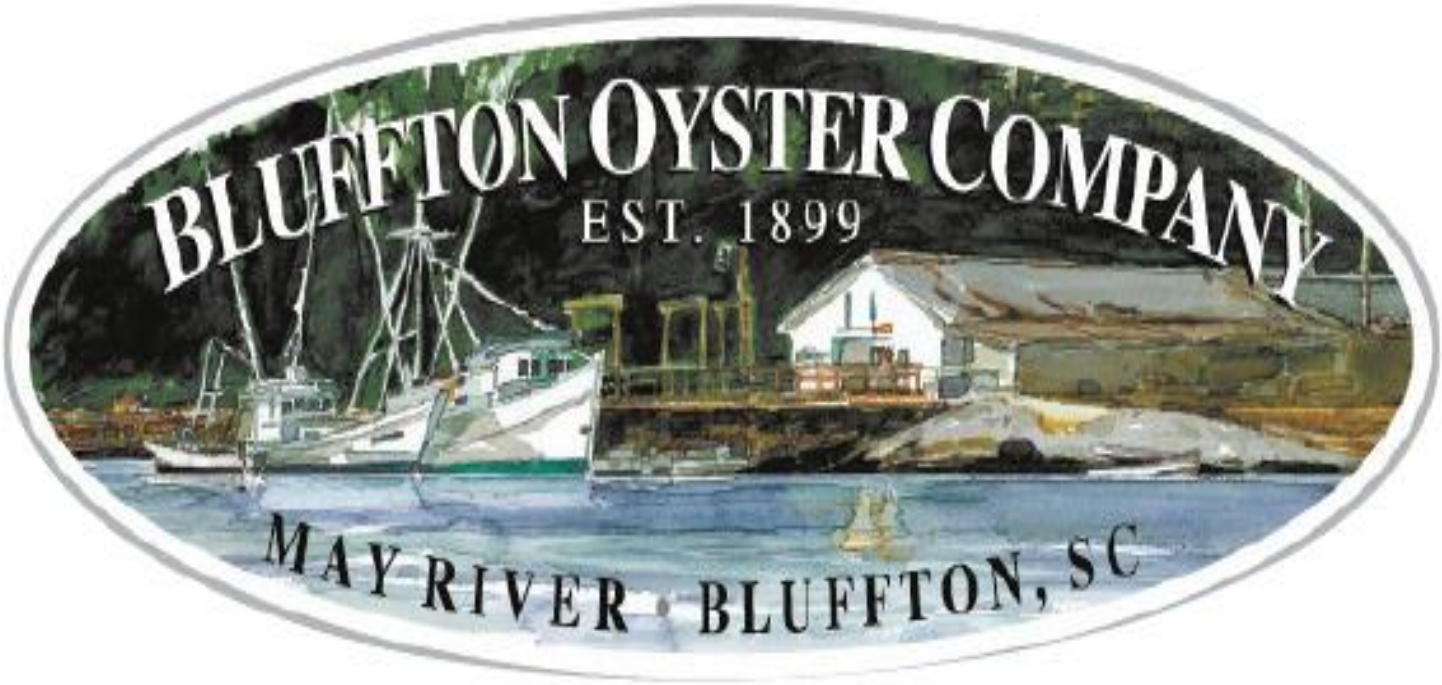

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Southeastern Estuarine Research Society
March 10-12, 2016
Bluffton Campus of the University of South Carolina at Beaufort
One University Boulevard, Bluffton, South Carolina 29909

Schedule at a Glance

Thursday, March 10

5:00 p.m.	Registration, Poster set-up, and Welcome Reception
6:00 p.m.	Welcome Address and Poster Presenter Introductions
6:30 p.m.	Keynote Address / Plenary Speaker **Climate change and the future of southeastern coastal habitats: A naturalist's perspective** *Christopher P. Marsh, LowCountry Institute, Spring Island Trust*

Friday, March 11

7:45 a.m. – 9:00 a.m.	"Coffee and Career Advice" Student Networking Event and Breakfast
8:30 a.m. – 9:00 a.m.	Registration and Poster set-up
9:00 a.m. – 9:15 a.m.	Welcome and Announcements
9:15 a.m. – 10:15 a.m.	Session I – Water Quality, Ecosystem Processes, and Hydrodynamics
10:15 a.m. – 10:45 a.m.	Break
10:45 a.m. – 12:00 p.m.	Session II – Water Quality, Plankton, and Producers
12:00 p.m. – 1:15 p.m.	Lunch
1:15 p.m. – 2:45 p.m.	Session III – Special Session Sea Level Rise and Estuaries in the Southeast
2:45 p.m. – 3:15 p.m.	Break
3:15 p.m. – 4:00 p.m.	Session IV – Science Education and Outreach
4:00 p.m. – 5:30 p.m.	Poster Reception (presenters should stand by their posters – judging will take place during this time)

Friday, March 11 – Continued

6:00 p.m. – 7:00 p.m.	Shuttle Service Pick-up at Hampton Inn and Suites (Shuttles will leave approximately every 30 minutes)
6:30 p.m. – 10:00 p.m.	Dinner Social at Waddell Mariculture Center 211 Sawmill Creek Road, Bluffton, South Carolina 29910

Saturday, March 12

8:15 a.m. – 8:30 a.m.	Welcome and Announcements
8:30 a.m. – 10:00 a.m.	Session V – Sediments and Invertebrates
10:00 a.m. – 10:30 a.m.	Break
10:30 a.m. – 12:00 p.m.	Session VI – Fish and Other Macro Vertebrates
12:00 p.m. – 12:30 p.m.	Business Meeting and Award Presentations

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

Sales help to support student travel awards!

PLATFORM PRESENTATIONS

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

Friday, March 11

9:00 Welcome and Announcements
Geno Olmi, SEERS President; Loren Mathews, SEERS Program Chair; Joe Staton, Local Host

9:15 a.m. – 10:15 a.m. Session I: Water Quality, Ecosystem Processes, and Hydrodynamics
Moderator: Amanda Cole, University of North Carolina Wilmington

9:15 The South Carolina Estuarine and Coastal Assessment Program (SCECAP): 1999-2014
Sharleen Johnson, Denise Sanger, South Carolina Department of Natural Resources

9:30 Transport times through salinity zones of Georgia riverine estuaries
Joan E. Sheldon, Merryl Alber, University of Georgia

9:45 Aquatic metabolism in a salt marsh dominated estuary - the O_2 and CO_2 journeys
Shiyu Wang, Charles Hopkinson, University of Georgia; Weijun Cai, University of Delaware; Daniela Di Iorio, University of Georgia*

10:00 Significant fecal bacteria and TSS reduction by coastal BMPs in Wrightsville Beach, N.C.
Michael A. Mallin, Mary I.H. Turner, Matthew R. McIver, University of North Carolina Wilmington; Byron R. Toothman, North Carolina Reserve, University of North Carolina Wilmington

10:15 a.m. – 10:45 a.m. BREAK

10:45 a.m. – 12:00 p.m. Session II: Water Quality, Plankton, and Producers
Moderator: Amanda Croteau, University of Florida

10:45 Effects of nitrogen on dissolved organic carbon and microplankton abundances in four coastal South Carolina systems
Michelle Reed, South Carolina Department of Natural Resources, Giacomo R. DiTullio, College of Charleston, Suzanne E. Kacenas, University of South Carolina; Dianne I. Greenfield, South Carolina Department of Natural Resources, University of South Carolina

Friday, March 11 – Continued

11:00 **Antibiotic and nutrient mixtures influence phytoplankton subsidies to coastal systems**
Jason Duff, Risa A. Cohen, Georgia Southern University*

11:15 **Toxic and nontoxic *Microcystis* in the Cape Fear River: Why, where and when?**
Madison Polera, Lawrence Cahoon, Michael Mallin, Patrick Erwin, University of North Carolina Wilmington*

11:30 **Holoplankton and meroplankton occurrence and seasonal abundance in Port Royal Sound, South Carolina**
Bill Weiss, LowCountry Institute

11:45 **Increased strandings of pelagic *Sargassum*: Symptom of eutrophication in the Gulf of Mexico?**
Brian LaPointe, Laura Herren, Alison Feibel. Harbor Branch Oceanographic Institute, Florida Atlantic University

12:00 p.m. – 1:15 p.m. LUNCH

1:15 p.m. – 2:45 p.m. Session III: Special Session – Sea Level Rise and Estuaries in the Southeast
Moderator: Geno Olmi, SEERS President

1:15 **Special Session Introduction**
Geno Olmi, SEERS President

1:30 **Is Florida headed back into the ocean? Some possible effects of sea level rise on low lying and porous peninsula that originally came from the ocean.**
Jeremy Stalker, Jacksonville University

1:45 **Sea level rise impacts on estuarine wetland carbon storage and nutrient cycling**
Lisa Chambers, University of Central Florida

2:00 **Contributions of organic and inorganic matter to volume and accretion in tidal wetlands at steady state**
James Morris, University of South Carolina

2:15 **Changes in coastal forest dynamics as a result of rising sea level**
William Conner, Clemson University

2:30 **Special Session Panel**

Friday, March 11 – Continued

2:45 p.m. – 3:15 p.m. BREAK

3:15 p.m. – 4:00 p.m. Session IV: Science Education and Outreach

Moderator: Madison Polera, University of North Carolina Wilmington

3:15 From seeds to shoreline: Engaging students in salt marsh restoration

E.V. Bell, South Carolina Sea Grant Consortium; Denise Sanger, Catharine Parker, Julie Binz, South Carolina Department of Natural Resources*

3:30 Promoting salt marsh stewardship through environmental education materials

Catharine Parker, Denise Sanger, South Carolina Department of Natural Resources, E.V. Bell, South Carolina Sea Grant Consortium; Julie Binz, South Carolina Department of Natural Resources*

3:45 Using marine mammal research as a way to engage K-12 students in the sciences

Mary Carla Curran, Savannah State University; Carolyn Kovacs, Sea Mester; Jessica Thompson, Savannah State University; Sabrina Bowen – Stevens, NOAA Southeast Fisheries Science Center; Laela S. Sayigh, Kathleen Patterson, Woods Hole Oceanographic Institution; Tara M. Cox, Savannah State University*

4:00 p.m. – 5:30 p.m. POSTER SESSION

6:30 p.m. – 10:00 p.m. DINNER SOCIAL

Saturday, March 12

8:15 Welcome and Announcements
Geno Olmi, SEERS President; Loren Mathews, SEERS Program Chair; Joe Staton, Local Host

8:30 a.m. – 10:00 a.m. Session V: Sediments and Invertebrates
Moderator: Kathryn Ellis, College of Charleston

8:30 Determination of soil microbial populations in the Satilla River Estuary using 16S rRNA next-gene sequencing
Adrienne Kambouris, Christina Tran*, Jessica Reichmuth, Christopher Bates, Augusta University*

8:45 Fiddler crabs and the changing ocean: can ocean acidification inhibit limb regeneration?
*Shannon Gregory**, Jessica Reichmuth, Augusta University*

9:00 Individual movement rates are sufficient to determine and maintain dynamic spatial positioning within *Uca pugilator* herds
Eilea R. Knotts, Blaine D. Griffen, University of South Carolina*

9:15 Factors affecting ghost crab burrow morphology in Horry County, South Carolina
*Erica Westwater**, Coastal Carolina University*

9:30 Effect of location on physical attributes of the daggerblade grass shrimp *Palaemonetes pugio* in Georgia
Coral Thompson, Sue C. Ebanks, Savannah State University*

9:45 Colonization and water quality changes following the restoration of a coastal tidal marsh in Tampa Bay, Florida
Amanda Croteau, University of Florida*

10:00 a.m. – 10:30 a.m. BREAK

10:30 a.m. – 12:00 p.m. Fish and Other Macro Vertebrates
Moderator: Jamie Alfieri, Georgia Southern University

10:30 Acoustic monitoring of spawning in captive and wild sciaenids
*Eric Montie, Christopher Kehrer**, Matthew Hoover**, Steven Vega**, Michael Powell**, Agnieszka Monczak*, Michaela Miller*, Hannah Nylander*, Mackenna Neuroth*, Andrea Berry**, Bradshaw McKinney**, University of South Carolina at Beaufort; Justin Yost, Karl Brenkert, Tim O'Donnell, Michael R. Denson, South Carolina Department of Natural Resources*

Saturday, March 12 – Continued

10:45 **Dietary overlap and potential food resource competition between pike killifish and juvenile common snook**
Geoffrey Smith, Debra Murie, University of Florida*

11:00 **The effect of season on the size and abundance of flatfishes in a Georgia tidal creek**
Hannah Reilly, Mary Carla Curran, Savannah State University*

11:15 **Low temperature tolerance of juvenile tarpon *Megalops atlanticus***
Marvin Mace III, Eric Haffey, Matthew E. Kimball, University of South Carolina

11:30 **Site fidelity and home range in cryptic demersal estuarine fishes**
Juliana Harding, Coastal Carolina University; Dennis M. Allen, University of South Carolina

11:45 **Light pollution impacts on *Caretta caretta* nesting in several tourism meccas in the Southeastern US using remote sensing sources**
Eric Koepfler, Louis Keiner, Emily Asp, Coastal Carolina University; Richard WhiteCloud, Sea Turtle Oversight Protection, Inc.

12:00 p.m. – 12:30 p.m. BUSINESS MEETING & AWARD PRESENTATIONS

POSTER PRESENTATIONS (in alphabetical order by number)

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

POSTER PRESENTATIONS (by poster number)

1 Osmoregulation in sharks revisited: I. rectal gland masses of estuarine, nearshore, and deep sea sharks
*Daniel C. Abel, Scott Parker, Megan Novak**, Delanie Sage**, Alexandra Dowlin, John Simcox**, Coastal Carolina University; R. Dean Grubbs, Florida State University*

2 Synergistic effects of parasitism and copper on snail mortality
James Alfieri, Georgia Southern University*

3 Nutrient and phytoplankton dynamics in Winyah Bay, SC.
*George Boneilo, Brittany M. Adam**, Carrigen R. Manns**, Kaela I. Moon**, Rickey A. Wood**, Ciara R. Wright**, Kristina M. Woodford**, Stephanie L. Brown**, Savannah S. Brooks**, Coastal Carolina University*

4 Variability is not the villain: A K-12 activity
Brigette Adair Brinton, Savannah State University, Armstrong State University; Mary Carla Curran, Savannah State University

5 Trematode metacercariae prevalence and intensity in *Uca minax*, *U. pugilator*, and *U. pugnax*, at Waties Island, SC.
Tyler P. Brun, Coastal Carolina University*

6 The effects of sediment compaction on ghost crab burrowing behavior
*Brooke Campbell**, Eric Rosch, Coastal Carolina University*

7 Evaluation of variables effecting foraging success rates in Eastern Brown Pelicans (*Pelecanus occidentalis carolinensis*) on the South Carolina coast
*Juliane Caughron**, Abbey Chaney**, Coastal Carolina University*

8 Predation on mud snail (*Ilyanassa obsoleta*) egg capsules and veligers by invertebrates inhabiting the invasive alga *Gracilaria vermiculophylla*
*Travis Draud**, Evan Ashe**, Michele Guidone, Armstrong State University*

9 Northeast Florida oyster condition assessment
Kaitlyn Dietz, Shannon Dunnigan, Northeast Florida Aquatic Preserves; Matthew Monroe, Guana Tolomato Matanzas National Estuarine Research Reserve; Andrea Noel, Northeast Florida Aquatic Preserves; Nikki Dix, Guana Tolomato Matanzas National Estuarine Research Reserve

10 Hydrological assessments of tidal creeks to inform nutrient management recommendations
Kathryn Ellis, Timothy Callahan, College of Charleston; Dianne Greenfield, University of South Carolina, South Carolina Department of Natural Resources; Joshua Robinson, Robinson Design Engineers*

11 Ecotoxicological assessment of the effects of crude oil and oil spill dispersants on the sheepshead minnow, *Cyprinodon variegatus*
Michelle Franco, University of Charleston; Marie DeLorenzo, NOAA National Ocean Service*

12 Assessing the effects of the mud snail, *Ilyanassa obsoleta*, on the benthic microalgal community in a pristine saltmarsh
Miranda Gore, James L. Pinckney, University of South Carolina*

13 Reproductive biology of the diamondback terrapin (*Malaclemys terrapin*) in the Charleston Harbor system, South Carolina, USA
Andrew M. Grosse, Erin M. Levesque, Steve A. Arnott, South Carolina Department of Natural Resources

14 Longterm acoustic monitoring of the May River soundscape – baseline Information on the patterns of fish spawning
Agnieszka Monczak, Michaela Miller*, Hannah Nylander*, Eric Montie, University of South Carolina at Beaufort*

15 Boat noise and acoustic communication of fishes: a risk assessment in the May River, South Carolina
Micaela E. Miller, Agnieszka Monczak*, Hannah Nylander*, Eric Montie, University of South Carolina at Beaufort*

16 The enumeration and identification of *Vibrio* in water and oyster tissue within Sisters Creek, FL
Shelby O'Brien, Anthony Ouellette, Jacksonville University*

17 Nesting behavior patterns of *Caretta caretta* in the South Atlantic Bight
*Rebecca O. Persons**, Khrysten E. Raymer**, Jennah W. Rains**, Stephen A. Borgianini, University of South Carolina at Beaufort*

18 Exposing *Artemia salina* to *Chattonella subsalsa*, a toxicity test
*Nicholas Picha**, Amy Grogan, Eric Koepfler, Coastal Carolina University*

19 A study on ghost crab burrowing behavior vs. lunar stage
*Hayden Roberts**, Coastal Carolina University*

20 An integrated system for high-resolution multiparameter water quality surveys in estuaries
William Savidge, Kate Doyle, Skidaway Institute

21 Top-down and bottom-up controls of phytoplankton assemblages in two South Carolina estuaries
Kimberly A. Sitta, College of Charleston; Cameron Doll, South Carolina Department of Natural Resources; Rebecca Mortensen, University of South Carolina; Michelle Reed, South Carolina Department of Natural Resources; Shawn Stormer, South Carolina Department of Natural Resources; Timothy Callahan, College of Charleston; Dianne I. Greenfield, South Carolina Department of Natural Resources, University of South Carolina*

22 Seawater addition long term experiment (SALTEx)
Dontrece Smith, University of Georgia; Ellen Herbert, Virginia Institute of Marine Science, Indiana University; Fan Li, University of Houston; Sarah Widney, Indiana University; Nicole Desha**, College of Coastal Georgia; Joe Schubauer-Berigan, U.S. Environmental Protection Agency; Steve Pennings, University of Houston; Christine Angelini, University of Florida; Patricia Medeiros, University of Georgia; Jeb Byers, University of Georgia; Merryl Alber, University of Georgia; Chris Craft, Indiana University*

23 The sea floor: A living learning residential community
*Mickayla Smith**, Jane L. Guentzel, Eric Rosch, Margaret Stoughton, Coastal Carolina University*

24 Collaborative research to prioritize and model the runoff volume sensitivities of tidal headwaters
Andrew Tweel, South Carolina Department of Natural Resources; Denise Sanger, South Carolina Department of Natural Resources, ACE Basin National Estuarine Research Reserve; Eric Montie, University of South Carolina at Beaufort; April Turner, South Carolina Sea Grant; John Leffler, South Carolina Department of Natural Resources

25 Differences in habitat utilization and temperature preferences of male and female Atlantic Stingrays *Dasyatis sabina* in the Herb River near Savannah, Georgia
Sarah Webb, Mary Carla Curran, Savannah State University*

26 Fish assemblages in Brusen Creek on St. Catherine's Island, GA
*Mikael Sapp**, Claudia Ong**, Jacob McKittrick**, Augusta University; Jason Moak, Phinizy Center for Water Sciences; Dharma Thiruvaiyaru, Sankara Sethuraman, Bruce Saul, Augusta University*

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

From seeds to shoreline: Engaging students in salt marsh restoration

E.V. Bell, South Carolina Sea Grant Consortium; Denise Sanger, Catharine Parker, Julie Binz, South Carolina Department of Natural Resources*

South Carolina is home to 2,876 miles of coastline and an estimated 344,500 acres of critical salt marsh habitat. As the coastal South Carolina population continues to rise, there is a critical need to educate residents about the benefits of and the threats to this ecosystem. From Seeds to Shoreline (S2S) is a South Carolina-based youth initiative that teaches stewardship of the salt marsh ecosystem through seed collection, germination, cultivation, and transplantation of *Spartina alterniflora*, the dominant plant in southeastern salt marshes. S2S spans the length of the school year, is aligned with state science standards, encourages student-driven science investigations, and culminates in a Restoration Day where students transplant young *Spartina alterniflora* seedlings to areas along South Carolina's coastline. In 2014, with funding from the Environmental Protection Agency, the S2S program expanded regionally into North Carolina and Georgia in partnership with each state's Sea Grant and National Estuarine Research Reserve programs. Funding also enabled the development of educational products: *Spartina alterniflora* poster, tidal creek salt marsh guide, lesson plans, and companion products. S2S remains the only student-driven salt marsh restoration program in South Carolina. The S2S program is coordinated by the South Carolina Sea Grant Consortium in partnership with Clemson University Cooperative Extension Service and the South Carolina Department of Natural Resources (SCDNR). Since the piloting of the program in 2011, S2S has grown from 16 teachers, 8 schools, and 700 students to more than 38 schools, 35 teachers, and more than 1800 students in the 2014-2015 school year.

Sea level rise impacts on estuarine wetland carbon storage and nutrient cycling

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Coastal and estuarine wetlands serve a variety of ecosystem services, including being a significant sink for carbon and a hotspot for nutrient removal and/or transformation. Sea level rise, and the associate increases in salinity and inundation, has the potential to significantly alter the balance between carbon storage and loss, and could make coastal wetlands more susceptible to submergence. Research indicates that understanding the stress response of soil bacteria, the microorganisms that regulate biogeochemical cycles in coastal wetlands, may be the key to understanding the fate of coastal wetlands. Studies demonstrate that freshwater estuarine wetlands are highly sensitive to saltwater intrusion, which can accelerate the rate of carbon loss through microbial respiration. In contrast, brackish and saline wetlands appear more sensitive to increases in tidal inundation, which can reduce respiration rates and may help preserve soil carbon for enhanced wetland accretion. Moreover, coastal wetland soil biogeochemistry is particularly sensitive to pulsing events (i.e., quick, dynamic changes in salinity), which can significantly alter both carbon and nitrogen cycling. Findings indicate that not only saltwater pulses (e.g., storm surges), but also freshwater pulses (e.g., river floods or urban stormwater run-off) can have substantial short-term consequences for coastal wetland ecosystem function.

Changes in coastal forest dynamics as a result of rising sea level

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On-going research studies in tidal forested wetlands in South Carolina are helping us to gain insights and practical experiences about the impacts of sea level rise on coastal ecosystems. These low-lying wetland ecosystems are representative of coastal wetlands along the Southeastern USA coast, from Texas to Delaware, which are currently converting from freshwater forested wetland to salt marsh. Even small concentrations of salinity (e.g., <2 ppt) can drastically decrease growth rates and litterfall production, leading to decreased productivity and permanent changes in the composition of these forests, resulting in deteriorating soil and water quality and reduction of the capacity for carbon sequestration within these coastal ecosystems. We have documented changes in forest structure and growth of trees in swamps of South Carolina, Georgia, and Louisiana from 1988-2014 subject to a variety of flooding regimes. We found that as estuarine influence shifts inland with sea-level rise, forest growth becomes linked to salinity and salinity-induced changes in nutrient availability. Salinity, soil total nitrogen, flood duration, and flood frequency affect forest diameter increment, litterfall, and basal area the greatest. Conversion to

oligohaline marsh is associated with increased sediment nutrient inputs that may then increase herbaceous productivity, further increase sediment trapping, and enhance the resilience of tidal wetland surface elevation to sea-level rise.

Colonization and water quality changes following the restoration of a coastal tidal marsh in Tampa Bay, Florida

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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 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. To evaluate restoration success, Robinson Preserve was divided into 4 main sampling regions based on water flow and connectivity to neighboring water bodies, and sampled quarterly from 2007-2013. Fish and invertebrate populations were sampled and the habitat was characterized for each region. Water quality parameters including DO, salinity, temperature, Secchi depth, TN, TP, Chl-*a*, and color were also measured within each region. Data were analyzed over the time-series for the whole preserve and by region. Water quality parameters were within expected ranges and similar to surrounding water bodies with distinct trends within each region. Within the first year following tidal reconnection, 18 fish and 14 invertebrate species had been collected. Although the rate of colonization slowed, at least one new species was documented during each subsequent sampling event. After 7 years of colonization, 85 fish and 105 invertebrate species have been observed. Numerous commercially or recreationally important species utilize the preserve for juvenile refuge and/or adult foraging.

Using marine mammal research as a way to engage K-12 students in the sciences

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Using marine mammal research is a perfect "hook" to engage K-12 students in the sciences. Students are able to use actual data and apply mathematics, science, and geography to real-world situations. We have published several K-12 interdisciplinary activities based on cetacean research and implemented these lessons in schools. 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 provided information on social bonds. The second activity focused on analyzing spatial patterns. Students mapped sighting locations of dolphins using latitudinal and longitudinal coordinates and looked for spatial patterns. A third activity instructs students on estimating abundance of common bottlenose dolphins, which requires them to follow standardized photo-identification protocols. We also designed an activity to teach students about marine mammal communication and vocal mimicry that is accessible to visually impaired students. One component of the activity demonstrated the relationship between playback speed and pitch; sound recordings of low-frequency blue whale "moans" were inaudible at regular speed, but audible at 8X speed. We also compared the sounds of different species, for example asking students how the songs of humpback whales differed from the rhythmic codas of sperm whales. In each of these activities, students enjoyed learning about marine mammal behaviors such as begging, strand feeding, and vocal mimicry. K-12 activities based on actual data can increase the reach of scientific findings, improve ocean literacy, and enhance educational opportunities for students.

Antibiotic and nutrient mixtures influence phytoplankton subsidies to coastal systems

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Rivers and streams transport essential freshwater, nutrients, and organisms, including phytoplankton, to coastal systems. Phytoplankton exhibit sensitivity to contaminants that enter rivers in agricultural runoff and wastewater effluent, including antibiotics such as tetracycline (TC) and excess nutrients. Ecologically relevant concentrations of TC decreased phytoplankton abundance under flowing conditions in previous artificial stream experiments, while nutrients are known to alter competitive interactions between species,

leading to dominance by species unpalatable to grazers or bloom-forming species. Although TC and excess nutrients are likely to be present simultaneously in the environment, how the combination affects phytoplankton communities remains unclear. We conducted two artificial stream experiments to test whether nutrients (nitrate and phosphate) and TC together affect phytoplankton communities differently than each contaminant alone. For both experiments, "communities" of three phytoplankton species were exposed to treatments of nutrients (nitrate and phosphate), TC, both, or no addition control for a minimum of one week. Both TC and nutrients increased total abundance relative to the nutrient-only and TC-only treatments due to increases in *Navicula* sp. and *Scenedesmus* sp. Abundance of *Navicula* sp. increased by 50-90% in the contaminant combination relative to nutrient-only and TC-only additions in both experiments, potentially due to reduced competition with aquatic bacteria. *Microcystis aeruginosa* trended toward increased abundance in the contaminant combination relative to the nutrient-only addition, but only in the first experiment. Our results suggest that simultaneous TC and nutrient inputs alter phytoplankton community composition in streams, which could ultimately change the abundance and quality of phytoplankton subsidies reaching coastal waters.

Fiddler crabs and the changing ocean: can ocean acidification inhibit limb regeneration?

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As carbon increasingly enters the atmosphere it dissolves into the oceans causing the pH to drop resulting in ocean acidification. Various studies have shown that ocean acidification can be detrimental to organisms that require calcium to form exoskeletons. It has been suggested that some calcifying organisms are able to acclimate and tolerate acidic conditions. In this study three species of fiddler crabs (*Uca pugnax*, *Uca thayeri*, and *Uca pugilator*) from three different sites (Waverly, Georgia, Tybee Island, Georgia and Hunting Island, South Carolina) were used to determine the effects of ocean acidification on limb regeneration at various pH levels. Each crab had three limbs removed and were then placed in mesocosms with various water pH levels of 8.1, 7.7, 7.4, and 7.1. The crabs were monitored daily over a period of eight weeks to determine the time required for ecdysis to occur in order to regenerate missing limbs. It was determined that there was not enough significant data to support a difference in ecdysis times by location; however, it was determined that there was a statistically significant difference in ecdysis time among the various pH levels. In all of the various pH conditions tested specimens were able to regenerate missing limbs; however, the significant difference in time for ecdysis to occur indicates that ocean acidification can affect the regeneration process resulting in delayed growth.

Site fidelity and home range in cryptic demersal estuarine fishes

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Naked gobies (*Gobiosoma bosc*) and combtooth blennies occupy subtidal oyster (*Crassostrea virginica*) reef habitats from New York to Florida with four blenny species (crested *Hypleurochilus geminatus*, feather *Hypsoblennius hentz*, freckled *Hypsoblennius ionthas*, and striped *Chasmodes bosquianus*) commonly observed in southeastern tidal creeks. We investigated adult blenny and goby site fidelity and home range with passive integrated transponder (PIT) tags from June 2013 through June 2015. Artificial substrates in a North Inlet, SC tidal creek were checked at least biweekly during the spawning season for all fishes. Approximately 31% of tagged fishes (n=256) were recaptured, with some individuals recaptured as many as 10 times. In companion laboratory studies, blenny survival post-tagging (92%) was higher than goby survival (76%) with at least 92% tag retention observed for 1-2 weeks in all fishes. Across the 9 sites separated by 100s of meters, 74 out of 80 tagged fishes remained within 10 meters of their original location at time scales of days to a year. Among fishes with only 1 recapture, naked gobies showed lower site fidelity than blennies (33% vs. 77-100%). Only 1 of 42 fishes that were recaptured more than once moved from the tagging reef. The average days at liberty ranged from 10 (feather blenny) to 46 days (crested blenny) with the maximum observed days at liberty for crested (245 days) and striped (367 days). These cryptic fishes display high site fidelity with home ranges of less than 10 m at time scales up to a year.

The South Carolina Estuarine and Coastal Assessment Program (SCECAP): 1999-2014

Sharleen Johnson, Denise Sanger, South Carolina Department of Natural Resources

The South Carolina Estuarine and Coastal Assessment Program (SCECAP) has been monitoring the overall health of the state's estuarine habitats since 1999. SCECAP is a collaborative effort among multiple agencies, currently including SCDNR, SCDHEC, and NOAA. Sampling primarily occurs in July

and August, because these months represent a period when some water quality variables may be limiting to biota, and many recreationally and commercially important fish and crustacean species utilize the estuary for nursery habitat during the summer season. The program has sampled 30-60 estuarine stations per year using a probability-based stratified sampling design, in which half the stations sampled each year are located in tidal creek habitats and the other half in open water habitats. SCECAP has developed four integrated indices that each evaluate a different aspect of the estuarine ecosystem: water quality, sediment quality, biological condition, and overall habitat quality. As a result of sampling a completely new set of randomly selected sites each year, SCECAP has identified areas with environmental quality concerns in both predictable and unexpected locations and thereby set the stage for targeted efforts to identify and address the underlying causes of compromised habitat quality in those areas. SCECAP findings are useful at multiple scales: for state-wide assessment, watershed-level assessments, and local government projects. Data collected for the program are also used for basic research (i.e. to explore relationships among land use, environmental factors, and biotic condition) and are routinely shared with diverse entities (federal, state, and local government agencies; non-profit organizations; and academic scientists).

Determination of soil microbial populations in the Satilla River Estuary using 16S rRNA next-gene sequencing

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Estuaries and other various ecosystems are commonly altered to support different types of human gain. The Satilla River Estuary (SRE) in Georgia has been cut for industrial purposes numerous times: the most notable cut is Noyes Cut. This cut was made in 1910 for the purpose of transporting lumber. Due to the lack of maintenance and management, it has led to changes in water chemistry and geomorphology. We hypothesize that these changes affect microbial population size and diversity. Soil has been sampled from four sites within the SRE to determine the microbiological makeup. Microbial DNA was isolated from soil samples collected. The 16s rRNA genes were sequenced using ion torrent sequencing to determine microbial community structure. We have found that the Node is the most diverse site, with decreasing diversity indices at each site over time. Increases in salinity in these locations results in a decrease in community similarity. Collectively, our results indicate that that SRE has lower diversity than other estuaries described in the literature.

Individual movement rates are sufficient to determine and maintain dynamic spatial positioning within *Uca pugilator* herds

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Spatial location within aggregations (i.e., periphery, central) is of biological significance to gregarious animals. Because these positions are a potential consequence of consistent individual behavioral differences, or personality, a better understanding of potential mechanisms concerning personality is central to predicting an individual's location. To determine the effects of individual personality on the dynamic spatial positioning of *Uca pugilator* while herding, field data collection and agent-based modeling were employed. Individuals were assayed to establish their personalities and returned to the field for observation as a means of identifying location preference within selfish herds. There was a significant difference between the extreme personalities and the proportion of time spent on the edge of the herd. The active individuals were at the periphery ~50% more of the time than less active individuals. An individual-based model qualitatively replicated these field results by applying the mechanism of activity level as an indicator of individual personality. This suggests that differences in personality-dependent movement are sufficient to explain the spatial positioning of individuals within selfish herds. This study enhances our understanding of the possible mechanisms that govern group movement, and has implications for modeling population dynamics that can be influenced by individual personality.

Light pollution impacts on *Caretta caretta* nesting in several tourism meccas in the Southeastern US using remote sensing sources

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We present a case study contrasting light pollution impacts upon female nesting and hatchling orientation of *Caretta caretta* in two southeastern tourist meccas, including Myrtle Beach (South Carolina) and several other in Florida including Fort Lauderdale. Of interest were the differing conditions regarding;

mean human population density, summer tourism populations, and the resultant light regimes present across the slightly to highly developed coastal landscapes in these locations. We used the Day/Night Band of the Visible Infrared Imaging Radiometer Suite (VIIRS) satellite imagery of moonless and cloudless nights over three month nesting periods to characterize the two geographic regions. Imagery (spatial resolution 500m/pixel) was trimmed and expressed as a line graph of intensity (W m^{-2} sr^{-1}) by latitude. Associated with the Florida data we also used LiDAR to determine; initial (0-5m above MSL) intertidal slope, distance to berms when present, distance to highest elevational feature in transect, elevation of that feature, and the slope from the MSL datum and that feature. Twenty beaches were examined with n=3 transect replication from the Florida survey region. We examined the relationships of these independent data sources to female nesting density (available from "Seaturtle.org" for SC, and the Fish and Wildlife Research Institute's Statewide Nesting Beach Survey program for FL. The subtle effects of increasing light pollution were shown in the nesting data from Myrtle Beach, where increasing light intensity by a factor of 2-3 from darkest subregions significantly diminished nesting density (nests/km). Comparisons also including the LiDAR data for Florida indicated interactions between light intensity and beach morphology. In terms of hatchling orientation more prominent variation in hatchling disorientation was found across the significantly higher light regimes in Fort Lauderdale. Finally, descriptions of the highly different coastal management strategies as well as the prognosis of light pollution impacts to sea turtle population health in these regions are discussed.

Increased strandings of pelagic *Sargassum*: Symptom of eutrophication in the Gulf of Mexico?

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Since 2011, unprecedented strandings of pelagic *Sargassum*, commonly known as "gulf weed" have been occurring over broad areas of the western North Atlantic Ocean and the Caribbean Sea. These strandings, characterized by excessive biomass, are considered harmful algal blooms as they have a detrimental impact on both the environment and the economies of these coastal areas. Previous ecophysiological and remote sensing research suggests that a *Sargassum* "growth continuum" begins in the Gulf of Mexico (GOM) and follows the Loop Current around the Florida Keys and then north to the Gulf Stream and ultimately the Sargasso Sea and Caribbean region. Ecophysiological studies of *S. fluitans* and *S. natans* in the GOM and FL Keys between 2010 and 2015 showed significantly higher tissue %N and N:P ratios compared to region-wide baseline measurements in the mid-1980s. Remote sensing measurements using high resolution (30 m) Landsat imagery showed extensive pelagic *Sargassum* biomass accumulates in the northern GOM in the winter/spring, and that it occurs at higher biomass levels than previously reported using lower resolution (300 m) MERIS imagery. These studies point to the importance of the GOM as a bioreactor for nutrient-enriched growth of *Sargassum*, which could be a significant factor in triggering these unprecedented *Sargassum* strandings.

Low temperature tolerance of juvenile tarpon *Megalops atlanticus*

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Tarpon *Megalops atlanticus* is a tropical/subtropical fish species commonly found in offshore and inshore waters along the southeastern US Atlantic and northern Gulf of Mexico coasts. Despite this wide geographic range, limited information is available on the ecology of tarpon occurring along the Atlantic coast north of Florida, but their northern distribution in this region is thought to be limited by low winter water temperatures. To determine the overwinter survival potential of juveniles inhabiting inshore areas near their northernmost reported distributional limit, we conducted laboratory experiments to estimate the low-temperature tolerance of tarpon exposed to: (1) ambient (fluctuating) water temperatures via a flow-through seawater system and (2) a constant rate of water temperature decrease (~2 °C day^{-1}). When exposed to ambient winter water conditions, the mean lethal minimum temperature for juvenile tarpon was 13.7 ± 1.1 °C. When exposed to a constant rate of water temperature decrease, the mean lethal minimum temperature was 9.2 ± 0.2 °C. Juvenile tarpon generally stopped feeding around 17 °C, and no fish were observed eating below 13 °C. Combining our results with three previously published studies reporting thermal limits for tarpon, we estimated an overall mean lethal minimum temperature of ~11 to 12 °C. Our results for juvenile tarpon are similar to low-temperature tolerances reported for other tropical/subtropical fish species thought to have temperature-limited distributions.

Significant fecal bacteria and TSS reduction by coastal BMPs in Wrightsville Beach, N.C.

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The Town of Wrightsville Beach, N.C. is an island resort community with beaches and other waterways used by the public for water-contact recreation. This community has had elevated fecal bacteria counts in some local waterways, and waterways adjacent to but outside of the town boundaries have had shellfish bed closures due to elevated bacteria counts. In an effort to curb such pollution, the town collaborated with the National Estuarine Research Reserve, the North Carolina Coastal Federation, the University of North Carolina Wilmington, and the engineering firm Withers and Ravenel to install best management practices (BMPs) designed to retain, treat, and reduce stormwater discharges to local estuarine waters during 2014 and 2015. A stormwater collection system draining a mixed commercial/institutional/roadway area with an outfall into the Atlantic Intracoastal Waterway was retrofitted with a series of low-cost rain gardens and water retention structural modifications. Results show that this led to a 78% reduction in *Enterococcus* counts and a 68% reduction in fecal coliform bacteria counts; regarding pollutant loads, these BMPs have caused a 42% reduction in stormwater discharge, a 26% reduction in *Enterococcus* discharge, a 56% reduction in fecal coliform discharge, and a 99% reduction in total suspended solids (TSS) discharge. A stormwater system collecting drainage from a dense residential area discharging into Bank's Channel was retrofitted with a sand filtration/stormwater retention device as well, which led to a 90% reduction in stormwater discharge from that drainage into that estuary, and associated 89-99% load decreases of fecal coliform bacteria, *Enterococcus*, and TSS.

Acoustic monitoring of spawning in captive and wild sciaenids

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Spawning aggregations of sciaenids in South Carolina are challenging to study, but passive acoustics may offer an effective solution since many of these fish rely on acoustic communication for reproduction. Our approach has been to first understand the relationship between sound production and reproductive output in captive sciaenids and then apply this knowledge to the field. Our captive studies with spotted seatrout and red drum have revealed that spawning occurs only on evenings in which fish call, and spawning is more productive when males produce more calls. In the case of red drum, spawning is more successful when males produce longer calls with more pulses. These captive data have provided us with a framework to identify spawning aggregations of sciaenids in the May River, SC. We have acoustically identified a community of soniferous fishes including oyster toadfish, weakfish, Atlantic croaker, black drum, silver perch, spotted seatrout, and red drum. We have discovered species-specific spatial patterns of sound production. Using this information, we have deployed longterm acoustic recorders (i.e., DSG-Oceans) strategically at locations throughout the May River (i.e., from 2013 to present) as a way to monitor spawning at precise temporal scales. We have discovered finely tuned seasonal, daily, temperature, and tidal patterns of courtship sounds. These data are providing baseline patterns which will help the community to assess the impacts of anthropogenic forces such as climate change, stormwater runoff, and noise on the reproduction of sciaenids in the May River, SC.

Contributions of organic and inorganic matter to volume and accretion in tidal wetlands at steady state

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A mixing model derived from first principles describes the bulk density (BD) of intertidal wetland sediments as a function of loss on ignition (LOI). The model assumes the bulk volume of sediment equates to the sum of self-packing volumes, k1 and k2, of organic and mineral, respectively. It explained 78% of the variability in total BD when fitted to 5075 measurements drawn from 33 wetlands distributed around the conterminous United States. Based on the fitted organic density (k1) and constrained by primary production, the model suggests that the maximum steady state accretion arising from the sequestration of refractory organic matter is ≤ 0.3 cm yr^{-1}. Thus, tidal peatlands are unlikely to survive indefinitely a higher rate of sea-level rise in the absence of a significant source of mineral sediment. Application of k2 to a mineral sediment load typical of East and eastern Gulf Coast estuaries gives a vertical accretion rate from inorganic sediment of 0.2 cm yr^{-1}. Total steady state accretion is the sum of

the parts and therefore should not be greater than 0.5 cm yr^{-1} under the assumptions of the model. Accretion rates could deviate from this value depending on variation in plant productivity, root:shoot ratio, suspended sediment concentration, sediment-capture efficiency, and episodic events.

Promoting salt marsh stewardship through environmental education materials

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Salt marshes and tidal creeks are predominant features of the Southeastern landscape and act as direct links between activities on land and estuarine environmental quality. Changes in environmental quality can affect the health of the salt marsh ecosystem and the well-being of surrounding communities. The From Seeds to Shoreline (S2S) K-12 education program is focused on increasing environmental awareness and stewardship of salt marsh habitats, thereby protecting coastal waters and reducing human health risk. A primary goal of the program is to develop an education model with three levels of engagement: information, outreach, and stewardship. Information products are being developed to support S2S with the foundation piece being a tidal creek-salt marsh guide. The guide will first cover: (1) overall ecology of the salt marsh ecosystem, including abiotic and biotic components; (2) ecosystem services, including human uses and risks; and (3) the historical and cultural aspects of tidal creeks and salt marshes. The guide will also classify and describe the dominant flora and fauna found in the tidal creek-salt marsh ecosystem to help readers identify and learn about life in the marsh. Companion products (e.g., posters) and lesson plans will be based on the information presented in the guide. These companion products will be tailored to address different grade levels from kindergarten through high school. Ultimately, we hope the project will provide lifelong learning at many levels, and will be modified for use in riparian habitats.

Toxic and nontoxic *Microcystis* in the Cape Fear River: Why, where and when?

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Microcystis aeruginosa, a toxin producing freshwater cyanobacteria formed unprecedented blooms in the Cape Fear River, NC during summer months from 2009 through 2012 which propagated downstream to the Cape Fear River Estuary. These blooms contained toxic strains capable of producing microcystins, potent hepatotoxins. *Microcystis* blooms have been documented around the world in warm, eutrophic, stagnant bodies of water. Historical flow, nutrients and temperature data from the river do not indicate a significant change in the river to support formation of previously unwitnessed blooms. Therefore, identification of a plausible upriver source of *Microcystis* is warranted. A 2015 study attempted to rule out potential primary sources using molecular markers and genotyping. Fourteen sites along the Haw River, Deep River and Cape Fear River were sampled twice monthly between May and September for analysis of toxic and nontoxic *Microcystis* presence and absence using two *Microcystis* specific toxin producing genes, mcyB and mcyD, and the *Microcystis aeruginosa* specific ITS. Results support consistent upper basin occurrence patterns with multiple potential sources. Other sources have been ruled out including Sharon Harris Reservoir, the South River and the Black River. Genetic sequencing was used to validate amplification of the *Microcystis aeruginosa* ITS and will be employed to possibly further indicate source and secondary populations within the Cape Fear River.

Effects of nitrogen on dissolved organic carbon and microplankton abundances in four coastal South Carolina systems

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Dissolved organic carbon (DOC) constitutes a major portion of the total dissolved organic matter pool in blackwater systems of the southeastern US. Terrestrial vegetation is the primary DOC source with phytoplankton contributing less. With continued alteration of forested land, terrestrially-derived DOC may be reduced. However, urbanized runoff will likely increase nitrogen (N) and phosphorus (P) inputs thereby stimulating phytoplankton growth and algal-derived DOC. Since bacteria utilize dissolved organic matter for growth and respiration, bacterial abundances may also be affected. We investigated seasonal (July 2012 to May 2013) DOC, bacteria, and phytoplankton biomass (chl *a*) levels in response to N and P additions at 4 coastal South Carolina sites: a detention pond, an urbanized creek, a forested/agricultural

creek, and a forested creek. DOC concentrations were highest at the forested creek (least developed site) suggesting a strong terrestrial influence. DOC was significantly and positively correlated with precipitation, but negatively correlated with salinity, indicating rainfall affected DOC mobilization. Chl *a* was highest during summer and positively correlated with temperature. Bacterial abundances were generally negatively correlated with salinity. During experiments, chl *a* was typically greater in addition treatments than controls, especially at the urbanized creek and detention pond. DOC and chl *a* were elevated following incubation in certain N-amended treatments, particularly those containing urea. These results indicate that N additions, especially urea, stimulated phytoplankton biomass, and likely increased the contribution of phytoplankton-derived DOC to the total DOC pool. The conversion of natural coastal landscapes into developed land likely affects the biogeochemical cycling of DOC.

The effect of season on the size and abundance of flatfishes in a Georgia tidal creek

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The distribution of flatfishes is affected by several environmental factors including temperature and salinity, which can both vary by season. The purpose of this study was to determine whether there was an effect of season on the size and abundance of flatfishes in a tidal creek near Savannah, Georgia. Sampling was conducted once a month from January 2004-January 2016 in Wylly Creek. Fishes were collected using a beam trawl during ebbing tide. Additional samples were collected from December to February 2013-2016 in an effort to obtain recently settled juveniles based on previously observed winter settlement pulses of the Bay Whiff *Citharichthys spilopterus*. All fishes were identified and measured, and the catch-per-unit-effort (mean number of individuals per sample date) was determined for each species. There was an effect of season on abundance, and the Bay Whiff had the most predominant seasonal pattern, with the highest abundance in winter (16.7±17.2 CPUE) and lowest abundance in fall (1.4±1.4 CPUE). The Blackcheek Tonguefish *Symphurus plagiusa* also displayed a seasonal pattern, with the highest abundance in summer (11.9±8.0 CPUE) and lowest abundance in fall (2.3±2.0 CPUE). These trends may be partly caused by differences in spawning times and larval transport mechanisms that result in settlement in different habitats during different times of the year.

Transport times through salinity zones of Georgia riverine estuaries

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We explored differences in the transit times of dissolved substances through the salinity zones in three riverine estuaries in Georgia (Satilla, Ogeechee, and Altamaha) with very different natural ranges of flow rates. The estuaries were compared in spite of the large difference in their river flow ranges by using flow rates ranging from the 10th-90th percentile within each system. Salinity distributions and transit times were estimated from box models generated using an optimum-boundary box modeling framework. Zone lengths and transit times were calculated for individual salinity zones in each estuary. The Satilla and Altamaha estuaries have long zones of tidal freshwater, the Satilla because it is a longer estuary and the Altamaha because its high river flow rate compresses the salinity distribution towards the mouth. The slower-flowing Satilla and Ogeechee estuaries have longer zones of higher salinity than the Altamaha estuary. In all of the estuaries, a greater proportion of the transit time is spent in higher-salinity zones and a lower proportion of time in tidal freshwater than might be expected based on the proportional length of the zones, largely due to the increase in estuarine volume that occurs towards the mouth. The extent to which materials may be transformed within the estuary may depend on the amount of time spent in salinity zones relevant to the process under consideration. These types of predictions can be useful in interpreting nutrient and pollutant dynamics in estuaries as well as in studies that compare the relative susceptibility of estuaries to perturbations.

Dietary overlap and potential food resource competition between pike killifish and juvenile common snook

Geoffrey Smith, Debra Murie, University of Florida*

Pike Killifish is an established non-native fish species in Florida that was first documented in south Florida in 1957 and secondarily in Tampa Bay tributaries in 1994. Decreases in small-bodied fish abundances have been linked to the introduction of Pike Killifish in both of these regions. Increases in the range and abundance of Pike Killifish in the Tampa Bay area and overlap in habitat usage has led to concerns about potential competition with, and predation on, early-juvenile Common Snook (≤100 mm SL). Stomach contents of Pike Killifish and early-juvenile snook were collected to examine the dietary overlap of these

two species and potential differences in the diet of early-juvenile snook from locations with and without Pike Killifish co-occurring. Prey resources were also collected at the time of fish collection to assess prey resource limitation and prey selectivity. Stomach content analysis indicates that there is some overlap in the diets of Pike Killifish and early-juvenile snook. However, early-juvenile snook have a wider diet breadth, consuming a number of organisms that are not consumed by Pike Killifish and make up a large portion of the early-juvenile snook diet. Preliminary analysis of prey resources appears to indicate that some prey groups may have lower abundances in locations where Pike Killifish are present and these differences are reflected in the diet of early-juvenile snook. Despite these potential differences, there does not appear to be a substantial difference in the diet overlap of early-juvenile snook from locations with and without Pike Killifish co-occurring.

Is Florida headed back into the ocean? Some possible effects of sea level rise on low lying and porous peninsula that originally came from the ocean.

Jeremy Stalker, Jacksonville University

Here are two facts: Sea level isn't so level, and Florida has spent most of geologic time under it. This talk will look at some of the overall controls on the variation in the elevation of the oceans and the effects of sea level rise. In a larger context we can predict that sea level rise won't be the same everywhere on our coastlines, tectonic and physical oceanographic forces will vary the magnitude, severity and timing of sea level increases. Many recent studies examine some of the possible effects of that rise on Florida's unique coastal aquifer systems, including the inland migration of salt water intrusion into the porous limestone aquifers, groundwater elevation increase which creates wetland areas that historically were dry, as well as the effects of the inundation of low lying coastal plains on water supply. We will examine how the effects of sea level rise will be felt far from the coastline into the interior of the Florida Peninsula.

Effect of location on physical attributes of the daggerblade grass shrimp *Palaemonetes pugio* in Georgia

Coral Thompson, Sue C. Ebanks, Savannah State University*

The daggerblade grass shrimp *Palaemonetes pugio* inhabits estuaries along the East and Gulf coasts of the United States, is a link between trophic levels, and is exposed to varying environmental conditions within these coastal habitats. The purpose of this study was to determine the spatial and temporal relationship between shrimp length, weight, and clutch size at 3 estuarine locations in Savannah, Georgia. The study was conducted August to October 2014 and February to August 2015 at Country Club Creek (CCC), Tom Thumb Creek (TT), and Moon River (MR). Male and female shrimp (N = 30 shrimp/site) were collected by dip net twice a month during low tide. Length and weight were measured, trematode cysts were counted, and clutch size was recorded for ovigerous females. Female shrimp represented 51.3% of the sample from CCC, 46.8% at TT, and 65.1% at MR. Mean clutch size from April-June 2015 was 292.6 ± 70.86, 282.6 ± 71.77, and 255.9 ± 60.49 eggs/shrimp at CCC, MR, and TT, respectively. Mean clutch size from July-September was 168.4 ± 53.43, 136.6 ± 47.12, and 140.0 ± 45.74 eggs/shrimp at CCC, MR, and TT, respectively. Overall, clutch size was significantly larger from April-June than from July-September. Mean trematode abundance was highest at CCC with 0.67 ± 0.57 cysts/mm. Shrimp at CCC had the greatest average weight, length, and clutch size. Ongoing and further research will include analyzing sediment and shrimp tissue to determine possible correlations between polycyclic aromatic hydrocarbon concentration and *P. pugio* clutch size.

Aquatic metabolism in a salt marsh dominated estuary - the O_2 and CO_2 journeys

Shiyu Wang, Charles Hopkinson, University of Georgia; Weijun Cai, University of Delaware; Daniela Di Iorio, University of Georgia*

Coastal salt marshes and estuaries play a disproportionally large role in global ocean carbon budgets despite their relatively small area. This is due to their high rates of metabolism. We have been examining the metabolism of estuarine tidal waters of the Duplin River adjacent to Sapelo Island, GA. and the coupling between the Duplin and the adjacent salt marshes driven by tidal flooding. The open-water diurnal approach was applied to measure metabolism using both inorganic carbon and dissolved oxygen. We find that the Duplin system to be a source of CO_2 to the atmosphere with an emission of 74 mmol CO_2 per year, and a sink of O_2 from the atmosphere with an absorption of 61 mmol O_2 per year. The estuary exported 29 mmol per year of CO_2 and imported 0.13 mmol per year of O_2 from the coastal ocean. The Duplin River was net heterotrophic especially in its headwaters during the warmer seasons, with an

annual rate of net heterotrophy of 60 mmol CO_2 and -49 mmol O_2. We find the marshes to export DIC to estuary during most seasons of the year and to be responsible for a major portion of overall system net heterotrophy. Intertidal marshes are also the site where much of the estuarine air-sea exchange of CO_2 and O_2 occurs.

Holoplankton and meroplankton occurrence and seasonal abundance in Port Royal Sound, South Carolina

Bill Weiss, LowCountry Institute

A study program is being conducted to characterize the zooplankton community in the Port Royal Sound (PRS) system of coastal South Carolina. Objectives of the program are: • To assess the functional status of the zooplankton community, both the holoplankton (permanent plankton) and meroplankton (temporary larval plankton) components, as the base of the estuarine and coastal aquatic food chain in the PRS area. • To assess the functional status of PRS and the adjoining coastal area as a nursery ground for estuarine and marine species, including those of commercial and recreational importance. Zooplankton samples are collected with 363 µm and 150 µm mesh plankton nets. This presentation summarizes the analytical results for the 363 µm mesh net samples collected from March through October 2015, which identified the presence of both holoplankton and meroplankton components in the size categories of meso- and macrozooplankton. Holoplanktonic forms included hydrozoans, cladocerans, ostracods, copepods, sergestid shrimp, reproductive adult polychaetes, and chaetognaths. Meroplanktonic forms included schyphozoan, ascidian, echinoderm, and brachiopod larvae; cephalopod paralarvae; penaeid postlarvae; caridean, mud, ghost, and mantis shrimp larvae; anomuran crab larvae, brachyuran crab larvae, and fish eggs and larvae. The seasonal occurrence and abundance of these zooplankton taxa in Port Royal Sound during 2015 are reported and compared with the findings of similar studies conducted in estuarine and coastal waters of the southeastern U.S. coast and eastern Gulf of Mexico.

Factors affecting ghost crab burrow morphology in Horry County, South Carolina

*Erica Westwater**, Coastal Carolina University*

Coastal dunes provide essential habitats for marine species such as plants and invertebrates including the ghost crab (*Ocypode quadrata*), which are well-established as biological indicators of the health of beach habitats. Burrows generally take on a J- or U-shaped pattern that can be branched or unbranched. Extra chambers and entrances serve as a refuge from predation and heat, or used as protection while mating. Burrows with obvious secondary entrances (referred to as “paired”) were examined to determine the factors that may influence their abundance and morphology. It was found that both burrow diameter and sand compaction were significantly related to the distance between the paired entrances. The angle formed between the waterline and the direction of the burrow entrances was discovered to be significantly associated with burrow depth and diameter. A closer examination of the construction and potential seasonal burrow patterns would lead to a better understanding of the exact function of the paired burrow. These results can be used to further understand the biology of ghost crabs as well as other coastal animals.

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

Osmoregulation in sharks revisited: I. rectal gland masses of estuarine, nearshore, and deep sea sharks

*Daniel C. Abel, Scott Parker, Megan Novak**, Delanie Sage**, Alexandra Dowlin, John Simcox**, Coastal Carolina University; R. Dean Grubbs, Florida State University*

A serendipitous observation of a smaller than expected rectal gland in a bigeye sixgill shark (*Hexanchus vitulus*) led us to question whether smaller rectal glands were characteristic of deep-sea sharks, and to also examine these glands in unstudied coastal species. Dry rectal gland mass/body mass ratios (x 1000) for 6 shallow-water species [28.9 ± 3.05 (μ ± SEM, N = 32); blacknose (*Carcharhinus acronotus*), finetooth (*C. isodon*), blacktip (*C. limbatus*), gulf smoothhound (*M. sinusmexicanus*), Atlantic sharpnose (*Rhizoprionodon terraenovae*), and bonnethead (*Sphyrna tiburo*)], and 5 mid- to deepwater species [(31.50 ± 3.81 (N = 57); gulper (*Centrophorus granulosus*), little gulper (*C. uyato*), dusky smoothhound (*Mustelus canis*), Cuban dogfish (*Squalus cubensis*), and shortspine spurdog (*S.* cf. *mitsukuri*)] were not significantly different. ANOVA and post-hoc tests showed significant differences between some species. Mean ratios ranged from 18.5 (*C. acronotus*) to > 40 (*M. canis*, *S. tiburo*, and *S.* cf. *mitsukuri*), and all were the range of previous studies. Although we have been unable thus far to obtain additional samples from *Hexanchus vitulus*, these preliminary results suggest that galeomorph and squalomorph deep-sea and nearshore sharks operate by the long held osmoregulatory paradigm, and that our initial observation may be species or genus-specific.

Synergistic effects of parasitism and copper on snail mortality

James Alfieri, Georgia Southern University*

Copper is highly toxic to gastropods, and is prevalent in estuarine ecosystems due to natural geologic sources, and anthropogenic sources such as terrestrial run-off and use as a marine anti-biofouling agent. Parasites represent a stressor that is often overlooked in toxicological tests. Parasites and metal contaminants can have synergistic or antagonistic effects on organisms, yet the interactions of the two remain unclear in estuarine ecosystems. To determine whether the combination of parasites and copper has an effect on estuarine snail mortality, we performed bioassays on parasitized and unparasitized individuals. We collected hydrobiid snails, *Spurwinkia salsa*, during low tide in October 2015 (Skidaway Island). 96-hour copper sulfate static acute toxicity tests were performed using mortality as an endpoint. Individual snails were placed in separate petri dishes of different concentrations. We used six concentrations in a geometric arrangement (0 mg L^{-1}, 0.1 mg L^{-1}, 0.2 mg L^{-1}, 0.4 mg L^{-1}, 0.8 mg L^{-1}, and 1.6 mg L^{-1}). Ten trials were performed (n=600). We found a 38% prevalence of trematode parasites. Parasitized individuals had greater mortality at lower concentrations ($p<0.05$). Parasitized individuals also showed a reduced survival time ($p<0.05$). This study suggests that copper interacts with the effects of the parasite, ultimately resulting in a synergistic effect on the mortality of the host. Further, these data suggest how anthropogenic disturbance can interact with natural stressors to affect population dynamics within estuarine ecosystems.

Nutrient and phytoplankton dynamics in Winyah Bay, SC.

*George Boneilo, Brittany M. Adam**, Carrigen R. Manns**, Kaela I. Moon**, Rickey A. Wood**, Ciara R. Wright**, Kristina M. Woodford**, Stephanie L. Brown**, Savannah S. Brooks**, Coastal Carolina University*

Winyah Bay is a coastal plain estuary located in South Carolina that has been classified for a moderate risk of Eutrophication by NOAA. Winyah Bay receives freshwater input from four rivers, the Waccamaw, Sampit, Black, and Pee Dee Rivers. The Waccamaw, Sampit and Black River are blackwater systems that discharge elevated amounts of colored dissolved organic matter. During the summer and fall of 2015 and the winter of 2016, bioassay experiments were performed to simultaneously examine both light and nutrient (nitrogen & phosphate) limitation throughout Winyah Bay. Sampling stations near the mouth of the Waccamaw and Sampit Rivers showed that phytoplankton were light limited in the late summer instead of nutrient limited. These stations were located in the industrialized area of the bay and typically had the highest nutrient concentrations and highest turbidity, with Secchi depths typically less than 0.5 meters. Results indicated that phytoplankton may be nitrogen limited near the mouth of Winyah Bay,

where nutrient concentrations and turbidity were observed to be lower than locations further upstream. There was also an observed dissolved oxygen and pH gradient during the summer of 2015. Dissolved oxygen levels less than 4.0 mg/L were routinely observed near the industrialized head of the estuary and corresponded with lower pH values.

Variability is not the villain: A K-12 activity

Brigette Adair Brinton, Savannah State University, Armstrong State University; Mary Carla Curran, Savannah State University

Everyone needs strong observational skills to solve challenging problems and make informed decisions. However, many students expect to find exact answers to their questions by using the internet and do not understand the role of uncertainty, especially in decision making and scientific research. Humans and other animals choose among many options by using information about their environment. During this activity, students use their observational skills to analyze data from images of grass shrimp and a highly variable salt-marsh habitat as case studies for prioritizing different pieces of information. They gain an increased appreciation of natural variability and learn to build a consensus in a scenario that has no correct answer.

Trematode metacercariae prevalence and intensity in *Uca minax*, *U. pugilator*, and *U. pugnax*, at Waties Island, SC.

Tyler P. Brun, Coastal Carolina University*

Trematode metacercariae are present in the three fiddler crab species located at Waties Island, SC. The three species observed were sand (*Uca pugilator*, n=92), mud (*U. pugnax*, n=71), and red-jointed (*U. minax*, n=51). Fiddler crabs act as a second intermediate host to this parasite, which has an effect on larger predators in the ecosystem. Crabs were collected by hand and examined for metacercariae prevalence in their soft tissues using dissecting microscopy. Metacercariae intensity in the gills, hepatopancreas, and muscle tissues was recorded for each species, along with carapace width and sex. Data were analyzed to discover any patterns in infection rates among species. There was a significant difference of infection ($p < 0.05$) among species, as well as a significant correlation relating to size; however, there was no significant difference between infection rates by sex and soft tissue location.

The effects of sediment compaction on ghost crab burrowing behavior

*Brooke Campbell**, Eric Rosch, Coastal Carolina University*

Human disturbance on modern beaches has increased dramatically in the last few decades due to an increasing population and associated coastal development. The impact of these intrusions upon the natural beach habitat can be effectively assessed by studying the organisms that live there, especially the Ghost Crab, *Ocypode quadrata*. The goal of the current study is to determine how much of an impact human disturbance has on the ghost crab population of Horry County, SC by comparing burrow abundance, depth, and diameter data with sand compaction levels among three locations. The three locations used in this experiment were downtown Myrtle Beach, Myrtle Beach State Park (MBSP) and Waties Island, with high, medium, and low levels of human disturbance, respectively. Significant differences in burrow depth, sand compaction, and burrow diameter were found among the sites, with the least impacted site having the higher values in all three categories. Correlations between compaction and burrow characteristics further elucidated the relationship between human activities, which often greatly disturb the sediment, and the influence on the animals that make their home on the beach.

Evaluation of variables effecting foraging success rates in Eastern Brown Pelicans (*Pelecanus occidentalis carolinensis*) on the South Carolina coast

*Juliane Caughron**, Abbey Chaney**, Coastal Carolina University*

Eastern brown pelicans (*Pelecanus occidentalis carolinensis*) are the only species of pelican that perform an aerial plunge as its primary mode of food capture. *P. occidentalis* feed on numerous species of bait fish that travel through the shallow waters adjacent to beaches. Many factors can influence the probability of a successful foraging attempt, such as approach height and distance from shore. The aim of the current study was to ascertain the ideal conditions for a foraging attempt. Data collection took place at Waties Island, SC and Huntington Beach State Park, SC during the spring and fall of 2015. Variables of importance were concluded to be age class, approximate distance from shore, approach height of dive, and occurrence of an obvious foraging event by other species. A binomial logistic regression analysis

was used to predict success rates under different conditions. Overall, dive attempts were successful 30.64% of the time, and optimal conditions consisted of an adult pelican attempting a dive during a high tide foraging event, beyond the breakers from 4.6 m or above. There were 12 different combinations of measured conditions and the vast majority of foraging attempts (77%) consisted of 4 separate combinations. These results may be extremely useful in determining if the optimal characteristics described in this study correspond to *P. occidentalis* exclusively or to all species with a similar method of prey capture.

Predation on mud snail (*Ilyanassa obsoleta*) egg capsules and veligers by invertebrates inhabiting the invasive alga *Gracilaria vermiculophylla*

*Travis Draud**, Evan Ashe**, Michele Guidone, Armstrong State University*

The invasive alga *Gracilaria vermiculophylla* is found along the eastern coast of North America. The co-occurring mud snail, *Ilyanassa obsoleta*, has been observed to lay egg capsules on this alga. Currently it is unknown whether mud snails experience increased reproductive success due to this novel egg laying substrate or if egg capsules or emerging veligers are consumed by predators that inhabit the algae. The purpose of this study was to quantify the consumption of egg capsules and veligers by these potential predators. In the field, ten *G. vermiculophylla* thalli and ten 16 cm^2 screens with a known number of attached egg capsules were deployed at a site invaded by *G. vermiculophylla*. After one week, substrates were retrieved and the number of remaining egg capsules determined. In the laboratory, replicate mesocosms with either egg capsules on *G. vermiculophylla* or veligers were exposed to one of two potential predators: grass shrimp (*Palaemonetes pugio*) or amphipods (*Gammarus mucronatus*). In both experiments, control jars without predators were used to monitor natural mortality rates. For all experiments, matched pairs t-tests were used to compare the start and ending number of veligers or egg capsules. Our laboratory results demonstrated that both grass shrimp and amphipods consume veligers, however neither consumed egg capsules. Field experiments suggest that egg capsule predators are present within the mudflat, however the identity of these predators is currently unknown.

Northeast Florida oyster condition assessment

Kaitlyn Dietz, Shannon Dunnigan, Northeast Florida Aquatic Preserves; Matthew Monroe, Guana Tolomato Matanzas National Estuarine Research Reserve; Andrea Noel, Northeast Florida Aquatic Preserves; Nikki Dix, Guana Tolomato Matanzas National Estuarine Research Reserve

Oysters are a prominent feature of estuaries in northeast Florida and they provide numerous ecological and economic benefits. Besides their importance as recreational and commercial fisheries, oysters provide ecosystem services including water filtration, sediment creation, habitat formation, and shoreline protection. Oyster reefs also influence estuarine hydrodynamics, plankton structure and productivity, and water quality. The prevalence of oysters in northeast Florida suggests that they have even more ecosystem influence than has been documented in other systems. Unfortunately, information on the status and trends of local oysters is scarce and we do not understand the current condition (and value) of our oyster resources. Therefore, the GTM Research Reserve (GTM) and Northeast Florida Aquatic Preserves (NEAP) is assessing oyster population condition throughout northeast Florida. Through two sampling periods, summer 2015 and winter 2015-16, oyster population structure metrics were collected on 21 and 50 reefs, respectively, throughout Nassau, Duval, St. Johns, and Flagler counties. Summer sampling preliminary analysis indicates the majority of the oyster reefs percent cover is dead oyster shell and a higher percent cover of live oysters within the more southern reefs sampled. Analysis also indicates there is no regional difference of white barnacle, porcelain crab, or black ribbed mussel density on reefs sampled. However, there is a higher density of gastropods on the most southern reef sampled than any other reefs. This Oyster Condition Assessment project is building upon the current and past research efforts of the GTM Research Reserve and complements oyster mapping efforts conducted by the St. Johns River Water Management District and the University of Central Florida to protect the water quality and restore oysters. The combined information and efforts will support a development of a baseline condition of the northeast Florida oyster reefs and continued/ future monitoring efforts for this keystone species.

Hydrological assessments of tidal creeks to inform nutrient management recommendations

Kathryn Ellis, Timothy Callahan, College of Charleston; Dianne Greenfield, University of South Carolina, South Carolina Department of Natural Resources; Joshua Robinson, Robinson Design Engineers*

The purpose of this study is to provide regulatory agencies with information about the hydrology of tidal creeks by developing mathematical relationships between time, stage, and discharge. Currently, there are no stage-discharge or time-discharge relationships for these creeks, or many other similar creeks in the South Carolina Coastal Plain, so this information will fill an existing gap. The results will be used to evaluate biological responses (e.g., algal blooms) in coastal waters to identify linkages to flow and nutrient (nitrogen and phosphorus) dynamics in the waters; in other words, can nutrient delivery rate (mass flux) predict biological responses in coastal wetlands? There are four study sites: two in the Ashepoo-Combahee-Edisto (ACE) Basin and two in the Charleston Harbor system. Opportunistic sampling, with the goal to encompass as large a range of measurements as possible, is occurring over a two year period (2015-2016) to measure volumetric discharge in each creek with an acoustic Doppler current profiler (ADCP) unit. Additionally, the discharge data, combined with information from a related effort to collect nutrient and phytoplankton data, will be used to calculate presumptive Total Maximum Daily Load (TMDL) estimates for these sites. A runoff model will be used to estimate the potential water entering the creeks from the land surface; this quantity will be compared to the total volume of water that enters or exits the creeks (the tidal prism) to better understand how runoff may affect the environmental health and algal ecology in these creeks.

Ecotoxicological assessment of the effects of crude oil and oil spill dispersants on the heepshead minnow, *Cyprinodon variegatus*

Michelle Franco, University of Charleston; Marie DeLorenzo, NOAA National Ocean Service*

The use of chemical dispersants as an oil spill response method has long been a topic of controversy. During the Deepwater Horizon Oil Spill of 2010, millions of gallons of chemical dispersants were applied, and many of the potential toxicological effects on wildlife remain unknown. This project will analyze the effects of two chemical dispersants (Corexit 9500 and Finasol OSR 52), and mixtures of oil and chemical dispersants on a common estuarine teleost fish, the sheepshead minnow, *Cyprinodon variegatus*. Embryonic and juvenile life stages of *C. variegatus* will be tested in aqueous laboratory exposures. The endpoints assessed will include mortality, embryonic development, cellular enzyme activity, and immunological response. Acute median lethal toxicity values will be determined for each dispersant individually and in mixture with oil, with embryonic and adult life stages of *C. variegatus*. We expect lethal and sublethal toxicity to be greatest in the chemically dispersed oil treatment. The goal of this study is to fill a data gap in current understanding of the toxicity of oil and chemical dispersants to important estuarine species, and benefit future environmental management decisions.

Assessing the effects of the mud snail, *Ilyanassa obsoleta*, on the benthic microalgal community in a pristine saltmarsh

Miranda Gore, James L. Pinckney, University of South Carolina*

Saltmarshes are among the most productive ecosystems globally; at North Inlet, South Carolina, about one third of the primary production comes from benthic microalgae. During the tidal cycle, the mobile microalgae vertically migrate through the upper 3mm of sediment. At low tide the algae are vulnerable to a variety of grazers, including the mud snail, *Ilyanassa obsoleta*, which is abundant in the tidal creeks. Many species of intertidal snails have been shown to significantly affect the community structure and density of microalgae within the sediment. This study found that *I. obsoleta* can cause a significant decrease in the concentration of total chlorophyll a when grazing an area with low snail density, but not in areas with high snail density. In the laboratory, snails were introduced to petri dishes with both grazed and ungrazed sediments. The *I. obsoleta* spent more time on sediment that had been previously grazed by its conspecifics. When snail cues were introduced to both sides of the dish, snails showed no clear preference for location, indicating that *I. obsoleta* likely uses chemical cues to locate conspecifics and congregate towards them, despite the competition for food.

Reproductive biology of the diamondback terrapin (*Malaclemys terrapin*) in the Charleston Harbor system, South Carolina, USA

Andrew M. Grosse, Erin M. Levesque, Steve A. Arnott, South Carolina Department of Natural Resources

Documenting spatial differences in natural history and reproductive biology of organisms with large home ranges is important in determining minute differences resulting from changes in habitat, temperatures or latitude. Collecting periodic data in one location is equally as important to document temporal changes. The diamondback terrapin exclusively inhabits brackish tidal zones and has a home range that extends from Massachusetts along the eastern and Gulf of Mexico U.S. coasts to Texas. In the Charleston Harbor, SC, diamondback terrapins populations have been monitored periodically since the 1980's and have shown a downward trend in numbers captured since 1995. While natural and anthropogenic threats are well documented (Vehicular mortality, habitat loss and degradation, drowning in crab traps, predation from native and non-native species; Wood 1997, Wood and Herlands 1997, Roosenburg et al. 1997, Feinberg and Burke 2003, Draud et al. 2004, Dorcas et al. 2007, Grosse et al. 2011), temporal comparisons of the reproductive biology for diamondback terrapins have not yet been done. As part of a study to identify the viability of responsible stock enhancement of diamondback terrapins as a valuable management tool for sustaining and recovering terrapin populations we documented reproductive biology parameters and made comparisons to previous studies done in the Charleston Harbor system, SC.

Longterm acoustic monitoring of the May River soundscape – baseline Information on the patterns of fish spawning

Agnieszka Monczak, Michaela Miller*, Hannah Nylander*, Eric Montie, University of South Carolina at Beaufort*

The goal of this study was to determine baseline patterns of fish sound production in the May River, South Carolina as a means to understand spawning patterns of a community of sciaenids and batrachoidids. The specific objectives were to: i) determine the diversity of sound-producing fish detected in the May River; ii) define the exact seasonal and daily patterns of sound production; and ii) understand how temperature, salinity, and tidal cycles affect calling patterns. Acoustic recorders (i.e., DSG-Oceans) were deployed at four stations from the source to the mouth of the May River from February to November 2013. The DSG-Oceans were set to record underwater sound for 2 minutes with an interval of 18 minutes. Calling of oyster toadfish, weakfish, Atlantic croaker, black drum, silver perch, spotted seatrout and red drum were detected in the May River. Acoustic detection rates and diversity of soniferous were higher near the mouth and decreased towards the source, suggesting a selection of deeper water for spawning. Each species followed a specific seasonal pattern of calling. Within a reproductive season, abrupt drops in temperature decreased calling, while abrupt rises in temperature increased sound production for silver perch and spotted seatrout. Daily patterns of sound production were observed for all sciaenids with peak calling occurring at dusk. In all sciaenids, evening chorus duration followed a cyclic pattern and was correlated with the lunar cycle. Future directions will focus on understanding how climate change may shift the timing of courtship sounds and seasonal reproduction.

Boat noise and acoustic communication of fishes: a risk assessment in the May River, South Carolina

Micaela E. Miller, Agnieszka Monczak*, Hannah Nylander*, Eric Montie, University of South Carolina at Beaufort*

Over the last century, anthropogenic noise in our coastal waters has increased dramatically, which may interfere with fish acoustic communication and reproduction. The overall goal of this study was to investigate the risk of boat noise on the acoustic communication of fish inhabiting the May River, SC. Our specific objectives were to: (i) examine the precise overlap of boat noises and fish frequency spectrums; (ii) investigate the temporal and spatial overlap of fish sounds and boat noise in the May River; and (iii) determine if boat noise interrupts fish chorusing. Acoustic recorders (i.e., DSG-Oceans) were deployed at three stations (i.e., 9M, 14M, and 37M) from the source to the mouth of the May River from February to November 2013. DSG-Oceans were set to record underwater sound for 2 minutes with an interval of 18 minutes. Boat noises overlapped with the frequency range of calling of silver perch, black drum, oyster toadfish, spotted seatrout, and red drum. As expected, boat noise was most prevalent during the spring and summer months when fish calling was the most active, suggesting an increased risk of acoustic interference during the spring and summer spawning seasons. Spatially, boat noise was significantly more frequent at station 37M, which was near the Intracoastal Waterway. In addition, fish chorusing at

station 37M was more likely to be interrupted by boat noise than at stations 9M and 14M. This study demonstrates the potential risk of recreational boat traffic on acoustic communication and reproduction of economically and ecologically important fish species.

The enumeration and identification of *Vibrio* in water and oyster tissue within Sisters Creek, FL

Shelby O'Brien, Anthony Ouellette, Jacksonville University*

V. parahaemolyticus and *V. vulnificus* have been known to cause severe infections through the consumption of raw or undercooked oysters in North America and are known to be the leading cause of seafood-borne illness and death. This study seeks to enumerate and identify Vibrio that exist in oyster tissue and the surrounding waters in the closed Duval County Shellfish Harvesting area using matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS). Other goals include determining if environmental conditions affect Vibrio abundance and diversity. Preliminary results from Sisters Creek indicate that total bacteria concentrations in water samples were 9,200 MPN/mL at Site 1 and 23,000 MPN/mL at Site 2, whereas, oyster samples exhibited a higher concentration of total bacteria with Site 1 having a concentration of 290,000 MPN/g and Site 2 oysters having a concentration of >1,100,000 MPN/g. MPN tubes were streaked onto TCBS and a subset of isolates were identified using MALDI-TOF MS. Isolates have been identified as *V. parahaemolyticus* and *V. alginolyticus* with identification percentages at or above 99%. Research is ongoing to identify more isolates and to determine if temperature and salinity have an effect on concentrations and diversity.

Nesting behavior patterns of *Caretta caretta* in the South Atlantic Bight

*Rebecca O. Persons**, Khrysten E. Raymer**, Jennah W. Rains**, Stephen A. Borgianini, University of South Carolina at Beaufort*

Sea turtle conservation and monitoring programs along the east coast of the United States have provided large amounts of nesting pattern data over several years. In this study we examined nesting activities of *Caretta caretta* including the variables such as nests/year, date of emergence, clutch count, relocation status, incubation time, and emergence success. Recently work by University of Georgia researchers allowed us to identify specific mothers and their nests through genetic authentication. Qualitative and quantitative differences in sea turtle nesting patterns over six to fifteen-year periods were examined. Data were analyzed from Hilton Head Island, and Kiawah Islands in South Carolina; Cumberland, Blackbeard, Jekyll, St. Catherine's and Wassaw Islands in Georgia. The scientific literature reports *Caretta caretta* nesting activity follows a three year pattern resulting in higher numbers of nests for two years and reduced number of nests in year three. Our analysis of Hilton Head Island nesting patterns over 16 years (2000-2015) shows a definitive inter-annual trend in nesting behavior; oscillating between high and low nest density on a multi-year cycle. Relocated nests have a greater survivorship than in situ nests indicating that conservation efforts provide higher emergence success. We observed differences in hatchling emergence between in situ versus relocated nests. Hatchling emergence success correlates with clutch size; however hatchlings from relocated nests exhibit greater emergence success than in situ hatchlings. Considerable variation was observed in nesting behavior across all islands. Locations where development and beachfront engineering is common had lower nest density per mile.

Exposing *Artemia salina* to *Chattonella subsalsa*, a toxicity test

*Nicholas Picha**, Amy Grogan, Eric Koepfler, Coastal Carolina University*

The raphidophyte, *Chattonella subsalsa*, has been reported to cause harmful algal blooms in every major ocean. In South Carolina, *C. subsalsa* blooms have been observed in brackish storm water detention ponds as well as estuarine waters neighboring urbanized areas. Blooms frequently cause fish kills although the fish kill mechanism of *C. subsalsa* is currently unknown. In many harmful species, the lethality of algal cells is thought to correspond with algal growth phase. Algal growth is known to progress through five distinct phases; lag, early exponential, late exponential, stationary, and decline. In nature, harmful algal blooms commonly occur in the late exponential or stationary growth phases, however in vitro studies of *Chattonella* have identified the early exponential phase as most lethal. The strain of *C. subsalsa* used for this study was found to progress through the five growth phases in a period of twenty days. To examine the lethality of *C. subsalsa* at various growth phases, the zooplankton species *Artemia salina*, was exposed to *C. subsalsa* culture at two day intervals for twenty days. Deaths fluctuated among the growth phases of *C. subsalsa*. The highest mortalities were observed in the late exponential and stationary phases. The late exponential and stationary growth phases were found to

have significantly greater percent mortalities than both the lag phase and control groups (Kruskal-Wallis rank sum test, p=0.05).

A study on ghost crab burrowing behavior vs. lunar stage

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Earth's moon has captivated mankind for thousands of years. Both humans and other organisms have depended on it for migration, navigation, and other cyclic events. In the marine environment, lunar cycle can have a pronounced effect on the behavior of animals. The effects of lunar stage on the burrowing behavior of the Atlantic Ghost Crab (*Ocypode quadrata*) where examined from March 1st to October 1st 2015 at Waites Island, a small barrier island at the northeast end of South Carolina. Of particular interest where the effects on burrow depth and diameter while also taking into account sand compaction. It was determined that both depth and diameter where significantly different at various lunar stages. Of these, a half-moon represented the deepest burrows whereas a full moon demonstrated the shallowest. In terms of burrow diameter, the widest burrows where found when the moon was at a quarter full stage, and where most narrow at the full moon stage. Provided with this baseline of study, future experiments that wish to replicate this data should maintain similar sample sizes in order to represent the data with more validity. Due to a narrow time frame sample sizes for each lunar stages varied significantly for this experiment.

An integrated system for high-resolution multiparameter water quality surveys in estuaries

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Spatially continuous water quality sampling has many advantages. Relative to discrete sampling it is easier to identify hotspots of biogeochemical activity and fronts where properties change rapidly. Dimensions of patches can be identified more precisely. We have assembled an integrated system for measuring along-estuary temperature, salinity, turbidity, chlorophyll fluorescence and oxygen concentrations at ~5-10m horizontal resolution. Inclusion of a scanning absorbance spectrometer in the package allows for more sophisticated assessment of dissolved organic properties of the river water. The system measures surface concentrations while underway, but its modular design allows the entire package to be lowered in profiling mode when the survey vessel is stopped. The system is presently being applied to surveys of the Ogeechee River, GA, where it is being used to map properties from the mouth of the estuary to the freshwater endmember during repeat seasonal transects.

Top-down and bottom-up controls of phytoplankton assemblages in two South Carolina estuaries

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Accelerated human population growth and urbanization along the South Carolina (SC) coast has resulted in nitrogen (N) and phosphorus (P) loading to receiving aquatic systems. Prior research suggests that phytoplankton biomass and numbers of harmful algal bloom (HAB) species increase in response to N, particularly urea and in developed and developing waterways. However, the extent that phytoplankton responses vary in tidal creeks within a single estuary remains unclear. This study assesses phytoplankton assemblage responses to N-form (nitrate, ammonium, urea) between two estuaries: the urbanized Charleston Harbor and the relatively less-developed Ashepoo-Combahee-Edisto (ACE) Basin. Two tidal creek sites per estuary were selected, such that one is located within a river system characterized by comparatively more development and the second is in a relatively less impacted river system. In addition to bottom-up processes, there is a fundamental lack of understanding about the importance of top-down (e.g. grazing) regulation of SC phytoplankton productivity and biomass; therefore, this study also analyzes zooplankton (micro- and mesozooplankton) populations and their potential effects on phytoplankton assemblages. Water quality, nutrients, phytoplankton (biomass, as pigment and biovolume, and community composition), and zooplankton (taxonomic classification and abundances) from in situ nutrient addition bioassays are being measured during the spring and summer over two years (2015-2016). Presented here are the preliminary findings from 2015. Results will be coupled with streamflow analyses to address how nutrient delivery (rate and volume) affects coastal biological responses and will aid regulatory managers in the development of estuarine nutrient standards.

Seawater addition long term experiment (SALTEx)

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Sea level rise and changes in river flows are expected to alter estuarine salinity gradients, resulting in saltwater intrusion into historically freshwater environments. Seawater Addition Long Term Experiment (SALTEx) is a field experiment designed to simulate saltwater intrusion in a tidal freshwater wetland to predict how chronic (Press) and acute (Pulse) salinization will affect this and other tidal freshwater ecosystems. Porewater chloride and sulfate concentrations increased in the Press plots within 2-3 months after treatments were initiated in April 2014. Increased sulfate reduction in response to seawater sulfate additions led to elevated porewater sulfide concentrations in the Press plots. Pulse additions of seawater in September-October of 2014 and 2015 led to transient increases in porewater chloride concentrations. In the first year of treatments, *Ludwigia* was eliminated from the Press plots and percent cover of *Polygonum*, *Pontederia*, and *Zizaniopsis* decreased. *Ludwigia* also disappeared from the Pulse plots in the first treatment year, and did not recover when pulse treatments ceased. Net ecosystem productivity and methane emissions decreased in the Press plots in 2014 and remained low in 2015, but were unaffected by the Pulse treatments in both years. Our findings indicate that chronic (Press) additions of brackish water have an immediate effect on porewater chemistry, followed by the loss of soft-stem/emergent vegetation, and result in a negative effect on ecosystem processes.

The sea floor: A living learning residential community

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Living learning communities are collaborations between university housing and academic departments designed to enhance the overall student experience by integrating classroom/laboratory learning, student life and extracurricular activities. At Coastal Carolina University, the residential community associated with the Marine Science program is known as the Sea Floor. Students selected to become members of the Sea Floor remain “in residence” for two consecutive semesters. These students are freshman that share a common course connection. This course is usually Introduction to Marine Science (MSCI 111) or MSCI 399s, which are one credit field/laboratory centered internships. The common course connection is designed so residents can establish and maintain an educational dialog with their peers. Activities designed to enhance the students’ networking skills and educational and social development skills include monthly lunches with marine science faculty and dinner seminars with guest speakers from academia, industry and government. Additionally, each semester several activities outside the classroom are planned so that students can more frequently interact with themselves and their faculty and staff partners. These activities include field trips to regional aquariums and local boat trips that include water sample collection and analysis. The resident advisor that supervises the Sea Floor is usually a sophomore or junior marine science major. This provides the residents with daily communication and mentoring from a marine science major that is familiar with the marine science program and residence life.

Collaborative research to prioritize and model the runoff volume sensitivities of tidal headwaters

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Non-point source pollution from stormwater runoff associated with large-scale land use changes threatens the integrity of ecologically and economically valuable estuarine ecosystems. Beaufort County, SC has implemented volume-based stormwater regulations and seeks to identify which of their tidal creeks and what portions of the creeks are most sensitive to stormwater runoff. Through a collaborative process with county officials and citizens, four watersheds of critical interest were instrumented with an array of 32 salinity sensors to monitor the movement of freshwater from volume “sensitive” headwaters to volume “insensitive” downstream waters. The change in salinity per unit rainfall was used as the primary metric of volume sensitivity. The Stormwater Runoff Modeling System (SWARM) was used to estimate the expected runoff and to project impacts of climate change and engineered stormwater retrofits on tidal

creeks. A strong working relationship was forged with relevant intended users and resulted in the establishment of a Watershed Advisory Committee that helped drive data collection, analysis, synthesis, and translation. Strong correlations between rainfall and salinity drop helped define which areas were most volume sensitive, and where retrofits may be most beneficial, and this information will permit Beaufort County to focus limited resources where they can be most effective.

Differences in habitat utilization and temperature preferences of male and female Atlantic Stingrays *Dasyatis sabina* in the Herb River near Savannah, Georgia

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Atlantic Stingrays *Dasyatis sabina* are ecosystem engineers and opportunistic benthic predators found in coastal and estuarine waters from New England to the Gulf of Mexico. They can tolerate wide ranges in salinity and temperature and are year-round residents of the Herb River near Savannah, Georgia. The purpose of this study was to determine differences in habitat utilization and temperature preferences of male and female Atlantic Stingrays. Twenty-two stingrays were caught from April-June 2015 via longline and surgically implanted with Vemco acoustic transmitters. Data were downloaded monthly from 10 acoustic receivers placed in varying stream orders within the creek system, with 1st order creeks being the smallest and 5th order the largest. Mean percent usage of receiver location ± 1 SD was calculated and then mapped using ArcMap. The major finding of this study was that female and male stingrays utilized 3rd order streams significantly more (32.35±12.12% of d and 14.67±10.59% of d, respectively) than any other stream order. There was no significant difference between the average temperature of females (27.88±3.36°C) and males (27.72±2.95°C) across all months or within individual months. Temperature differences were reported in other studies, but only when females were pregnant, which we were unable to assess. The frequent use of 3rd order streams by both sexes may be because these creeks retain water throughout all tidal stages while possibly providing more protection from predators than deeper creeks.

Fish assemblages in Brusen Creek on St. Catherine's Island, GA

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St. Catherine's Island, in Liberty County, is one of Georgia's uninhabited barrier islands. Due to its location approximately seven miles from the mainland and eighteen miles from the Altamaha River, the surrounding estuary has seen negligible anthropogenic impacts throughout its history. Specifically, Brunsen Creek, on its southern end, is considered to contain a pristine marine ecosystem. This study was initiated to provide baseline data for the surrounding Georgia estuarine ecosystems, many of which have had human impacts. Ichthyofaunal data was collected monthly within Brunsen Creek via trawling from September 2014 through August 2015, and will continue for the immediate future. At this time, statistical relationships between fish assemblages and environmental factors, such as temperature and salinity, cannot be established. However, observed consistent relationships in natural migration and reproduction that have also been noted in other studies. Temporal trends in the appearance of fishes in Brunsen Creek samples, and their increasing lengths, reflect a well-established natural pattern along Georgia's coast. Tracking these trends will provide a baseline of expected life history events for several species and a reference for further research within southeastern estuaries.

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