Southeastern Estuarine Research Society

Semi-annual Meeting

March 16th – 18th, 2011

University of Georgia Odum School of Ecology

Athens, GA

PROGRAM & ABSTRACTS

SEERS

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

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

A special thanks to:

YSI
Georgia Sea Grant
South Carolina Sea Grant Consortium
University of Georgia Odum School of Ecology
University of Georgia Department of Marine Sciences
University of Georgia Warnell School of Forestry and Natural Resources &
Joe DeVivo, National Park Service

Our Local Hosts:

Joan Sheldon
Merryl Alber

Chair of Student Promotions Committee (Travel Awards):

Elizabeth Brinker

Session Chairs
Anonymous Judges

SEERS Congratulates our Student Travel Award Winner!
Loren Mathews, University of Florida

Please be sure to check out the SEERS merchandise with the new logo designed by Sylvia Schaefer of the University of Georgia.
Sales help to support student travel awards.

YSI is a developer and manufacturer of sensors, instruments, software, and data collection platforms for environmental water quality and water quantity monitoring and testing. Reaching beyond our products, we build relationships with our customers through our dedicated customer service, including technical applications and service support. We work with professionals to develop water monitoring solutions for our planet's natural resources. Our instruments, software, and data collection platforms are focused on environmental monitoring and testing. The integrated systems we deliver to our customers help them to obtain critical data about the quality of water.

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Georgia Sea Grant envisions a Georgia coast **where healthy ecosystems** and **natural resources** maximize the resilience and economic vitality of communities.

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- Help create a robust state seafood industry
- Assist developers in adopting sustainable building practices

Odum School of Ecology
The University of Georgia

The University of Georgia
WARNELL
SCHOOL OF FORESTRY & NATURAL RESOURCES

Department of
Marine Sciences
University of Georgia Athens, Georgia 30602 USA

Sea Grant
S.C. Sea Grant Consortium

PROGRAM

Welcome to the Spring 2011 meeting of the Southeastern Estuarine Research Society (SEERS) in Athens, Georgia at the Odum School of Ecology of the University of Georgia. The meeting will commence with registration and the poster social on Wednesday evening from 5:30 – 7:30 p.m. On Thursday, there will be oral presentations in the morning and afternoon, with additional time to view posters at lunch time. The SEERS business meeting will be at the end of the oral sessions on Thursday. Friday morning, the meeting will begin with research presentations in the morning, followed by a Career Workshop Session and wrap up with the student presentation awards. All of these events will take place at the Odum School of Ecology on the UGA Campus. The banquet will be at Flinchum's Phoenix, Whitehall Forest on Thursday evening.

Schedule at a Glance

Wednesday, March 16

5:30 p.m.	Registration opens
6:00 - 7:30	Poster session and social

Thursday, March 17

8:30 - 9:00 a.m.	Registration and Welcome
9:00 - 10:00	Oral Presentations
10:00 - 10:20	Break
10:20 - 11:40	Oral Presentations
11:40 - 1:00 p.m.	Lunch
1:00 - 2:20	Oral Presentations
2:20 - 2:40	Break
2:40 - 4:00	Special Session
4:00 - 5:00	Business meeting
6:30 - 9:00	Banquet

Friday, March 18

8:30 - 9:00 a.m.	Registration and Welcome
9:00 - 10:20	Oral Presentations
10:20 - 10:40	Break
10:40 - 11:40	Career Workshop
11:40	Student Presentation Awards

SEERS T-shirts and stainless steel water bottles with the new SEERS logo will be available for purchase during all registration times, lunch and breaks. They make great Birthday gifts!

POSTER PRESENTATIONS

Listed Alphabetically by Primary Author, Presenting author is underlined

- **Graduate student authors (*), Undergraduate student authors (**)**

Stormwater runoff- Modeling impacts of urbanization and climate change
Anne Blair[1], Denise Sanger[2], A. Frederick Holland[1], David White[3], Lisa Vandiver[4], Susan White[1] ; [1]NOAA Hollings Marine Laboratory, [2]SC Sea Grant Consortium [3]Clemson Univ., [4]Univ. of SC

Does alginate addition enhance *Spartina alterniflora* salt marsh recovery?
*Jessica Cain**, Georgia Southern University; Risa Cohen, Georgia Southern University*

Physical factors contrasting beach sands in sea turtle nesting areas in South Carolina, USA
*Megan Farris**, Coastal Carolina University*

Georgia Coastal Research Council
Janice Flory, University of Georgia

Correcting a Lidar-Derived DEM for Error Due to Dense Wetland Vegetation
Sandra Fox, Palmer Kinser, Lawrence Keenan, Saint Johns Water Management District, and Clay Montague, William Wise, University of Florida

Can you hear me now? Recruitment facilitation by biological noise in a marine reserve
Ashlee Lillis and David Eggleston, Department of Marine, Earth & Atmospheric Sciences North Carolina State University*

Albemarle-Pamlico Watershed and Estuary Study (APWES): Ecosystem services science to support decision-making
B. Rashleigh and D. Keith, U.S. Environmental Protection Agency

The Nutrient Budgeter, a MATLAB-based program to simplify watershed nutrient budget calculations, and application to the Altamaha River
Sylvia C. Schaefer, Merryl Alber, Department of Marine Sciences, University of Georgia*

Hypoxia in an Urbanized Southeastern Coastal Embayment: Long Bay, SC
Denise Sanger[1], Eric Koepfler[3], Erik Smith[2], George Voulgaris[2], Susan Libes[3], Clay McCoy[3], Brent Lewis[3],Richard Peterson[3], Richard Viso[3], Derk Bergquist[4], Dianne Greenfield[2,4], David Whitaker[4]; [1] South Carolina Sea Grant Consortium (SCSGC), [2]University of South Carolina (USC), [3]Coastal Carolina University (CCU), [4]South Carolina Department of Natural Resources (SCDNR)

Nutrient Cycling in Marsh Impoundments of Merritt Island National Wildlife Refuge: Evaluation of management effect using Ecological Network Analysis
Cassondra Thomas, Cardno TBE

Long-term data helps ask appropriate questions – a seagrass example
Robert Virnstein, Seagrass Ecosystems Analysts

Thursday 8:45 Welcome: Denise Sanger, SEERS President & Joan Sheldon, Local Host and SEERS Treasurer

PLATFORM PRESENTATIONS

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

Thursday 9:00- 10:00 a.m. Session I: Sea – level
Moderator: Adrian Burd, University of Georgia

9:00 Effects of wind-driven sea-level variation on salt marsh dynamics and its implications for ecological succession: a modeling approach
Daehyun Kim, University of Kentucky; William E. Grant, Texas A&M University; David M. Cairns, Texas A&M University; Jesper Bartholdy, University of Copenhagen

9:20 LIDAR Digital Elevation Model Correction and Accuracy Assessment
Christine Hladik, Marine Sciences Department, University of Georgia; Merryl Alber, Marine Sciences Department, University of Georgia*

9:40 Freshwater tidal swamp communities on the Savannah River floodplain
Jamie A Duberstein, Baruch Institute of Coastal Ecology and Forest Science, Clemson University; William H Conner, Baruch Institute of Coastal Ecology and Forest Science, Clemson University*

BREAK 10:00-10:20

Thursday 10:20- 11:40 a.m. Session II: Phytoplankton
Moderator: Michael Mallin, University of North Carolina Wilmington Center for Marine Science

10:20 River Discharge Influences Phytoplankton Abundance and species composition in the Altamaha River Estuary, Georgia
West, M.B.,Georgia Southern University, Harrison, J.S.,Georgia Southern University, Cohen, R.A. Georgia Southern University*

10:40 Seasonal changes in picophytoplankton community structure in the Altamaha River estuary and neighboring sounds.
*Elizabeth Mann, Skidaway Institute of Oceanography; Travis Alstad, Skidaway Institute of Oceanography; Karin Biller**, Hochschule Mannheim-University of Applied Sciences; Ashley Greenleaf**, Duke University*

11:00 Temporal variability in phytoplankton biomass and implications for a well-flushed subtropical lagoon in northeast Florida
Nikki Dix, University of Florida; Ed Phlips, University of Florida*

11:20 Modeling primary productivity in a subtropical estuary
A. Loren Mathews, University of Florida; Edward J. Phlips, University of Florida*

LUNCH AND POSTER PERUSAL 11:40 a.m. – 1:00 p.m.

Thursday 1:00- 2:20 p.m. Session III: Ecosystem impacts and interactions
Moderator: Clay Montague, University of Florida

1:00 Metapopulation dynamics guides oyster restoration in North Carolina
David B. Eggleston and Brandon Puckett, North Carolina State University Department of MEAS and Center for Marine Sciences & Technology Morehead City, NC

1:20 The effect of horses on Cumberland Island salt marsh fauna
Caroline McFarlin, Dept. of Marine Sciences, UGA; Merryl Alber, Dept. of Marine Sciences, UGA*

1:40 Pollutant removal efficacy of a constructed wetland in a tidal creek watershed
Michael A. Mallin, Janie A. McAuliffe, Matthew R. McIver, Yosef Shirazi*, Center for Marine Science, University of North Carolina Wilmington*

2:00 Accumulation of enteric pathogens in the eastern oyster, *Crassostrea virginica*
Crews, M.K., and Lipp, E.K. Environmental Health Science, University of Georgia*

BREAK 2:20-2:40

Thursday 2:40-4:00 Special Panel Discussion:
National Ocean Policy and Regional Approaches
Moderator: Denise Sanger, SC Sea Grant Consortium
Panelists
Geno Olmi, Coordinator, NOAA Southeast and Caribbean Regional Team: **NOAA in the Southeast and Caribbean Region**
Chuck Hopkinson/David Bryant, Georgia Sea Grant. **Southern Sea Grant Programs**
Merryl Alber, University of Georgia. **South Atlantic Regional Research Priorities Plan**

Thursday 4:00-5:00 SEERS Business Meeting

Thursday 6:30-9:00 p.m. Banquet at Flinchum's Phoenix, Whitehall Forest
Directions will be provided.

Friday 8:45 Welcome

Friday 9:00-10:20 Session V: Ecosystem services & Ichthyofauna
Moderator: David Eggleston, North Carolina State University

9:00 Improving land use decisions on the Georgia Coast: an introduction to valuation of ecosystem services
JP Schmidt, Post-doctoral Associate Marine Sciences University of Georgia

9:20 Productivity of functional guilds of fishes in managed wetlands in coastal South Carolina
K.F. Robinson, Georgia Cooperative Fish and Wildlife Research Unit, University of Georgia; C.A. Jennings, Georgia Cooperative Fish and Wildlife Research Unit, United States Geological Survey*

9:40 Reproductive status and population demographics of the tripletail, *Lobotes surinamensis*, aggregation near Jekyll Island, Georgia
Russell Parr[1], Spud Woodward[2], Cecil Jennings[1,3], Robert Bringolf[1]*
[1]Warnell School of Forestry and Natural Resources, University of Georgia
[2]Coastal Resources Division, Georgia Department of Natural Resources
[3]USGS, Georgia Cooperative Fishery and Wildlife Research Unit

10:00 Recruitment trends of Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*, in the Altamaha River, Georgia: Are we on the road to recovery?
Michael S. Bednarski, University of Georgia; Douglas L. Peterson, University of Georgia*

BREAK 10:20-10:40

Friday 10:40-11:40 Session VI: Career Workshop

STUDENT PRESENTATON AWARDS 11:40

ABSTRACTS

Recruitment trends of Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*, in the Altamaha River, Georgia: Are we on the road to recovery?

Michael S. Bednarski, University of Georgia; Douglas L. Peterson, University of Georgia*

Historically, Atlantic sturgeon once supported a lucrative commercial fishery throughout the eastern coastline of North America, however, decades of overharvest and habitat alteration have decimated most populations. In response, the Atlantic States Marine Fisheries Commission closed this fishery in 1998, and today, this species is being considered for listing under the Endangered Species Act. Unfortunately, the effects of the fishery closure are unclear because of a lack of quantified data on current abundance and recent population trends. Recent studies have shown, however, that mark-recapture estimates of age-1 cohorts may provide a quantified measure of recruitment that can forecast long-term population trends. The objectives of this study were 1) to assess recruitment of age-1 Atlantic sturgeon in the Altamaha River and 2) to determine the influence of different environmental factors on year class strength of Atlantic sturgeon. From 2004-2010, we conducted mark -recapture estimation of age-1 Atlantic sturgeon cohorts within the Altamaha River using the Huggins closed-capture model in Program Mark. Over the seven years of the study, age-1 population estimates varied from 433-6225 individuals. Age-1 population estimates were then compared to different environmental variables to assess their influences on annual recruitment. Our results suggest that the primary factor influencing recruitment of Atlantic sturgeon is the length of time following the fishery closure. These findings provide the first quantified evidence that the 1998 fishery moratorium has aided in the recovery of the species. Similar efforts are needed to evaluate population trends and key recruitment variables in other parts of the range.

Does alginate addition enhance *Spartina alterniflora* salt marsh recovery?

*Jessica Cain**, Georgia Southern University; Risa Cohen, Georgia Southern University.*

Widespread losses of salt marsh underscore the importance of developing new restoration techniques. The polysaccharide alginate increases *Spartina alterniflora* over successive growing seasons without repeat addition, making alginate addition a possible alternative to nitrogen fertilizers. We hypothesized that amending the marsh sediments with alginate would increase transplant success, through greater plant growth and survival, and increased colonization of common epifauna. In May 2010, mature *S. alterniflora* plants were transplanted from intact high marsh to an adjacent bare area formed by wrack deposition at Skidaway Island, Georgia. Twenty permanent plots were established and randomly assigned to two treatments; transplants with or without alginate amendment. The responses to alginate addition were assessed over one growing season by measuring *S. alterniflora* stem height and density, along with densities of three common macroinvertebrates (*Uca sp., Littoraria irrorata, Guekensia demissa*). Stem densities and heights, respectively, increased until October and September and then began to decrease in November in both treatments. Additionally, there was an early trend towards faster growth in both stem densities and heights in the alginate treatment. *Uca sp*. densities increased faster in the alginate treatment relative to the transplant control through 10 weeks post- addition, potentially due to stimulation of feeding. Densities of *L. irrorata* were elevated through 14 weeks post-addition while *G. demissa* densities were consistently lower in the experimental treatment. The initial trend towards rapid plant growth and increased densities of some epifauna indicates that alginate amendments may be useful in accelerating salt marsh restoration, and warrant further investigation.

Accumulation of enteric pathogens in the eastern oyster, *Crassostrea virginica*

Crews, M.K., and Lipp, E.K. Environmental Health Science, University of Georgia*

Human sewage contamination from faulty septic systems poses a major risk to public health. Bivalves are effective sentinels of human waste inputs because of their natural ability to incorporate environmental elements into their tissues. The objective for this study was to measure the accumulation of enteric pathogens across the lifetime of the eastern oyster, *Crassostrea virginica*. *C. virginica* were recruited to artificial substrate (i.e., 'spat sticks') and sampled quarterly to measure the types and amounts contaminants at three sites in coastal Georgia. Naturally grown oysters and experimental spat were analyzed using culture based methods for enteric bacteria and real time RT-PCR for viral contaminants. The most contaminated site, affected by a dense concentration of septic systems, contained 805 MPN/g and 168 MPN/g for fecal coliform bacteria and enterococci, respectively, in spat tissue while adult oysters had only 480 MPN/g for fecal coliform bacteria and 96 MPN/g for enterococci. The intermediately contaminated site had 33 MPN/g and 5 MPN/g of fecal coliform bacteria enterococci, respectively, in spat tissue, and 4 MPN/g and 2 MPN/g for fecal coliform bacteria and enterococci, respectively, in adult tissue. The reference site had 2 MPN/g for fecal coliform bacteria and 22 MPN/g of enterococci in spat tissue while adult oysters contained no fecal coliform bacteria and 3 MPN/g of enterococci. Spat tissue at all three sites were positive for human enterovirus, but norovirus was not detected. The results indicate that enteric pathogens accumulate at an increased level in *C. virginica* spat compared to adult oysters.

Temporal variability in phytoplankton biomass and implications for a well-flushed subtropical lagoon in northeast Florida

Nikki Dix, University of Florida; Ed Phlips, University of Florida*

Phytoplankton biomass is a key structural element of estuarine ecosystems. It represents the base of the food web, affects biogeochemical cycling, and reflects water quality. The most common measure of phytoplankton biomass, chlorophyll *a*, has been successfully correlated with metrics of ecosystem function (e.g., production and metabolism). This study examined the magnitude and temporal variability of chlorophyll *a* over eight years in a subtropical lagoon, the Guana Tolomato Matanzas National Estuarine Research Reserve (GTMNERR) in northeast Florida. Selected metrics of chlorophyll *a* variability in the GTMNERR were compared to estuaries around the world and used to draw conclusions about the relative productivity and the potential drivers of productivity in the system. Overall, the GTMNERR appears to remain well-balanced despite long-term anthropogenic influences including inputs from one of the country's oldest urbanized watersheds and impacts associated with the Intracoastal Waterway. It is therefore an example of resilience to change that warrants investigation.

Freshwater tidal swamp communities on the Savannah River floodplain

Jamie A Duberstein and William H Conner, Baruch Institute of Coastal Ecology and Forest Science, Clemson University*

The lower Savannah River has been manipulated throughout the years to accommodate international shipping. These modifications have caused salinization of freshwater marshes in the past and have threatened the integrity of the freshwater tidal swamps. Global sea level rise is now viewed as a potential catalyst to alter coastal habitats. Two freshwater tidal forest stands were sampled in the lower Savannah River floodplain in order to document current conditions and fine-tune habitat types. Trees and shrubs were identified and soil sample were taken in 32 plots situated in backswamp and streamside zones along the river. Multivariate statistics were used to discern four communities: shrub, water tupelo, swamp tupelo/hazel alder, and water oak/redbay. Soil properties, especially organic matter content, were related to each community. Descriptions of each community include both overstory and understory species' trends in addition to trends with soil properties.

Metapopulation dynamics guides oyster restoration in North Carolina

David B. Eggleston and Brandon Puckett, North Carolina State University, Department of MEAS and Center for Marine Sciences & Technology, Morehead City, NC

Marine reserves are a potentially powerful management tool, and are most effective when established as networks. Reserve networks, that is multiple reserves connected by migration, function to increase spawning stock biomass within reserve boundaries and promote sufficient inter-reserve connectivity to ensure network persistence. Network persistence depends on the interaction of two primary mechanisms: (1) demographics—the potential for growth, survival, and reproduction within reserves, and (2) connectivity—the potential to distribute offspring among reserves. Metapopulation and source/sink concepts were used to assess the performance of oyster restoration via broodstock reserves in Pamlico Sound (PS), NC, the second largest estuary in the US. We parameterized a spatially-explicit, stage-based matrix metapopulation model with empirical measures of oyster demographic rates (fecundity, settlement, growth, survival) within reserves, as well as larval connectivity (hydrodynamic and particle-tracking larval dispersal simulations) among reserves to determine (1) the relative contribution of each reserve to the network, (2) the potential for reserves to persist as a network connected by dispersal, (3) benefits of increasing reserve size within the context of SLOSS (single large or several small), and (4) where in Pamlico Sound to locate new reserves. Mean oyster density increased by 432% during the 4 yr. field study, and oyster growth and survival rates were relatively high compared to other systems. The metapopulation, source/sink conceptual framework is proving to be a powerful approach for integrating variable spatiotemporal dynamics in demographic rates and larval connectivity among oyster reserves, and is guiding decision-makers in where and in what sizes to restore oyster populations.

Physical factors contrasting beach sands in sea turtle nesting areas in South Carolina, USA

*Megan Farris***, Coastal Carolina University*

Nests in which sea turtle embryos develop can vary in physical characteristics between separate nesting beaches or within the same nesting beach (Garrett et. al 2010). In order to get the most out of conservation efforts for the Loggerhead turtle, *Caretta caretta*, it is important to understand which physical characteristics of the nesting beaches offer the best conditions for hatchling success. Currently, sand is being collected from all 28 *Caretta caretta* nesting beaches in South Carolina. For each nesting beach triplicate samples are collected from historical high and low density nesting areas. For beaches without known nesting density trends samples are taken from two randomly selected areas (n=3 for each) using a table of random numbers to select sampling sites. The sand is dried and physical characteristics including; bulk density, grain size distribution, color characteristics, as well as thermal response testing will be determined. The sand characteristics are then compared to the number of hatchlings to determine if the sand characteristics influence the success of hatchlings. Of the sites that have been tested thus far, the grain size distribution has a phi size of 2 to 2.5 and the average bulk density is 40.33g.

The Georgia Coastal Research Council

Merryl Alber, Janice Flory, Joan Sheldon, Christine Laporte, University of Georgia, Athens

Good coastal zone management requires good coastal science.
However, managers and other decision makers do not always have timely access to scientific information. The Georgia Coastal Research Council
(GCRC) is a model for fostering practical, working relationships between coastal scientists and managers. The GCRC holds regular meetings with coastal researchers and managers, maintains a website as a clearinghouse for information on research activities, synthesizes technical information, and coordinates research efforts on emerging coastal resource issues. The GCRC role in these activities varies, from producing white papers and management tools to organizing

working groups. The GCRC is not a policy organization, but rather seeks to provide unbiased, objective information about scientific issues.
The goals of the GCRC are:
- To provide mechanisms for improved scientific exchange between coastal scientists and decision makers.
- To promote the incorporation of best-available scientific information into State and local resource management.

LIDAR Digital Elevation Model correction and accuracy assessment
Christine Hladik and Merryl Alber, Marine Sciences Department, University of Georgia*

Accurate habitat mapping in salt marshes is important for both management and conservation goals. Habitat maps can identify sensitive areas and also be used to document changes over time in response to sea level rise and human perturbations. While many variables affect species patterns, elevation is one of the most important as it determines the frequency and duration of tidal flooding. Light Detection and Ranging (LIDAR) is effective at measuring surface elevations at the whole marsh scale. However, dense salt marsh vegetation presents complications for the reliable use of LIDAR and species-specific correction factors are often needed. The goal of the current study was to test the applicability of species-specific LIDAR DEM correction factors derived for the salt marshes surrounding Sapelo Island, GA. Application of the derived correction factors significantly improved the accuracy of the LIDAR DEM, reducing the overall mean LIDAR error from 0.10 ± 0.12 to -0.01 ± 0.09 m (SD). In the corrected DEM, the elevations of all vegetation classes were not significantly different than the RTK elevations, with the exception of *Juncus* (JR). However, *Juncus* elevations were still improved with the modification. The corrected DEM will be used to produce an improved habitat map, which can be used to model the relationship between marsh species distributions and controlling factors such as elevation, proximity to tidal creeks, and proximity uplands. This will also allow us to make predictions on how vegetation would shift in response to sea level rise and other potential changes.

Effects of wind-driven sea-level variation on salt marsh dynamics and its implications for ecological succession: a modeling approach
Daehyun Kim, University of Kentucky; William E. Grant, Texas A&M University; David M. Cairns, Texas A&M University; Jesper Bartholdy, University of Copenhagen

Long-term, eustatic sea-level variation has been considered as a primary factor of geomorphic and ecological dynamics of salt marshes. However, Kim et al. (in press) hypothesized that recent variations in the North Atlantic Oscillation (NAO) have increased the frequency and duration of ocean storminess and marsh submergence, thereby enhancing sediment accretion and retarding ecological succession. To test this hypothesis, we parameterized a simulation model based upon data on the NAO variation and rates of sedimentation, and then evaluated model performance based upon field data on sea-level variations and surface elevation. These data have been acquired from the Skallingen salt marsh in Denmark since the 1930s. In general, the model showed decreases in sedimentation rate and duration of marsh submergence until about 1980 but increases in these factors since then. This year (i.e., 1980) marked the point, from which the NAO entered its positive phase. This phase implies a large pressure difference between the Icelandic low-pressure and the Azores high-pressure systems, which results in frequent, strong westerly gales across the North Sea. These physical dynamics explained vegetation changes at Skallingen well, where there had been progressive succession until about 1980, and retarded (or even retrogressive) succession since then. Overall, our model articulates that short-term, wind-driven sea-level variations are associated with the NAO variation, and significantly contribute to salt marsh dynamics. To conclude, we stress the need for a multi-

temporal perspective in coastal science to recognize the role of sea-level variations at both long- and short-time scales under globally-changing environmental conditions.

Can you hear me now? Recruitment facilitation by biological noise in a marine reserve
Ashlee Lillis and David Eggleston, Department of Marine, Earth & Atmospheric Sciences North Carolina State University*

Biologically produced sound may be an important orientation cue for planktonic marine larvae to locate patchily distributed recruitment grounds such as reefs. This recruitment facilitation could be particularly significant in the context of marine reserves, where protection or development of soniferous habitats could enhance larval replenishment and community establishment. I developed a simple deterministic differential equation model to explore the potential effects of recruitment facilitation via biological noise on the dynamics of interacting species in a marine reserve. The model examines populations of three species: eastern oyster, a reef-forming species; snapping shrimp, a noise-producing species occupying oyster reef habitat; and stone crab, an oyster predator and potentially sound-receptive species. Population dynamics were simulated with and without recruitment facilitation by sound following the creation of an artificial oyster reef. Model results show that recruitment facilitation could speed the establishment of a stone crab population on an oyster reef. However, depending on baseline stone crab recruitment rates (currently unknown), recruitment enhancement leads to either an increased stable stone crab density with little decrease in adult oyster density, or population oscillations with oyster density substantially diminished as stone crab increases. This exploratory model highlights the need for determining the recruitment rates of oysters and oyster-reef-associated fauna such as stone crab and the effect of reef sounds on these rates.

Pollutant removal efficacy of a constructed wetland in a tidal creek watershed
Michael A. Mallin, Janie A. McAuliffe, Matthew R. McIver, Yosef Shirazi, Center for Marine Science, University of North Carolina Wilmington

Hewletts Creek, in Wilmington, North Carolina, USA drains a large (7,436 acre) suburban watershed and as such is impacted by high fecal bacteria loads and periodic algal blooms from nutrient loading. During 2007 a 7.6 acre wetland was constructed to treat stormwater runoff from a 589 acre watershed within the Hewletts Creek drainage. A rain event sampling program was carried out in 2009-2010 to evaluate the efficacy of the wetland in reducing pollutant loads (fecal bacteria, nutrients, suspended solids and metals) from the stormwater runoff passing through the wetland. During the eight storms sampled, the wetland served to greatly moderate the hydrograph, retaining and/or removing 50-75% of the inflowing stormwater volume within the wetland. High removal rates of fecal coliform bacteria were achieved (based on "first flush"), with an average load reduction of 99% and overall concentration reduction of > 90%. Particularly high (>90%) load reductions of ammonium and orthophosphate loads also occurred, and lesser but still substantial reductions of total phosphorus (89%) and TSS loads (88%) were achieved. Removal of nitrate was seasonally dependent, with lower removal occurring in cold weather and high percentage (90%+) nitrate load removal occurring in the growing season when water temperatures exceeded C. Most metals tested had concentrations too low to be measured in inflowingo15 and outflowing waters, except for zinc, for which an average load reduction of 87% was achieved. This constructed wetland appears to be very successful in reducing both concentrations and loads of polluting substances to the receiving waters.

Seasonal changes in picophytoplankton community structure in the Altamaha River estuary and neighboring sounds

*Elizabeth Mann, Skidaway Institute of Oceanography; Travis Alstad, Skidaway Institute of Oceanography; Karin Biller**, Hochschule Mannheim-University of Applied Sciences; Ashley Greenleaf**, Duke University*

The contribution of picophytoplankton less than 2u in size to primary productivity in estuaries can be significant, although their importance declines from oligotrophic to eutrophic environments. To address the relative lack of knowledge of picophytoplankton dynamics in southeastern estuaries, their community composition was determined in the Altamaha River and the neighboring sounds along a salinity gradient during a range of seasons. Picophytoplankton were quantified using flow cytometry in early and late fall 2005 and again in July and October 2010. This community consisted of single cells and chains of cyanobacteria containing the photosynthetic accessory pigments phycoerythrin (PE) or phycocyanin (PC) and picophytoeukaryotes, some with light harvesting systems including both phycobilin and chlorophyll protein complexes. PC effectively absorbs the red light prevalent in high turbidity water and halotolerant phytoplankton containing this pigment are expected to com pete effectively in estuaries. Considerable variability was observed as picophytoplankton responded to changes in salinity, light attenuation, nutrient availability and temperature. For instance, while PC chains were abundant in 2005 in the Altamaha, this group was not seen in significant numbers in 2010. Within this variability, some consistent patterns emerged: 1) All phytoplankton containing PE decrease in number with decreasing salinity 2) If PE chains are present, their relative importance increases when water temperatures are colder 3) PC cyanobacteria abundance increases up-river and overall abundance drops significantly in late fall 4) picophytoeukaryotes appear to have source populations in both high and low salinity water and are extremely abundant in the upper reaches of Sapelo Sound.

Modeling primary productivity in a subtropical estuary

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Urban and agricultural development in and around the Caloosahatchee River and Estuary on the southwest coast of Florida has altered the flow and quality of water in the system since the late-1800s. Recent algal blooms have brought attention to nutrient issues and processes affecting production and biomass accumulation there. The major purpose of this project was to measure phytoplankton productivity in the Caloosahatchee Estuary in order to test a previously developed empirical model that is based on simple measures of phytoplankton biomass and light availability in the photic zone. Primary production rates, in terms of oxygen evolution, were measured at four sites (one each in the upper estuary, middle estuary, lower estuary, and San Carlos Bay) using simulated *in situ* light:dark bottle incubations in a flow-through raceway. Physical-chemical parameters, nutrient concentrations, and phytoplankton abundance and composition were assessed at each site for their direct and indirect effect on phytoplankton production and the model relationship. Gross primary productivity (GPP) estimates obtained from the simulated *in situ* experiments were converted into daily rates of carbon fixation and integrated over the water column, yielding a range of 90 to 3357 mg C m^{-2} day^{-1}. When the estimates from all four sites were pooled, there was a strong linear relationship between daily GPP and the model predictor (r^2 = 0.83, $p<0.001$). Differences between the measured and predicted productivity rates varied by season, and these deviations were examined as indicators of secondary controls on phytoplankton productivity in this estuary.

The effect of horses on Cumberland Island salt marsh fauna

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Both sudden dieback and herbivore overgrazing have been blamed for reducing *Spartina* biomass in salt marshes. My previous work in sudden dieback areas in GA showed significant decreases of 50-100% of fauna in areas without *Spartina*. To compare these effects with the effects of intense herbivory on salt marsh fauna, I worked at 5 sites on Cumberland Island, GA, where horses frequently graze. I assessed *Spartina*, faunal, and edaphic variables using transects through 3 zones at each site (healthy, edge, affected). *Spartina* density, height, and percent cover were significantly reduced in grazed (affected) areas as compared to healthy areas by ~50%, ~75% and ~50%, respectively. Fauna were also reduced in grazed areas: snails by ~85%, fiddler crabs by ~50% and macrofauna by ~75%. In addition, macrofauna taxon richness and diversity were lower in grazed areas. There were no significant differences between zones for pH (averaged across all sites and zones, 7.78 ± 0.05 (SE)), salinity (32 ± 1.4), redox potential (-291 ± 16 mV, uncorrected value), or organic matter content (16.4 ± 2%), nor did any of these factors explain faunal abundance. This work suggests that the effects on fauna due to grazing may be similar to those of sudden dieback.

NOAA in the Southeast and Caribbean Region

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The National Oceanic and Atmospheric Administration (NOAA) has been adopting a more regional approach to its interaction with, and delivery of products and services to, stakeholders. In addition to the traditional regional construct of the National Marine Fisheries Service and the National Weather Service, NOAA now has cross-agency regional collaboration teams that work to improve communication and coordination within the region – both within the agency and with partners and stakeholders – and address regionally identified priorities. NOAA's Southeast and Caribbean Regional Team covers the states of NC, SC, GA, and FL and also the territories of Puerto Rico and the US Virgin Islands. A few projects will be highlighted, including NOAA support for the state-led regional ocean partnership, the South Atlantic Alliance, and new efforts to improve regional climate services.

Reproductive status and population demographics of the tripletail, *Lobotes surinamensis*, aggregation near Jekyll Island, Georgia

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Tripletail (*Lobotes surinamensis*, Lobotidae) are a medium-sized, deep-bodied fish that typically are found associated with submerged, emergent, or floating structure; but in the murky Atlantic Ocean off the Jekyll Island, Georgia coast, they float along the surface in large numbers from May through July. Increasing popularity with recreational anglers and the lack of basic life history data suggest the need for basic biological information for fisheries managers. A total of 226 tripletail were sampled primarily by hook-and-line methods to sample fish from the Jekyll Island aggregation during March through August in 2009 and 2010. An experimental fish trawl (N = 11) was also used to capture tripletail during 2009. Gonads were removed, weighed, and preserved for histological evaluation. Histological examination of tripletail testes (N = 119) revealed males in juvenile (2%), undeveloped (7%), early spermatogenic (21%), mid-spermatogenic (36%), and late spermatogenic (34%) reproductive stages. Histological examination of female ovaries (N = 99) revealed immature (67%), developing (23%), late developing (8%), and regressed (2%) reproductive stages; females with hydrated oocytes were not observed during the course of this study. Aging techniques for otoliths (N = 223) and first dorsal spines (N = 223) were used to estimate ages for each individual. Tripletail appear to grow

very rapidly and are capable of reaching 500 mm in one year. Managers charged with protecting this species will benefit from new information about the biology and ecology of the Jekyll Island aggregation.

Albemarle-Pamlico Watershed and Estuary Study (APWES): Ecosystem services science to support decision-making

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The APWES is a place-based study for the U.S. EPA Ecosystem Services Research Program. It is designed to develop ecosystem services science to inform watershed and coastal management decisions in the Albemarle-Pamlico watershed and estuary in North Carolina and Virginia. The study applies analysis of seven ecosystem services (clean air; clean water; climate resilience; flood and storm protection; food, fiber, and fuel; recreation; and biodiversity) to management decisions related to EPA regulatory authority in air quality, wetlands, and water quality, and the related issue of water quantity. APWES research includes mapping and monitoring, modeling, and decision support tools. The APWES examines tradeoffs or synergies among services under alternative scenarios, and seeks to understand how ecosystems can be managed sustainably for ecosystem protection and economic benefit.

Productivity of functional guilds of fishes in managed wetlands in coastal South Carolina

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Naturally-functioning estuarine intertidal wetlands are net exporters of secondary production, but impounded wetlands do not allow for the export of secondary production. In coastal South Carolina, many 18th-century ricefield impoundments currently are managed as migratory waterfowl habitat. Water-level manipulation in these impoundments closes intertidal habitat to fish migration for most of the year; and when open, only limited migration occurs. The effects of impoundments on fish production and energy transfer are largely unknown. We used the size frequency method to estimate summer production of fish estuarine-use functional guilds in three Combahee River impoundments. The guilds included amphidromous (AM), catadromous (CA), and estuarine species (ES), freshwater migrants (FM), freshwater stragglers (FS), and marine migrants (MM). We predicted production to vary with impoundment salinity: Big Rice Field (BRF) is most the saline (17 – 21 psu), Nieuport is in termediate (4 – 16 psu), and ACE is freshest (3 – 9 psu). We expected MM production to be highest in BRF, where salinity is similar to natural habitat. We also expected that FM and FS production would be highest in ACE. MM production was highest in BRF in 2008 (23.30 g·m-2·summer-1) and 2009 (20.92 g·m-2·summer-1), but highest in Nieuport in 2010 (30.22 g·m-2·summer-1). FS production was highest in ACE throughout the study (15.56 – 117.38 g·m-2·summer-1). FM production was highest in ACE in 2008 (16.64 g·m-2·summer-1), but highest in Nieuport in 2009 (7.03 g·m-2·summer-1) and 2010 (5.02 g·m-2·summer-1). Production of other guilds was low for all years, which indicates that impoundments may provide poor habitat for these guilds.

Stormwater runoff – Modeling impacts of urbanization and climate change

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Urbanization and associated sprawl are changing our landscape and altering watershed hydrology. As land becomes covered with surfaces impervious to rain, water is redirected from groundwater recharge and evapotranspiration to stormwater runoff, and as the area of impervious cover increases, so does the volume and rate of runoff. Pollutants accumulate on impervious surfaces, and increased runoff volume with urbanization is a leading cause of nonpoint source

pollution. As more volume runs off more quickly, vulnerability to shallow flooding increases. Climate change likely will amplify the impact of urbanization on stormwater runoff, further increasing the quantity of polluted runoff and the incidence of flooding. Within this context, a science-based system for evaluating the relative impacts of both urbanization and climate change on stormwater runoff at the local scale is warranted. We developed a method for modeling stormwater runoff for small (< 10 mi^2) coastal watersheds in the southeastern U.S. by using algorithms and flow curve number method of the U.S. Department of Agriculture's Natural Resources Conservation Service and then calibrating the output to better reflect regional conditions. Models were validated with gaged data from U.S. Geological Survey (USGS). The method developed can be used for a number of different applications including various urbanization and climate change scenarios. Rainfall amount, storm duration, and soil condition can be varied to integrate climate change into the model. Forecasting changes in runoff will ultimately enable better decisions related to minimizing the impacts of stormwater runoff. This modeling method will be developed into tools designed for use by research scientists, engineers, coastal managers, educators, and outreach professionals.

The Nutrient Budgeter, a MATLAB-based program to simplify watershed nutrient budget calculations, and application to the Altamaha River

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Understanding the sources of excess nitrogen (N) and phosphorus (P) entering the landscape is the first step in controlling down-stream eutrophication of coastal waters. Budgets such as those developed as part of the SCOPE Nitrogen Project are extremely useful in this regard, but can be time-consuming and complicated to construct, particularly for researchers unfamiliar with the methodology. For example, data from the U.S. Census of Agriculture present a particular challenge, as data are frequently withheld to protect the privacy of farmers and the missing values must be estimated before these data can be used. We have developed a MATLAB-based program designed to automate and simplify the calculation of nutrient inputs, particularly nitrogen and phosphorus, to watersheds. The program returns the components of a SCOPE-style nutrient input budget, including net food and feed import (consisting of human and livestock N or P consumption and crop and livestock N or P production), crop and forest N fixation, N or P in fertilizer use, manure and fertilizer N volatilization, and atmospheric N deposition, from county-level input data. These components are arranged into independent modules which can be run jointly or separately, and are fronted by a graphical user interface that minimizes the user's need to be familiar with the MATLAB language. We describe this program and demonstrate its application in the calculation of N and P inputs to subwatersheds of the Altamaha River watershed in Georgia.

Improving land use decisions on the Georgia Coast: an introduction to valuation of ecosystem services

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Development often proceeds without a true representation of the resulting costs and benefits. Frequently, the value of ecosystem services such as water purification, carbon sequestration, recreational and aesthetic value, are not considered. Because, in most cases, they are public goods not valued directly by markets, representing the value of ecosystem services in standard economic analyses, even where the physical nature of the service is well-understood, has been problematic. As a result, ecologists and economists have begun to develop methods to quantify the benefits of processes and resources not adequately captured by markets. Here, I present a brief introduction to methods used to estimate the value of ecosystem services as a means of improving our ability to make efficient decisions (reflecting the total economic value of resources) regarding future growth. I follow this introduction with examples outlining how such methods can be applied to counties on the Georgia coast which are experiencing rapid growth.

Specifically, we look at methods of incorporating the value of storm protection, water purification, and maintenance of forested lands.

Long-term data helps ask appropriate questions – a seagrass example

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Short-term data, even a decade's, can be misleading. First the good news: Over the past 6-8 decades, seagrass has been INcreasing in the Indian River Lagoon based on (a) mapping from aerial photos and (b) twice-a-year monitoring of fixed transects. Generally, the footprint of seagrass has been increasing, with some tapering off over the past decade. HOWEVER, although the areal extent of seagrass has been increasing, the density of seagrass has declined dramatically over the past 8-10 years by nearly 50%. The tough question: what factor/stressor could allow seagrass to expand at the deep edge where it is limited by light, but cause shallower seagrass receiving higher light levels to thin out?

River Discharge Influences Phytoplankton Abundance and species composition in the Altamaha River Estuary, Georgia

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Alterations in river discharge affect estuarine water quality and nutrient concentrations, which can affect phytoplankton abundance and species composition. We examined periods of expected high and low nitrate concentrations, associated with river discharge, for differences in phytoplankton abundance and species composition in the Altamaha River Estuary, Georgia. We predicted that high nitrate concentrations would increase phytoplankton abundance and species diversity, while low nitrate concentrations would decrease relative abundance and species diversity. To test these predictions, the estuary was sampled during low river discharge conditions in June and high river discharge conditions in July of 2010. Water quality (dissolved oxygen, conductivity, temperature, light attenuation, pH), nutrients (nitrate, phosphate), and phytoplankton were collected during high tide at an average salinity of 3.6 ppt. Nitrate concentration and phytoplankton abundance were lower during low river discharge. Phosphate concentration was greater during the low discharge when compared to the high river discharge. There was no change in species diversity between high and low, however the relative abundance and proportion of the dominant species *Skeletonema costatum* was less during low discharge while the abundance and proportion of an unidentified species was greater during low discharge. There was a strong inverse correlation between the proportion of *S. costatum* and the proportion of the unidentified species in the low discharge period however this relationship was not present during high discharge. These changes in relative abundance of the dominant species can have implications for higher trophic levels.