



SUSTAINABLE COASTAL DEVELOPMENT AND ECONOMY

ACCOMPLISHMENTS

Consortium Scientists Completing Assessment Study of Potential Areas of the Northern South Carolina Coast for Wind Energy Development

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The Bureau of Ocean Energy Management, U.S. Department of the Interior, awarded the S.C. Sea Grant Consortium \$750,000 to support scientists and staff at Coastal Carolina University, University of South Carolina, and the College of Charleston to conduct geophysical mapping and paleolandscape and shipwreck identification studies six to ten miles off the northern coast of South Carolina. The purpose of the study is to generate information that will be useful in assessing potential locations for future wind energy development efforts. An extensive geophysical dataset has been assembled to characterize sea floor habitat potential, shallow geologic framework and identify potential paleolandscapes and historic shipwrecks offshore of South Carolina. The Regional Geophysical data from the CCU-NOAA 2015 cruise has been processed, interpreted, and integrated into a project GIS. Initial comparisons to NOAA Fishery Sonar data have also been completed. Submerged prehistoric sites and relict landforms suitable to the preservation of these sites, and historic sites, structures, and objects, have been identified and documented. The final report to BOEM is currently in preparation.

S.C. Sea Grant Consortium Assists McClellanville with Maintaining Sustainable Working Waterfront **April Turner, Julie Davis, and Susan Lovelace, S.C. Sea Grant Consortium**

Traditional uses of waterfront properties are diminishing as property values soar and development increases along the coast. The commercial seafood industry in much of coastal South Carolina has been affected by the competing demands for and subsequent change of use of waterfront property. Commercial fishermen in South Carolina find it increasingly difficult to secure dependable and affordable docking space, fuel, and ice. The coastal community of McClellanville and its Jeremy Creek working waterfront are no exception. There are two commercial docks, Carolina Seafood and Livingston's Bulls Bay Seafood, along McClellanville's commercial waterfront. Both are used as dock facilities for larger vessels and as shore-side support facilities by the entire industry. Carolina Seafood is the town's largest employer and purchaser of harvest from most of the town's resident fishermen. The owners of both are approaching retirement without a succession plan, and the uncertainty of their future is cause for concern among the local commercial fishermen and the community. With no plan and without intervention to protect the use of the docks, the land likely will be sold and converted to other uses, resulting in the loss of the local seafood trade. In 2008 and 2015, two S.C. Sea Grant Consortium-supported research projects were completed to identify issues and explore priorities for maintaining, preserving, and enhancing traditional working waterfronts in South Carolina and to assess the climate resiliency of S.C. working waterfronts. As a result of these efforts, the town reached out to the Consortium for assistance. In September 2017, the Consortium collaborated with the town and other partners to obtain a Hometown Economic Development Grant (\$25,000) awarded by the Municipal Association of South Carolina. Over the course of the next two years, the project team will develop a master plan for the future of McClellanville's working waterfront. One option being explored is cooperative ownership and operation of the seafood wholesale and distribution business, benefitting the harvesters and ensuring the long-term sustainability of the town's working waterfront.



User-Friendly Resources Guide Produced for Flood Disaster Preparation, Response, and Recovery
April Turner, Chelsea Acres, Susan Lovelace, S.C. Sea Grant Consortium

The South Carolina Coastal Information Network (SCCIN; www.sccoastalinfo.org) was created in 2006 by the S.C. Sea Grant Consortium to enhance coordination of outreach efforts and the strategic dissemination of information to coastal communities. In response to the October 2015 flood, the Consortium worked with partners to compile nearly 400 products, many of which were provided by the Extension Disaster Education Network (EDEN). The bulk of the compiled resource products were websites and hosted PDFs addressing issues related to flood disaster preparation, response, and recovery. These resource materials were added to the SCCIN website portal. These resources were evaluated for clarity, quality, and regional relevance by the SCCIN partners, culminating in the development of the S.C. Flood Resources Guide. The document is a PDF with clickable links to nearly 200 resources that can be browsed by function (e.g., preparation, adaptation), focus (e.g., property, food safety), or audience (e.g., farmers, business owners). Charleston County is in the process of revising its hazard mitigation plan, and members of the county's Public Information Committee recommended including the S.C. Flood Resources guidebook as part of the county's outreach strategy resource materials. Additionally, the guide has been referenced at a June 2017 Horry County staff and board floodplain training exercise, as well as shared with new employees when there are staffing changes.

A Preliminary Tool to Rapidly Detect and Quantify CyanoHABs has been Developed with S.C. Sea Grant Consortium Research Support

Dianne Greenfield and William Jones, University of South Carolina

Knowledge of harmful algal bloom (HAB) abundances has important implications for assessing bloom severity, and rapid detection enables forecasting. Technologies that facilitate expedient and accurate monitoring of a bloom's progress will facilitate early warning of potentially toxic events and enable water quality managers and public health officials to take appropriate actions related to drinking water or swimming warnings that protect public safety. S.C. Sea Grant Consortium (Consortium) researchers at the University of South Carolina and the Medical University of South Carolina examined methods to rapidly detect and quantify cyanobacterial HABs (CyanoHABs) associated with severe public health risks, coastal fish kills, and declining water quality. The focus was on tools that would be cost- and time-efficient and could be used in field or laboratory settings. Using the cyanobacteria *Microcystis* because it is common and is almost always toxic, researchers developed four capture probes using sequenced DNA from several phytoplankton species strains within this genus. Validation of the probes through testing allowed researchers to develop the blueprint for a sandwich hybridization assay (SHA) tool to facilitate rapid and accurate HAB assessments in the field. Researchers followed the progression of dense and toxic CyanoHAB blooms in four stormwater ponds on James Island, South Carolina, noting high levels of nitrogen and phosphorous that likely fueled the blooms' persistence. This enabled them to track changes in water quality, sample for SHA validation, and evaluate population trends. The SHA tool was validated for environmental samples, and researchers are testing laboratory-cultured samples in an effort to validate the tool for use in a laboratory setting and preparing to reach out to the private sector to discuss commercial production of a testing kit for stormwater pond managers for use in HAB monitoring efforts.

S.C. Sea Grant Consortium Research Suggest that Stormwater Pond Sedimentation Issues Not as Severe as Maintenance Guidance Suggests

Erik Smith and Claudia Benitez-Nelson, University of South Carolina



Stormwater ponds are the most common best management practice for controlling runoff in coastal South Carolina and are frequently associated with residential developments. Dredging is the largest cost associated with the life-cycle maintenance of stormwater ponds and is often the responsibility of residential neighborhood homeowners associations. Direct estimates of sedimentation rates occurring in residential stormwater ponds typical of coastal South Carolina and a comprehensive understanding of what factors influence the variability of sedimentation rates among ponds are critical to aid in pond management. Providing locally relevant estimates of pond sediment sources and accumulation rates will allow pond owners to better anticipate and plan for maintenance dredging. To accomplish this goal, S.C. Sea Grant Consortium researchers surveyed 14 ponds in Georgetown and Horry counties. Surprisingly, sediment accumulation rates were found to be far less than what was anticipated based on the S.C. Department of Health and Environmental Control Stormwater Management BMP Handbook. This guidance recommends dredging of stormwater ponds every 5-10 years to prevent storage volume loss of more than 25 percent. Research indicates, however, a median timeframe of 68 years for ponds to reach this volume reduction threshold, suggesting communities can go much longer between maintenance dredgings. Researchers also examined stormwater permits, real estate records, and historic aerial imagery in an effort to provide detailed and more accurate pond sedimentation sources and rates. Results indicated sedimentation is primarily terrestrial in nature, with little input from internal algal sources. The major predictor of sedimentation rate was found to be the relative percentage of impervious surfaces, such as roads, parking lots, and buildings, surrounding the pond. Terrestrial, not algal, inputs were also found to be the major source of organic matter in pond sediments.

S.C. Sea Grant Consortium Researchers Examine Sources and Toxicity of Black Microplastic Fragments in Local Estuaries

Peter van den Hurk, Clemson University and John Weinstein, The Citadel

Marine plastic debris is considered to be a top environmental problem and has been identified as an emerging global issue that may affect our ability to conserve biological diversity and maintain ecological interrelationships. Despite resistance to degradation, plastics are vulnerable to eventual decomposition into microplastic particles (<5 mm) as a consequence of prolonged exposure to ultraviolet radiation (UV), physical abrasion from sediments, and biological degradation. This is particularly relevant along beaches and in estuaries where UV penetration into shallow waters and wave action make plastic brittle, increasing the potential for fragmentation. These particles may be ingested by a variety of organisms, from invertebrates to fish, with various consequences, including gut blockage, translocation from the gut into tissues, and the transfer of persistent organic pollutants from the microplastic into the tissues of the organisms. S.C. Sea Grant Consortium researchers at The Citadel and Clemson University continued to examine sediment and water samples from four test sites, including locations in close proximity to outfalls from industrial manufacturers of plastic products. Prior investigations have found black fragments to be the most common microplastic particles observed in both Charleston Harbor and Winyah Bay. This is a phenomenon which is unique to the two estuaries; most research to date demonstrates that white fragments, identified as polyethylene, polypropylene, or polystyrene, are the most common microplastic particles observed in the environment. Tire wear particles were found to be in high abundance at the four test sites, constituting an average of 17.1% of total microplastics collected. Analysis of the black fragments demonstrated the presence of components of automobile tires, and that these particles are produced by the abrasion of tires on roadway surfaces. Pathways of tire-wear particles into Charleston Harbor are being investigated, and preliminary data suggest runoff from bridges concentrates the black fragments and creates hotspots of particles in receiving bodies of



water or sediment. Researchers also conducted toxicity studies of black fragments and polyethylene beads in grass shrimp and mummichogs; no significant mortality was observed as a result of exposure in the guts or gills of the organisms.

S.C. Sea Grant Consortium Sullivan Fellowship Research Illuminates Impacts of and Adaptation Measures to Address Artificial Light on Loggerhead Hatchling Orientation

Emily Asp, Eric Koepfler, Louis Keiner, and Scott Parker, Coastal Carolina University

Sea turtle hatchlings primarily utilize sight to detect differences in elevation and light intensity to navigate from their nest to the water's edge. The presence of artificial lights can cause visual misdirection, resulting in disorientation (aimlessly wandering in circular paths) or misorientation (moving in distinct paths away from ocean). Extensive research has been done on the effects of high levels of artificial light, but little on the effects of comparatively lower levels of artificial light on hatchling sea turtle orientation. Through a Kathryn D. Sullivan Earth and Marine Science Fellowship, S.C. Sea Grant Consortium researchers at Coastal Carolina University examined these lower intensity areas to identify whether there is a threshold of artificial light above which hatchling orientation is negatively affected. An infrared camera recorded hatchling trajectories at loggerhead sea turtle nests from areas varying in light intensity along the Grand Strand region of South Carolina. Orientation parameters, including lateral range of movement, orientation deviation, and average speed, were measured from each nest to determine whether they were significantly affected by total and artificial radiance values at the time of emergence. Lateral range of hatchling movement is not significantly influenced; however, deviation from seaward direction and average speed are. Results may help inform current management practices to enhance loggerhead hatchling survival efforts. In most circumstances observed within this study, it is not a few bright lights along the horizon leading to decreased orientation, but rather the urban glow associated with larger cities in close proximity to nesting locations. Inland sources contribute to increased urban glow. Simple light intensity management techniques can decrease this glow from inland sources, as well as save homeowners and business billions of dollars on wasted electricity. Additionally, light barriers in the form of restored dunes could be constructed to enhance natural orientation of hatchlings.

The Consortium Provides Leadership to Nature-Based Travel and Tourism in South Carolina

April Turner, S.C. Sea Grant Consortium

A 2016 study by the S.C. Department of Natural Resources found that the economic impact of natural resources to the state increased by 15% over the past decade to \$33.4 billion. More than 28 percent of the state's 4.96 million residents live in the state's eight coastal counties, and tourism is now a \$20.1 billion industry, with the eight coastal counties accounting for approximately 65 percent of that total. People are increasingly drawn to the South Carolina coast, with both residents and tourists taking advantage of the opportunities the state's natural and cultural resources provide. The interest of the S.C. Sea Grant Consortium in coastal tourism has focused on two issues: 1) assisting businesses and communities as they attempt to strike a balance between the vitality and abundance of South Carolina's coastal and marine resources and the economic health of the tourism industry that depends on them, and 2) assisting rural coastal communities with developing, encouraging, and promoting tourism practices that are economically, environmentally, and culturally sustainable. The Consortium provides technical assistance, leadership, and annual conference programming and workshop support. The Consortium's Coastal Communities Specialist serves the S.C. Nature-Based Tourism Association (SCNBTA) as its president and as technical advisor to the association's board. In the past year, the specialist has assisted with program planning for the association's quarterly board meetings and annual



conference, updating the website and social media, and developing marketing and membership strategies. The activities of the specialist and the support of the Consortium helps to ensure the continued sustainability and viability of the SCNBTA and the businesses it represents.

Consortium Holds “Our Coastal Future Forum” for Coastal Residents and Decision-makers
Susan Lovelace, S.C Sea Grant Consortium; Matt Nowlin, College of Charleston; Justin Reedy, University of Oklahoma

A group of 100 coastal residents, municipal decision-makers, scientists, and facilitators collaborated to learn about coastal issues and deliberate solutions in the first Our Coastal Future Forum, October 18-19, 2017 in the Trident Technical College conference center. The forum was developed as part of a research project funded by the National Academies of Sciences, Engineering, and Medicine, Gulf Research Program. Its objectives included assessing the effectiveness of small-group engagement of the participants in deliberating current issues in coastal planning and management, prioritizing issues, analyzing the differences in public opinion on issues associated with climate resilience, and comparing opinions from the deliberation process with statewide knowledge and beliefs. Presentations and deliberative-type small-group discussions focused on biodiversity, environmental health, living marine resources, ocean energy, and mineral resources. Key topics that emerged included protection of ecosystem services, restoration of wetlands and oyster reefs, conservation easements and sustainable practices in development at the landscape level, voluntary water quality testing, stormwater management practices and contaminants associated with stormwater, underutilized local seafood species, the diminishing local commercial fishing fleet, long-term costs and benefits of beach renourishment, modification of the National Flood Insurance Program, the pros and cons of seismic testing to determine the feasibility of collecting offshore resources (natural gas, oil), and role of solar in discussions about energy resources. Through surveys, educational activities, and small-group discussions, the research team members plan to identify insights about coastal management priorities and decision-making they can share with local, state, and regional leaders. Additional smaller and single-topic forums will be held in the coming year. Research to be reported was supported by the Gulf Research Program of the National Academies of Sciences, Engineering, and Medicine under award number 200007353.