

# HEALTHY COASTAL ECOSYSTEMS

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## IMPACT

### South Carolina Wetlands Programming Leads to Implementation of Enhanced Wetland Policies by Decision-Makers

**Brooke Saari, S.C. Sea Grant Consortium**

**Maeve Snyder, North Inlet-Winyah Bay National Estuarine Research Reserve**

**Abigail Locatis Prochaska, ACE Basin National Estuarine Research Reserve**

**Amy Scaroni, Clemson University**

**Recap:** S.C. Sea Grant Consortium contributed to a multi-organization team that collaborated on providing stakeholder wetlands education opportunities, focusing on the valuable ecosystem services provided by coastal wetlands and how land use activities close to wetlands and other water bodies can threaten these services.

**Relevance:** South Carolina has approximately 4.5 million acres of freshwater and coastal wetlands. Though wetlands are widely recognized, their benefits may be less so. Increases in development have led to great losses of the state's wetland assets. Questions regarding wetlands, ranging from what they are to who regulates, are common. Consistent messaging and general outreach opportunities are needed to further wetland knowledge.

**Response:** A multi-organization team collaborated on bringing wetlands education opportunities to stakeholders. Wetlands buffers was a largely requested topic, and experts were brought together for companion webinar events focusing on science and design basics and putting into practice ordinance and case study examples.

**Results:** A total of 257 participants attended the Wetland Buffer webinar series. Of those, 184 received Continuing Education Units. Of the 85 participants who completed an evaluation, 72 reported increased knowledge and 66 plan to incorporate knowledge into their job duties. A later evaluation completed by 11 people showed that 10 did in fact use that knowledge within their jobs for zoning and land use decisions, enhancing wetland policies, and communication of wetland and buffer benefits.

## ACCOMPLISHMENTS

### S.C. Sea Grant Researchers Study Impacts of Microplastic and Tire-Wear Particles in Coastal Waterways

**Peter van den Hurk, Clemson University**

**John Weinstein, The Citadel**

**Barbara Beckingham, College of Charleston**

**Recap:** S.C. Sea Grant Consortium researchers found microplastic particle accumulation in stormwater pond fish and stormwater treatment devices.

**Relevance:** Marine plastic debris is considered to be a top environmental problem and an emerging global issue that might affect our ability to conserve biological diversity and maintain ecological interrelationships. In 2014, a comprehensive survey of the occurrence of microplastic particles in Charleston Harbor was conducted, and the most common type was found to be black fragments from tire-wear particles produced through the abrasion of tires on road surfaces.

**Response:** Consortium researchers are characterizing the cumulative effects of microplastics, including tire particles, with their associated toxic chemicals on keystone estuarine organisms in stormwater detention ponds and salt marsh-tidal creek systems. Researchers completed chronic exposure experiments in which mummichogs were exposed to crumb rubber particles, examined particle accumulation in a variety of fish species, processed water and sediment samples at selected stormwater pond sites, and measured spatial distribution of microplastic particles in stormwater ponds.

**Results:** Significant microplastic particle accumulation was found in all fish species studied in stormwater ponds and pond outfalls. Decreasing concentrations and compositions of microplastics were observed from the pond inlets down through the tidal creeks. Concentrations of microplastics including tire wear particles were documented in different chambers within stormwater treatment devices and differences have been observed that will contribute to an analysis of how inlet structures affect microplastic capture.

## **S.C. Sea Grant Consortium Researchers Assess Pandemic-related Plastic Personal Protective Equipment in Charleston Harbor**

**John Weinstein, The Citadel**

**Recap:** S.C. Sea Grant Consortium researchers found that approximately 3% of total plastic items collected in Charleston Harbor in fall 2021 was personal protective equipment.

**Relevance:** The recent COVID-19 pandemic resulted in increased use of plastic-related personal protection equipment combined with relaxation of local bans on single use plastics to reduce the spread of virus. This increased use of plastics, in combination with ongoing problems related to their improper disposal, may have increased the overall levels of plastic litter in the harbor. As this plastic degrades, it could contribute to higher abundances of microplastic particles in coastal waters, sediment, and biota.

**Response:** Building on their existing research, S.C. Sea Grant Consortium researchers proposed characterizing plastic litter around Charleston Harbor, and comparing current abundance and types of plastic litter to what was collected in 2013. They hope to reveal the extent of pandemic-related plastic pollution and possibly shed light on its sources, transport, and potential impacts.

**Results:** Of the 9,832 plastic items, including personal protective equipment (PPE), collected at 10 Beach Sweep sites, approximately 3% was PPE, primarily gloves. Overall abundance and weight of plastics collected in 2021 were 2.7-times higher than plastics collected in 2013. No PPE was documented in 2013, while 286 items were found in 2021.

## **S.C. Sea Grant Consortium Researchers Document Stream Dynamics in an Estuary Headwater System to Inform Planning**

**Tim Callahan, College of Charleston**

**Recap:** S.C. Sea Grant Consortium researchers developed a stream rating curve detailing the relationships between water level and discharge, allowing decision-makers to better understand potential impacts of development on the watershed.

**Relevance:** Estuaries are important in supporting the seafood and tourism industries, as well as ecosystem services of food sources, floodwater storage, and improved water quality. The study site, Huger Creek in Berkeley County, S.C., is a tidal freshwater stream with headwaters in the Francis Marion National Forest and is a unique ecosystem to study due to tidal induction and stormwater flooding interactions. This stream can serve as an analog for the thousands of similar portions of upper estuaries.

**Response:** S.C. Sea Grant Consortium researchers collected and interpreted streamflow data to determine important water balance relationships for this system, compare this system to other similar estuaries in this region, and create models to predict streamflow and nitrogen flux in this tidal freshwater system. Development of much of the surrounding area is being considered, and having concrete hydraulic data will help inform decision-makers throughout the planning process.

**Results:** Researchers demonstrated a connection between stream hydrology dynamics and antecedent moisture condition as well as tide stage. Stream water discharge was related to stream water depth, and the volume of stormwater runoff contributing to stream flow was positively correlated to the antecedent precipitation index and negatively correlated to the tide stage. Researchers are developing a stream rating curve in collaboration with Xylem, Inc. and the U.S. Forest Service ([cloud.xylem.com/hydrosphere/public-sites/OWA\\_0F9901851269438B90AAFA0BA3EA1184](https://cloud.xylem.com/hydrosphere/public-sites/OWA_0F9901851269438B90AAFA0BA3EA1184)).

## S.C. Sea Grant Consortium Plans Inaugural Research Symposium

**Brita Jessen, Louis Heyward, and Susan Lovelace, S.C. Sea Grant Consortium**

**Recap:** The first S.C. Sea Grant Research Symposium will bring together scientists, students, and stakeholders in May 2022 to share research impacts, build networks to address emerging issues in coastal science and management, and define action steps to enhance equity and community-driven solutions.

**Relevance:** S.C. Sea Grant Consortium staff and advisors sought an opportunity to foster an identity and value of the S.C. Sea Grant “brand” for Consortium-funded researchers, provide an opportunity for researchers to engage with staff, and offer opportunities for attendees to learn of current research.

**Response:** The Consortium staff conducted an interest survey of S.C. coastal and marine scientists and natural resources practitioners in the fall of 2021 and identified the need for a local platform to share recent work, develop new cross-disciplinary teams, receive training to strengthen engagement skillsets, and create successful Consortium-funded research proposals.

**Results:** Staff are planning the first symposium centered on a theme of *Science + Inclusion = Solutions*. The symposium objectives are: Share research-based success stories from Consortium-funded researchers and students; attract new partners and foster novel teams; provide training for researchers and students to build a foundation of diversity, equity, and inclusion (DEI) in research and develop long-term trust with community stakeholders; co-create future research priorities including DEI in S.C. coastal communities.

## S.C. Sea Grant Consortium Develops Resilience Research Action Plan Tool

**Susan Lovelace, Brita Jessen, and Susannah Sheldon, S.C. Sea Grant Consortium**

**Recap:** S.C. Sea Grant Consortium creates an interview structure and guide to document and prioritize coastal resilience research needs from members of the research, resource management, and community leadership sectors of S.C. coastal communities.

**Relevance:** Programmatic opportunities to enhance coastal resiliency are being developed nationally and statewide, including through the newly-created South Carolina Office of Resilience. However, a comprehensive plan to prioritize research needs and decision-support tools has never been created for the S.C. coast. Data collection and analysis from coastal resilience researchers and community decision-makers is critical to build a strategic action plan that prioritizes resilience research needs.

**Response:** The Consortium is developing a Resilience Research Roadmap to identify critical information gaps for coastal communities and decision-makers of South Carolina for the purpose of understanding the drivers, risk, and community effects of environmental change; assisting community-led risk mitigation; creating tools and education products that enable community resilience action; developing strategies that enhance the safety, equity, and well-being of S.C. coastal communities within the context of regional environmental change.

**Results:** The interview structure and a guide have been created for deployment in 2022 to document and prioritize coastal resilience research needs from members of the research, resource management, and community leadership sectors of S.C. coastal communities.

## S.C. Sea Grant Consortium Leads Project to Renovate S.C. Water Monitoring Network

**Brooke Saari and Landon Knapp, S.C. Sea Grant Consortium**

**Norm Levine and Duncan Williamson, College of Charleston**

**Recap:** The S.C. Sea Grant Consortium is helping renovate the 2015 South Carolina Water Monitoring Network portal to meet the updated data and visualization needs of stakeholders, using funding for a dedicated student to focus on targeted improvements and expansion.

**Relevance:** The 2015 South Carolina Water Monitoring Network portal was created following Hurricane Joaquin and associated flooding. The tool aimed to coordinate and capture where water quality samples were being taken, what organization was sampling, and what was being tested. Over the following years the tool was not maintained and could not be utilized properly. Discussions with the Coastal Environmental Quality advisory board determined that this tool should be renovated.

**Response:** Funding was realized and a College of Charleston graduate student was hired to coordinate the renovation. To kick off the project, invited stakeholders were invited to discuss their needs during a workshop. A summary document was created to guide discussions on what could and could not be accomplished. A list of voluntary beta testers was compiled for a first draft review of the tool.

**Results:** A student was hired for the project and a stakeholder workshop convened with 15 stakeholders representing various organizations around the state. The completion of a new water monitoring tool is estimated during Summer 2022. The final tool will have gone through beta testing and updates, and a user direction fact sheet

and long-term maintenance plans will be implemented.

## **S.C. Sea Grant Consortium Participated in Coordination of the Healthy Pond Virtual Series**

**Brooke R. Saari, S.C. Sea Grant Consortium**

**Maeve Snyder, North Inlet-Winyah Bay National Estuarine Research Reserve**

**Abigail Locatis Prochaska, ACE Basin National Estuarine Research Reserve**

**Guinn Wallover, Beatriss Calhoun, and Ellen Sturup Comeau, Clemson University**

**Recap:** S.C. Sea Grant Consortium staff contributed to the design, implementation, and facilitation of a healthy ponds program series focused on pond owners and homeowners associations in coastal South Carolina.

**Relevance:** In South Carolina, stormwater ponds are the most common structural best management practice for regulating stormwater runoff, particularly in coastal areas where development rates are high. Despite their benefits, they create a unique set of management issues without proper maintenance. Some of the most common barriers to pond maintenance include lack of awareness of responsibility, misinformation on best management techniques, and financial costs.

**Response:** The Consortium, along with partners, organized and implemented a regional pond education series called the Healthy Pond Series. The program was tailored to the regions within the coastal zone, in mostly virtual format. Six interactive programs focused on extending the latest stormwater pond scientific information, resources, guidance, and tools to pond managers and owners. The goal was to create an opportunity for pond owners to learn and share pond management techniques.

**Results:** These webinars allowed 268 participants to learn about dredging, erosion, pond inspection, aquatic plant management, nutrients, and wildlife. Participants included multiple government levels, homeowners associations, academia, and the private sector. A post-event survey (32% response rate) revealed that respondents increased knowledge (97%), learned something new (86%), and felt that attending these events was a good use of their time (86%).

## **Stakeholders Continue to Make Use of S.C. Sea Grant Consortium's Stormwater Ponds Report**

**Brooke Saari, S.C. Sea Grant Consortium**

**Recap:** Since publication, the State of the Knowledge Report on Stormwater Ponds continues to be a used and valued resource for South Carolina.

**Relevance:** More than 9,000 residential stormwater ponds in the eight coastal counties of South Carolina are providing numerous benefits, including control of stormwater runoff and improvement of water quality. In order to maintain and enhance the functionality of the stormwater ponds, we need to ensure that our coastal residents, stormwater managers, and researchers have access to the most relevant information, tools, and resources needed to make sound management decisions, communicate their efforts, and inform sustainable behaviors.

**Response:** The S.C. Sea Grant Consortium coordinated the development of the state of knowledge (SOK) report on stormwater ponds in South Carolina, published in 2019. Since publication, the SOK report and the executive

summary serve as outreach products to improve public knowledge regarding stormwater ponds.

**Results:** The executive summary of the SOK report was provided to various audiences since publication, with more than 300 copies distributed and 79 copies downloaded (29 downloads this past year). The SOK report has been accessed 539 times, and the PDF was downloaded 189 times (69 in the past year). These products have been used by other outreach organizations such as Clemson Extension and the Ashley Cooper Stormwater Education Consortium.

## **S.C. Sea Grant Consortium Coordinates New Coastal Environmental Quality Extension Advisory Committee**

**Brooke Saari, S.C. Sea Grant Consortium**

**Recap:** The Coastal Environmental Quality Extension (CEQ) specialist continues to build meaningful programs with input from external partnerships within the established CEQ Advisory Committee.

**Relevance:** In April 2020, the S.C. Sea Grant Consortium hired the new CEQ Program Specialist to establish a sustainable extension program within the Healthy Coastal Ecosystems focus area, more specifically related to stormwater and related issues in South Carolina. Building a successful extension program requires inclusive and constructive collaboration with partners throughout the state to enhance our reach into the important communities we serve.

**Response:** In August 2020, the Consortium convened the first CEQ Extension Advisory Committee meeting. The purpose of the committee is to discuss and identify current issues impacting our coastal natural resources and the communities dependent upon them, and assisting with the formulation of solutions to address the identified needs of our constituents through strategic planning priorities. Several relevant stakeholder groups with an interest in healthy coastal ecosystems participated, resulting in a committee of nine partners.

**Results:** Feedback was gathered through two meetings in 2021, specifically focused on efforts within the three Coastal Environmental Quality program focus areas: stormwater, water quality and environmental health. Input is continually sought to build and support programming efforts. This committee will continue to be critical to the growth and continued successes of the CEQ program.

## **Beaufort Stormwater Pond Management Conference Co-organized by S.C. Sea Grant Consortium**

**Brooke Saari and April Turner, S.C. Sea Grant Consortium**

**Ellen Sturup Comeau, Clemson University**

**Abigail Locatis Prochaska, ACE Basin National Estuarine Research Reserve**

**Recap:** The S.C. Sea Grant Consortium co-organized the hybrid format pond management conference that provided training and technical assistance to 41 stormwater professionals, homeowners, and local government officials and staff in Beaufort County. Similar conference planning is underway for the greater Charleston and the Grand Strand regions of the South Carolina coast in 2022.

**Relevance:** In South Carolina, stormwater ponds are the most common structural best management practice for regulating stormwater runoff, particularly in coastal areas where development rates are high. Despite their benefits,

they create a unique set of management issues without proper maintenance. Some of the most common barriers to pond maintenance include lack of awareness of responsibility, misinformation on best management techniques, and financial costs.

**Response:** The Consortium, and partners, organized and led a regional pond conference October 26-28, 2021, extending the latest stormwater pond scientific information, resources, and tools to public and private-sector pond managers and owners. Goals of this event were to increase awareness of pond purpose and need for regular maintenance, provide information and tools to overcome common pond management challenges, and integrate pond owners and managers with service providers to assist in inspections and management actions.

**Results:** Forty-one participants, including property managers, homeowners association representatives, and pond management professionals, attended the conference. Conference evaluations had a 75% response rate and indicated that 95% learned something new and 37% will apply something they learned to improve their stormwater pond.

## **S.C. Sea Grant Consortium Conducts Flooding 411 Effort to Educate Stakeholders**

**Brooke Saari and Sarah Watson, S.C. Sea Grant Consortium**

**Ellen Sturup Comeau, Guinn Wallover, Beatriss Calhoun, and Kim Morganello, Clemson University**

**Maeve Snyder, North Inlet-Winyah Bay National Estuarine Research Reserve**

**Abigail Locatis Prochaska, S.C. Department of Natural Resources**

**Recap:** S.C. Sea Grant Consortium assisted with four webinars for Flooding 411, an educational program addressing flooding issues faced by coastal South Carolina residents.

**Relevance:** Approximately 27% of the population of South Carolina lives in the coastal area, which is prone to be impacted by flooding. Many residents in the coastal zone indicated on stormwater program evaluations the need for flooding information - how it impacts them, what to expect, how to respond and how to prepare. As impacts are projected to increase with changes in climate and sea levels, providing residents with information on flooding and mitigation was an important need.

**Response:** The Consortium members worked with the program team on a needs assessment sent to stakeholders. We also assisted in planning the summer series, coordinating speakers, providing content, and moderating. Four 90-minute webinars addressed flooding issues facing coastal South Carolina residents, with various scientific and government experts delivering information on flooding safety, property protection, community impacts, and who to contact.

**Results:** The series kickoff was a success, with a range of 93 to 138 participants attending each of the four webinars, representative of South Carolina and other states. Approximately 151 South Carolina Planning Education Advisory Committee Continuing Education Unit certificates were awarded throughout the series, equating to \$34,172 in economic benefit. Overall 95% of survey respondents indicated these webinars were worthwhile to attend, 100% learned something new and 67% plan to apply their knowledge.

## **S.C. Sea Grant Consortium Conducts with Water Chats, a Water Quality Technical Training Program**

**Brooke Saari and Matthew Gorstein, S.C. Sea Grant Consortium**



## **Guinn Wallover, Clemson University**

**Recap:** Water Chats is a new water quality technical training program designed to connect natural resource professionals and decision-makers with the latest water quality research in the state to inform management decisions.

**Relevance:** Water has defined South Carolina through settlements, culture, tourism, drinking water, recreation, food, and habitats. Natural resource managers depend on research to inform their decisions. However, obtaining applicable research can be an issue, with a disconnect between resource managers and researchers. Water Chats was created to bridge this gap by facilitating access to and use of new and emerging water quality research to inform natural resource management decisions in South Carolina.

**Response:** To inform the program focus and identify needs, a technical advisory group was convened, called the Water Chats Advisory Council. The members represented a diverse group of stakeholders from various organizations with water quality interests throughout the state, spanning government, non-government organizations, industry, extension and academia. Group input was used to initiate the planning of the 2022 summer webinar series and content.

**Results:** Several planning meetings were held in 2021, including two full advisory meetings and four subcommittee meetings, with 62 total attendees with some participating in multiple meetings. This group identified four main topic areas: emerging contaminants, harmful algal blooms, stormwater control measures, and source water protection. In addition, program leads worked on a student abstract call and pitched a special issue journal proposal, all of which will be underway in 2022.

## **S.C. Sea Grant Consortium Revitalizes South Carolina Low Impact Development Atlas**

### **Emmi Palenbaum, April Turner, and Landon Knapp, S.C. Sea Grant Consortium**

**Recap:** The S.C. Sea Grant Consortium recently remodeled and updated the S.C. Low Impact Development (LID) Atlas, an online tool that displays current LID projects statewide, and created an interactive GIS map and a data entry survey for individuals and organizations to submit entries for both publicly and privately owned LID sites.

**Relevance:** The goal of the atlas is to share information among communities and organizations so low impact development projects can serve as models for communities trying to address stormwater and growth-related issues in South Carolina. The atlas was previously hosted elsewhere and required reformatting to display LID entries in a concise and up-to-date system.

**Response:** In spring of 2021, the previous LID project entries were checked for accuracy and new points of contact were established for each up-to-date site. The map was then developed to display all of the projects and to provide key information gathered from the data entry survey, such as the type of LID site, contact information of the property owner, the physical address or coordinates for the site, project summary, and more.

**Results:** The finalized GIS map, entry survey, and resources about Low Impact Development projects are now hosted on the S.C. Sea Grant Consortium website and are ready to receive new entries.