



SOUTH CAROLINA SEA GRANT CONSORTIUM

Impacts and Accomplishments

FY 2022-2023



S.C. Sea Grant Consortium
287 Meeting Street, Charleston, S.C. 29401
843.953.2078 • www.scseagrant.org

TABLE OF CONTENTS

Healthy Coastal Ecosystems..... 3

Sustainable Coastal Development and Economy 17

Weather and Climate Resilience 24

Sustainable Fisheries and Aquaculture 39

Scientific Literacy and Workforce Development 51

HEALTHY COASTAL ECOSYSTEMS

ACCOMPLISHMENT

S.C. Sea Grant Consortium Hosts Inaugural State-Wide Research Symposium

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

RECAP: The first S.C. Sea Grant Consortium (Consortium) Research Symposium was hosted in May 2022 at The Citadel with the theme *Science + Inclusion = Solutions* to generate new interdisciplinary connections and partnerships, share research outcomes, and provide training for students and researchers to build trust and work more closely with historically underserved and underrepresented communities.

RELEVANCE: The Consortium staff recognized a need to create a community of researchers and students funded by the Consortium. Additionally, following two years of reduced in-person meetings due to COVID-19, the local research community has lacked opportunities to regather and create opportunities for partnerships and connections. Finally, with an eye on the increasing importance of diversity, equity, and inclusion (DEI) in Consortium-funded research, ongoing DEI-related training for all SC students and researchers is necessary.

RESPONSE: The S.C. Sea Grant Consortium Research Symposium convened 115 researchers and students at The Citadel in May 2022 to share research; attract new partnerships; provide training to incorporate DEI in all aspects of research; and develop closer partnerships with stakeholders. Due to a positive response by attendees, the Consortium will continue the symposia (every-other year frequency) to provide opportunities for all researchers to share ideas, foster partnerships, receive training, and build a community identity.

RESULTS: Students and researchers gathered as a state-wide community for the first time to exchange Consortium-funded research and receive training on the incorporation of DEI for research teams and stakeholder engagement. All members were invited to participate in facilitated breakout discussions focused on water quality, aquaculture, green infrastructure, resilience, restoration, and public health. Information gained at these sessions informed Consortium staff on the agency's research and strategic plan priorities.

PARTNERS: S.C. Sea Grant Consortium (staff and partners)

S.C. Sea Grant Consortium Builds Partnerships to Compete for Marine Debris Funding Opportunities

Susan Lovelace, Matt Gorstein, Brooke R. Saari, Brita Jessen, and Sarah Pedigo, S.C. Sea Grant Consortium

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

RECAP: The S.C. Sea Grant Consortium leads the submission of seven marine debris proposals (four Marine Debris Challenge and three Community Action Coalition) through significant contributions from several staff.

RELEVANCE: There are many types, sources, and causes of marine debris, which has long been a significant issue and includes plastic waste, trash, derelict vessels and fishing gear, and microplastics. To strengthen efforts in

prevention and mitigation, the Infrastructure Investment and Jobs Act (IIJA), has directed NOAA's National Sea Grant College Program to execute \$50 million over five years for the prevention and removal of marine debris.

RESPONSE: To address issues related to marine debris in South Carolina and the South Atlantic Region, the Consortium worked to build four research teams and three community action coalitions to compete for these funding opportunities. All of the proposals had diversity, equity, and inclusion principles woven throughout—from partners to students, and from capacity building to allocation of funding resources.

PARTNERS: University of South Carolina, Clemson University, College of Charleston, Gullah/Geechee Sea Islands Coalition, Gullah Geechee Chamber of Commerce, Gullah Preservation Society, Robinson Design Engineers, South Carolina Aquarium, Murrells Inlet 2020

S.C. Sea Grant Consortium Renovates and Enhances SC Water Quality Monitoring Portal

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

Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

Norman Levine, College of Charleston

Duncan Williamson, College of Charleston (Graduate Student) and S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium (Consortium) led the renovation and enhancement of the 2015 the 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 a tool created following Hurricane Joaquin associated flooding. The tool aimed to coordinate/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. Through preliminary discussions with the Coastal Environmental Quality (CEQ) advisory board, it was determined that this tool should be renovated.

RESPONSE: Funding was realized and a student was hired. To kick off the project, a workshop was convened with invited stakeholders to discuss needs and uses. A summary document was created to guide discussions (internally) on what could and could not be accomplished. A list of voluntary beta testers was compiled and utilized for review of the tool review.

RESULTS: The new tool is in the final development stage with an estimated completion date of summer 2023. Beta testing feedback and updates were gathered throughout late 2022 and early 2023. The final tool will have a completed user direction story map and video (updated per beta tester feedback). Final outreach materials and long-term maintenance plans will be implemented by completion date.

S.C. Sea Grant Consortium Participated in the Coordination of the Grand Strand Healthy Pond Series

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

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

C. Guinn Wallover, Mount Pleasant Water Works (formerly of Clemson Cooperative Extension)

RECAP: The S.C. Sea Grant Consortium (Consortium) staff contributed to the design, implementation, and facilitation of a 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 series was tailored to the regions within the coastal zone, in mostly virtual format. Two interactive programs focused on extending the latest stormwater pond scientific information, resources, guidance, and tools to pond managers and owners. The goal of these webinars was to create an opportunity for pond owners to learn and share pond management techniques.

RESULTS: These webinars educated 30 participants about the topics of aeration and plastic pollution in stormwater ponds. Participants included multiple government-level sectors, homeowners associations, academia, and private sector. A post-event survey (50% response rate) revealed that respondents increased knowledge (100%) and indicated they learned something new (73%). Overall, participant feedback revealed that attending these events was a good use of their time (100%) and indicated excitement over upcoming opportunities.

Consortium's *State of Knowledge Report on Stormwater Ponds* Continues Be Valued Resource in South Carolina

Brooke R. 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 effort to develop 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 was provided to various audiences since publication, with more than 300 copies distributed and 118 copies downloaded (39 downloads this past year). The SOK report has been accessed 669 times and the PDF was downloaded 261 times (72 in the past year). These products have been used by other extension and outreach organizations such as Clemson Extension and the Ashley Cooper Stormwater Education Consortium.

S.C. Sea Grant Consortium Implements Water Chats—A Water Quality Technical Training Program

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

C. Guinn Wallover, Mount Pleasant Water Works (formerly of Clemson Cooperative Extension)

Amy Scaroni, Clemson University

Heather Nix, Clemson Cooperative Extension

RECAP: Water Chats is a 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 decision making. However, obtaining applicable research can be an issue with a disconnect between resource managers and researchers. Water Chats was created to deliver timely water quality information to natural resource managers in South Carolina.

RESPONSE: Through input from the Water Chats advisory council, eight webinars were convened (focusing on research and application in four theme focus areas: contaminants of concern, harmful algal blooms, stormwater control measures, and source water protection). Presenters included 21 research and management professionals as well as 10 graduate student researchers, from 15 different universities, chosen through a call for abstract submissions process.

RESULTS: Over 470 attendees from approximately 90 organizations representing program target audiences (technical managers, natural resource managers, regulatory staff, decision makers, engineers, outreach professionals, and researchers) were in attendance throughout the eight free webinars. Evaluation data showed 95% of respondents (n=66) gained new knowledge and 74% plan to apply that knowledge to their work, with 92% overall found the webinars a good use of time. Target audience attendees indicated topics were timely and applicable.

South Carolina Water Chats: Delivering Research to Those Who Need It

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

Amy Scaroni, Clemson University

C. Guinn Wallover, Mount Pleasant Water Works (formerly of Clemson Cooperative Extension)

RECAP: As part of the Water Chats program, the S.C. Sea Grant Consortium (Consortium) is coordinating the publication of a special issue of the *Journal of South Carolina Water Resources* to supplement efforts to better connect researchers and natural resource managers in the state.

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 decision making. However, obtaining applicable research can be an issue with a disconnect between resource managers and researchers. Water Chats was created to deliver timely water quality information to natural resource managers through virtual webinars and publications.

RESPONSE: As another outlet for Water Chats content in addition to the webinars, the Consortium coordinated the development of a Water Chats-focused special issue of the *Journal of South Carolina Water Resources*. This open-access journal issue will provide an opportunity for students, early career scientists, outreach professionals, and researchers to publish their work in an accessible format and will feature both research articles and communication

pieces.

RESULTS: A guest editor team of partners across state agencies, universities, and NGOs was convened to review articles focused on applied water quality research in South Carolina. Eleven letters of intent for articles have been received and are in the latter stages of review. The special issue will be published in 2023.

Building a Regional Network to Study the Influence of Climate Change on Contaminants of Emerging Concern

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

Katy Smith, University of Georgia Marine Extension and Georgia Sea Grant

Cathy Janasie, National Sea Grant Law Center

Hailey Connell, College of Charleston (Graduate Student)

RECAP: S.C. Sea Grant Consortium (Consortium) staff convened a group of partners to conceptualize, write, and submit for grant funding to build a contaminants of emerging concern (CEC) program and network in the Southeast.

RELEVANCE: Interactions of increased pollution and extreme climate variation has put pressure on water quality in the Southeast, lending a need for future research to address contaminant and climate hazards on human and ecosystem health. CECs pose potential threats that are understudied especially as it relates to their reactions to various climate drivers.

RESPONSE: Consortium staff convened a group of partners to conceptualize a contaminants of emerging concern (CEC) program and network in the Southeast that focuses on impacts of climate change. The work group included Sea Grant partners from Georgia and the Sea Grant Law Center. Advisors from federal and state government informed the writing of a proposal to build the program.

RESULTS: The project team was funded \$411,148 to convene the project, including conceptualizing and releasing a Southeast-focused request of proposals. With funding acquired, the project kicked off with a graduate student hiring search. To allow prioritization of research needs, the student is conducting a literature review and gap analysis to identify research needs and focus. The project team next steps include convening an advisory committee of experts with diverse perspectives to determine what issues of CECs and climate to address for requests for proposals to be released in late 2023.

Charleston Area Stormwater Pond Management Conference Co-organized by S.C. Sea Grant Consortium

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

Beatriss Calhoun and Samantha Porzelt, Clemson Extension

C. Guinn Wallover, Mount Pleasant Water Works (formerly of Clemson Cooperative Extension)

Abigail Locatis Prochaska and Sean Cannon, A.C.E. Basin National Estuarine Research Reserve

RECAP: The S.C. Sea Grant Consortium (Consortium) co-organized the pond management conference that provided training and technical assistance to 75 stormwater professionals, homeowners, academics, and local government officials and staff in the greater Charleston area.

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 a regional pond conference on April 28, 2022, 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: Seventy-five participants (including property managers, homeowners' association representatives, and pond management professionals) attended the conference. Fourteen participants received up to five continuing education unit credits. The project team was able to successfully bring together participants into a long awaited in-person conference after years of virtual formats.

Second Year of Flooding 411–Residential Focused Flooding Education Program Provided for Coastal South Carolina

Brooke R. Saari and Emmi Palenbaum, S.C. Sea Grant Consortium

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Ellen Sturup Comeau, Beatriss Calhoun, and Kim Morganello, Clemson Cooperative Extension

C. Guinn Wallover, Mount Pleasant Water Works (formerly of Clemson Cooperative Extension)

Maeve Snyder, USC-North Inlet-Winyah Bay NERR

Abigail Locatis Prochaska, S.C. Department of Natural Resources and A.C.E. Basin NERR

RECAP: The S.C. Sea Grant Consortium (Consortium) assisted with year two of the Flooding 411 program, which consisted of a summer series of four 90-minute virtual educational webinars that were provided to coastal South Carolina residents to help them learn how to address various flooding issues they experience. There was also a separate complimentary webinar series of "Ask an Expert" hours.

RELEVANCE: Approximately 27% of South Carolina's population lives in a coastal area (which is prone to flooding). Many residents in the coastal zone have indicated on various program evaluations the need for more information on how flooding impacts them, what to expect, how to prepare, and how to respond. As flooding impacts are projected to increase with climate change and sea levels, it is important to continue providing residents with information on flooding and mitigation actions.

RESPONSE: The Consortium and partners used Flooding 411 program (previous-year) evaluations along with informal MS4 needs assessments to plan the summer series to meet stakeholder needs. Four 90-minute webinars addressed flooding issues concerning coastal SC residents. The "Ask an Expert" hour focused on understanding flood insurance. The Consortium assisted in coordinating speakers, providing content for sessions, and moderating. Various scientific and government experts delivered information on flooding safety, property protection, community impacts, and who to contact.

RESULTS: The four webinars offered in June 2022 were titled: "Water in Our Landscape: Constant Change," "Who's Who for Flood Management and Recovery," "Reducing Flood Impacts to Your Property and Community," and

“Successful Community Flood Management.” The Consortium worked on two of the webinars, developed the website, and produced all advertisement flyers for the series and individual webinars. Participants (~61 attending) were overall favorable of the series and content with praise being for the residential focus.

Trawl to Trash: S.C. Sea Grant Consortium Supporting Shrimpers and Removing Marine Debris

Brooke R. Saari, Sarah Pedigo, and Matt Gorstein, S.C. Sea Grant Consortium

Dodie Sanders, Bryan Fluech, Katie Higgins, and Todd Recicar, University of Georgia Marine Extension and Georgia Sea Grant

Victoria Smalls, Gullah Geechee Cultural Heritage Corridor

RECAP: The S.C. Sea Grant Consortium (Consortium) builds outreach components of the Trawl2Trash program in South Carolina and convenes and leads a team to request funds from the NOAA Marine Debris Community award to expand the Trawl2Trash program. This program was originally developed by Georgia Sea Grant and expanded to the Consortium in 2021 to help commercial shrimpers in GA and SC earn money during the offseason by upcycling shrimp trawl nets into stow bags.

RELEVANCE: Heavily worn trawl nets that are no longer fishable become burdens to fishermen. If disposed of improperly, they can become “ghost fishing gear” or take up property space. Additionally, many shrimpers go months in the offseason without earning income. In creating a product from these used nets, shrimpers can earn extra income while nets are repurposed. Resulting stow bags are distributed through community outreach and stewardship efforts to prevent and collect litter from coastal waterways.

RESPONSE: Education and extension specialists with the Consortium and University of Georgia Marine Extension and Georgia Sea Grant developed a NOAA Marine Debris proposal for expansion of the Trawl2Trash program.

RESULTS: In South Carolina, rack cards were developed to provide information on bag use and program purpose. Consortium staff distributed stow bags to volunteers cleaning up litter in waterways, partners, and the public so they could collect and dispose of marine debris.

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

Peter van den Hurk, Clemson University

John Weinstein, Citadel

Barbara Beckingham, College of Charleston

RECAP: The S.C. Sea Grant Consortium (Consortium) researchers found microplastic particle accumulation in shrimp and stormwater treatment devices.

RELEVANCE: Marine plastic debris is considered 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 found was 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). Sediment samples collected on streets, within stormsewer catch basins, and at the stormsewer discharge point to their adjacent tidal creeks were analyzed for tire road wear particles and other microplastics.

RESULTS: Researchers analyzed the effectiveness of using the hot needle method of identifying microplastics, and found it to be >90% effective in identifying them in field samples. An improved method to isolate and identify tire road wear particles from soil/sediment matrix was also developed and described. Tire road wear particles (TWRPs) and other microplastics were present at every sample site, with TWRPs being the most dominant. Finally, significant delays in maturation of shrimp were found in samples that consumed microplastics versus the control of pluff mud.

PARTNERS: Mount Pleasant Stormwater, CrystalStream Technologies

S.C. Sea Grant Consortium Contributes to Blue Carbon Roundtable and Research

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

RECAP: In Atlanta, the S.C. Sea Grant Consortium (Consortium) and partners—including Georgia Sea Grant and U.S. Geological Survey (USGS)—contributed to a roundtable discussion and a subsequent grant proposal to educate multiple sectors (including private finance, resource managers, scientists, and community leaders) on the opportunities and information needs to support public-private partnerships that enhance coastal wetland conservation and resilience using carbon storage, often called blue carbon.

RELEVANCE: Promoting the storage of coastal blue carbon in coastal wetlands (e.g., salt marsh, seagrass, mangroves) is an emerging strategy to support long-term conservation, restoration, and sustainable management. Decision-makers from diverse sectors (e.g., private land owners, investors) are interested in blue carbon as an incentive to invest in coastal habitat conservation and rehabilitation. However, more research and cross-sector dialogues are needed to understand the options available to enhance blue carbon storage in the Southeast.

RESPONSE: Consortium staff participated in a roundtable dialogue (with colleagues from Georgia Sea Grant, USGS, and Woods Hole Oceanographic Institution) to describe the opportunities, challenges, and information needs associated with blue carbon as a link for public-private partnerships in the Southeast. Attendees included restoration practitioners, bankers, and shareholders interested in the blue carbon market. Consortium staff educated the participants on blue carbon, associated co-benefits for coastal and marine ecosystems, and the work needed to conduct successful coastal restoration.

RESULTS: The roundtable group committed to meeting quarterly and expand its members to continue the discussion of the future of blue carbon. Additionally, Consortium staff were encouraged to submit a proposal to the First Horizon Bank Foundation to enhance regional (Southeast, Gulf coast, Caribbean) research on blue carbon options. The Consortium proposed the Southeast Blue Carbon Database research project—which received funding.

PARTNERS: Georgia Sea Grant, University of Georgia, National Sea Grant Law Center, U.S. Geological Survey, First Horizon Bank, East Tennessee State University Research Corporation

S.C. Sea Grant Consortium, Georgia Sea Grant, and University of Georgia Plan Inaugural Blue Carbon Law Symposium

Brita Jessen, S.C. Sea Grant Consortium

Katie Hill, Georgia Sea Grant

Adam Orford, University of Georgia School of Law

RECAP: The S.C. Sea Grant Consortium (Consortium) partnered with Georgia Sea Grant and the University of Georgia (UGA) School of Law to plan and host the first Blue Carbon Law Symposium (scseagrant.org/blue-carbon-law-symposium) to be held at UGA in May 2023 and publish a special issue of the *Sea Grant Law & Policy Journal* focused on blue carbon.

RELEVANCE: Blue carbon crediting has the potential to support the development of healthy coastal ecosystems by long-term conservation, restoration, and sustainable management of coastal and tidal habitats. Key issues to generate blue carbon crediting on publicly held lands include property ownership, boundary shifts, easement agreements, and legal authority by public agencies to authorize or engage with crediting. To date, no conference in the United States has been convened to address these issues and assemble a cross-disciplinary audience.

RESPONSE: Consortium staff and partners recruited a steering committee to develop a 1.5-day agenda that convenes legal scholars, ESG (Environmental, Social, and Governance) investors, conservation finance and carbon registry specialists, coastal and marine decision-makers, and scientists to co-create a whole-field understanding of the role and opportunity for coastal blue carbon investment.

RESULTS: The Blue Carbon Law Symposium was developed. Invited speakers include experts in law, ecosystem science, community engagement, and finance; a senior counsel at the Council for Environmental Quality; and the NOAA Chief Scientist.

PARTNERS: Georgia Sea Grant, University of Georgia, National Sea Grant Law Center

S.C. Sea Grant Consortium Researchers Measure Microplastics in Sediments and Shrimp of South Carolina Waterways

Andrew Tweel, S.C. Department of Natural Resources

RECAP: S.C. Sea Grant Consortium (Consortium) researchers and students are currently conducting a study of the distribution of microplastics in sediments and shrimp in South Carolina. Building capacity at S.C. Department of Natural Resources (SCDNR) to analyze the distribution of microplastics in sediment and Penaeid shrimp allows researchers to include such analyses in monitoring programs.

RELEVANCE: Microplastics in the marine environment have gained increasing attention in recent years, yet their coast-wide distribution in the estuarine habitats of South Carolina remain largely unknown. Preliminary data suggests that microplastics commonly occur throughout our estuaries, yet factors related to the prevalence of these contaminants and their distribution among penaeid shrimp has not been well studied.

RESPONSE: Consortium-funded researchers have established new laboratory capacity to analyze microplastics at the Marine Resources Research Institute (SCDNR). Sediment and shrimp samples were collected to determine: 1) the types, abundances, and distribution of microplastics in sediment in estuaries along the SC coast; 2) the spatial patterns which may correlate to microplastic type or abundance, such as level of development; and 3) the prevalence of microplastic particles in Penaeid shrimp in South Carolina.

RESULTS: Early data have been presented by a graduate student at three conferences within the state. Additionally,

the researchers have worked with the Coastal Reserves and Outreach office of S.C. Department of Natural Resources to develop educational materials related to microplastics in SC. This includes a set of laminated one-pagers, demonstration kit of the density separation process, and petri dishes with example materials for microscope analysis by school groups.

PARTNERS: College of Charleston

S.C. Sea Grant Consortium Researchers Investigate Physiology of Harvested and Bled Horseshoe Crabs

Daniel Sasson, S.C. Department of Natural Resources

Jody Beers, College of Charleston

Fabio Casu, National Institute for Standards and Technology

RECAP: To better understand the physiological response to collection and blood extraction from horseshoe crabs (a keystone ecosystem species), S.C. Sea Grant Consortium (Consortium)-funded researchers are investigating horseshoe crab harvest and bleeding across age classes to examine crab metabolic rates and blood profiles.

RELEVANCE: Horseshoe crabs (listed as vulnerable by the IUCN) are a critical keystone species of the Atlantic coast, providing essential nutrition for migrating sea and shore birds and other marine predators. Horseshoe crab blood is collected for human pathology laboratories to identify bacterial infection. While the total mortality of the collected and returned crabs is recorded by industries, much less is understood about the physiological fitness of the crabs after collection and bleeding.

RESPONSE: Consortium-funded researchers are examining the metabolic rate and metabolite products in horseshoe crab blood following collection and bleeding.

RESULTS: Early results indicate that age plays a factor in the types of blood profiles following collection and bleeding. While conducting this work, the PIs and graduate student have attended multiple public outreach events at schools and on local beaches to talk about horseshoe crab biology, ecology, and ongoing research.

Researchers Engage Stormwater Managers to Identify Ponds for Research on Phosphorus Dynamics and Water Quality

Debabrata Sahoo, Amy E. Scaroni, and C. Guinn Wallover, Clemson University

Erik Smith, University of South Carolina

Brooke R. Sarri, S.C. Sea Grant Consortium

RECAP: Scientists and extension agents worked with stormwater managers, workers, and technicians from the City of Charleston, Charleston County, and Horry County to identify stormwater ponds to study links between phosphorus dynamics, overall water quality, and the negative impact of algal blooms. These interactions led to the selection of suitable sites, the development of effective sampling protocols, and increased engagement from the project team.

RELEVANCE: Stormwater ponds are the most common (over 9,000 in coastal South Carolina) control structures used to meet permit requirements for land development in coastal South Carolina. While these ponds are designed to control flooding, they may also act as a water quality enhancement feature. Recently, residential areas have

experienced increases in algal blooms likely due to increased nutrient input (such as phosphorus).

RESPONSE: S.C. Sea Grant Consortium-funded researchers are working with stormwater managers and technicians to identify residential stormwater ponds at different age classes in order to study the correlation between stormwater pond age and phosphorus (P) dynamics. The study evaluates whether sediment acts as a source or sink of water column P over time, as sediment P sorption capacity decreases with increased P loading. All members of the project team are working directly with partners.

RESULTS: Site visits were conducted at stormwater ponds around Charleston to verify their age and accessibility, and finalize sampling protocol with the research committee.

PARTNERS: City of Charleston, Charleston County, Horry County

S.C. Sea Grant Consortium Researchers Investigate Benefits of Floating Wetland Installments for Stormwater Pond Quality

Bill Strosnider and Matt Kimball, University of South Carolina
Sarah White and Amy E. Scaroni, Clemson

RECAP: To better understand the potential of floating treatment wetlands as water quality enhancement in coastal stormwater ponds, S.C. Sea Grant Consortium (Consortium)-funded researchers conducted initial field sampling, experimental treatments of wetland plant growth under brackish conditions, and focus group dialogues with South Carolina residents to understand perceptions and maintenance concerns regarding coastal stormwater ponds.

RELEVANCE: Mitigation of contaminants in coastal-area, brackish ponds is critical because of their role as a last defense before stormwater impacts estuaries and coastal waters. Floating treatment wetlands (FTWs) are an increasingly applied and inexpensive constructed wetland technology that can be deployed in existing stormwater infrastructure. Since FTWs are a nascent technology, significant questions remain regarding contaminant processing capacity and habitat creation potential.

RESPONSE: Consortium-funded researchers are taking a multi-scale approach (greenhouse/mesocosm and field) to measure the ecological conditions for potential stormwater pond plant species to thrive, and the remediation benefit of floating treatment wetlands in brackish ponds. Additionally, team members are working with homeowners associations and stormwater pond managers to identify maintenance needs and goals while providing information on the potential benefits and outcomes of floating treatment wetlands. Results will be shared with pond owners and managers.

RESULTS: Potential field sites were surveyed in early 2022, and three suitable stormwater ponds were identified. Sampling efforts began in spring 2022, and these data will serve as the pre-treatment baseline data prior to application of the floating wetland treatment in spring 2023. Focus groups of coastal residents were also conducted to determine priorities regarding community ponds, and results were used to develop an online survey for distribution in spring 2023.

PARTNERS: Charleston Aquatics and Environmental, Inc., Beemats Floating Wetlands, Town of Mount Pleasant, Old Village Landing Homeowners Association, pond management professionals employed by The Lake Doctors, Inc. and The Greenery, Inc.

S.C. Sea Grant Researchers Developing New Tool to Model Compound Flooding

Timothy Callahan, College of Charleston

RECAP: S.C. Sea Grant Consortium (Consortium)-funded researchers are studying the causes and impacts of compound flooding from multiple sources (rainfall, stormwater, and tidal inundation) in local areas of Charleston County in order to create a map-interface tool that allows municipal decision-makers to plan for novel flood conditions.

RELEVANCE: In the last decade coastal S.C. has faced unpredictable compound flooding, where multiple flooding sources (stormwater runoff and tidal inundation) occur on the landscape at the same time. Sea-level rise, intense rainfall, and landscape change lead to a new type of flooding in this compound flooding zone where floodwaters from stormwater runoff collide with tidal floodwaters moving inland. Expanded information on compound flooding is needed for region-specific management decisions.

RESPONSE: Consortium-funded researchers and students are conducting a compound flooding risk study based on field data from two different sites (high urban density and semi-rural) near Charleston County and incorporate past and current research on compound flooding into a map-based tool for communication and decision-making with applicable predictions of areas that will be increasingly subject to compound flooding.

RESULTS: Tidal creek sites were established at Stono Preserve in Hollywood, SC, and Shem Creek in Mount Pleasant, S.C. where discharge and salinity measurements are collected biweekly, dependent on tidal conditions and precipitation. A discharge rate model is also being calibrated for incorporation into a map-based tool.

PARTNERS: Town of Mt. Pleasant Stormwater Management, Xylem, Inc., Creekside Neighborhood Association (Mt. Pleasant), Charleston Waterkeeper

S.C. Sea Grant Consortium Researchers Study Avian Biodiversity in Ephemeral Wetland Habitats

Daniel McGlinnn and Lucy Davis, College of Charleston

Stacey Lance, Savannah River Ecology Laboratory

Lisa Lord, The Longleaf Alliance

RECAP: S.C. Sea Grant Consortium (Consortium)-funded researchers are measuring avian habitat use and biodiversity in ephemeral wetlands within a coastal-forested system in comparison with upland habitat in order to measure the effects of management (tree thinning) designed to promote ephemeral wetland sites.

RELEVANCE: Ephemeral wetlands are unique habitats that occur in spatially isolated locations in forested landscapes and are sensitive to changes in hydrology and land-use change. They are also important repositories of bird biodiversity, yet are understudied. In order to determine the consequences of both ephemeral wetland loss and restoration potential, more research is needed to understand the use of ephemeral wetlands by avian communities.

RESPONSE: Consortium-funded researchers are conducting a comparative field study of avian biodiversity in wetland and upland habitats. They are examining whether bird biodiversity is higher in ephemeral wetlands compared to surrounding upland savannas, if the degree of species turnover, or beta diversity, is different between wetlands and uplands, and finally, what environmental variables drive species composition and biodiversity within

ephemeral wetlands.

RESULTS: The researchers found that wetlands were significantly more diverse and had more birds than uplands. Species such as blue-gray gnatcatchers, red-bellied woodpeckers, and great crested flycatchers were more common in wetlands. At this time the variation of wetland biodiversity and species composition has not correlated with vegetation metrics.

PARTNERS: Folk Land Management, Halidon Hill, Quinby Plantation

S.C. Sea Grant Consortium Researchers Investigate Ocean Acidification in Long Bay, S.C.

Angelos K. Hannides, Danielle Viso, and Susan Libes, Coastal Carolina University

Janet Reimer, Southeast Ocean and Coastal Acidification Network (SOCAN)

Emily Hall, Mote Marine Laboratory

RECAP: S.C. Sea Grant Consortium (Consortium) researchers are undertaking a study and associated outreach activities to measure the spatial and temporal extent of coastal ocean acidification (which may have negative impacts on shellfish production in coastal waters) and communicate the causes and effects of ocean acidification to residents and teachers.

RELEVANCE: Coastal ocean acidification (OA) can have a detrimental impact on shellfish production and survival. Hypoxia events (extended periods of low dissolved oxygen) have been detected by continuous sensors in Long Bay, SC, where a major shellfishery exists. Hypoxia may drive increased OA. A study is therefore needed to characterize temporal and spatial scales of OA in Long Bay and provide education resources to the public about potential effects of OA in coastal waters.

RESPONSE: Consortium-funded researchers conducted field sampling for acidification components on Long Bay for analysis. All information on the project will be placed on the Southeast Ocean and Coastal Acidification Network (SOCAN) webpage (www.socan.secoora.org/coastal-carolina).

RESULTS: All field sampling was completed and analysis is underway to characterize temporal and spatial scales of coastal ocean acidification in Long Bay, S.C. Additional outreach included a presentation to the S.C. Marine Educators Association meeting and planning for an ocean acidification module for the Teachers on the Estuary program with the two S.C. National Estuarine Research Reserves.

Consortium Works with Coastal Carolina University Engineering Students to Investigate Marine Debris in Capstone Project

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

George Hitt, Coastal Carolina University

RECAP: The S.C. Sea Grant Consortium tasked a group of engineering students with developing an innovative solution for marine debris in South Carolina for their senior capstone project. The Consortium provided mentorship to the team of engineering students over the fall semester as they brainstormed ideas to further pursue in the spring semester.

RELEVANCE: As required by Accreditation Board for Engineering and Technology, students in the engineering science program must have a culminating major engineering design experience that incorporates appropriate engineering standards and multiple constraints and is based on the knowledge and skills acquired in earlier coursework. During the fall semester, students work on analysis of the problem and study feasible solutions. In the spring semester, the students will further the solutions through prototypes, modeling, and redesign.

RESPONSE: The Consortium developed a project description that tasked a team of students to come up with an innovative marine debris solution for South Carolina. Students were asked to solve how to clean up marine debris once it enters stormwater ponds, lakes, rivers, marinas, harbors, and the ocean.

RESULTS: During the fall semester, the coastal processes specialist met with the student team regularly to provide input, feedback, and answer questions generated by the team as they brainstormed the feasibility of potential solutions. The semester ended with the team presenting their ideas to the Consortium and identifying a solution to further pursue. In the spring semester, the student team will continue to develop their chosen solution with guidance from the coastal processes specialist.

S.C. Sea Grant Consortium Developing Online Tool to Estimate Bacteria Sources and Loading Rates at a Watershed Scale

Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

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

Norman Levine and Morgan Peshoff, College of Charleston

Amy Scaroni and Raghupathy Karthikeyan, Clemson University

RECAP: In response to the growing number of water bodies impaired by bacteria pollutants in South Carolina, the S.C. Sea Grant Consortium formed a collaborative team to create an online tool to assess fecal bacteria pollution sources for use by watershed and stormwater managers.

RELEVANCE: South Carolina has roughly 1,200 impaired water bodies, with bacteria the cause of over half of these impairments. Additionally, there are concerns that sea-level rise and extreme precipitation events could impede proper functioning of septic systems, potentially further exacerbating this issue. Impaired water bodies can have a variety of negative impacts on overall public health, economic health, and ecosystem health. There are limited tools available to assist with estimating fecal bacteria pollution loading rates.

RESPONSE: A collaborative project team was formed to plan and develop a geographic information system-based tool (GIS) for assessing fecal bacteria pollution sources and loading rates on a watershed scale. S.C. Sea Grant Consortium staff began work on the tool as part of the project team, including GIS data analysis and engagement with environmental organizations to ensure proper sourcing and application of pollution datasets.

RESULTS: Funding was obtained (\$22,281) from the Clemson University South Carolina Water Resource Center to create the tool and a graduate student was hired at the College of Charleston for data sourcing and tool construction. Tool completion date will be late 2023, followed by training and outreach efforts for watershed and stormwater managers.

PARTNERS: College of Charleston, Clemson University

SUSTAINABLE COASTAL DEVELOPMENT AND ECONOMY

IMPACT

S.C. Sea Grant Consortium Manages the S.C. Clean Marina Program, Recertifying 4 Marinas in 2022

April Turner, S.C. Sea Grant Consortium

Nick Wallover, S.C. Department of Natural Resources

Liz Hartje, S.C. DHEC–Office of Ocean and Coastal Management and S.C. Clean Marina Technical Advisory Committee (7 industry members)

RECAP: The S.C. Sea Grant Consortium (Consortium) and partners continued to manage the S.C. Clean Marina Program (SCCMP), educating marina owners and staff about best management practices for improving water quality, which resulted in four marinas achieving clean marina recertification designations.

RELEVANCE: Due to the proximity of marinas to water, there is a potential for pollution generated from marina activities such as fueling operations, boat cleaning, maintenance/repair, boat sewage, and stormwater runoff from property parking lots to contaminate marina waters.

RESPONSE: In 2020, the Consortium took over the coordination of the SCCMP and over the past few years has worked with its partners to redevelop and revitalize/reinvigorate the program and increase the number of certified clean marinas in the state.

RESULTS: A certification training workshop was held on May 25, 2022 where eleven participants representing eight marinas were in attendance. As a result of this training, four marinas completed the recertification process and were designated as S.C. Clean Marinas. The Consortium and partners have continued to improve/enhance the SCCMP, by organizing training workshops, hosting technical team meetings, developing promotional and educational materials, and conducting site visits.

PARTNERS: S.C. Department of Natural Resources, Liz Hartje, S.C. DHEC–Office of Ocean and Coastal Management and the marina industry in S.C.

ACCOMPLISHMENTS

Consortium Assists Partners to Develop Concept for Boating Infrastructure Grant Program Economic Valuation Project

Matt Gorstein, S.C. Sea Grant Consortium

Nick Wallover and Ben Stone, S.C. Department of Natural Resources

Dan Gutentag, College of Charleston

RECAP: The S.C. Sea Grant Consortium (Consortium) assists S.C. Department of Natural Resources (SCDNR) in evaluating the economic benefits of the Boating Infrastructure (BIG) Program in South Carolina.

RELEVANCE: The primary purpose of the BIG program is to provide transient boaters with access to amenities that would otherwise be inaccessible due to limited infrastructure. The BIG program has supported the building of infrastructure in S.C. for almost 20 years, with an estimated \$35 million of funds obligated to projects in SC (roughly half of which are complete). SC benefits from the program since SCDNR is able to bring federal tax dollars back into the state. In FY21, they pulled in \$4.5 million dollars (33% of the entire awarded funds).

RESPONSE: SCDNR is interested in understanding the impact the BIG program has on the economy or community in S.C. to be able to put the cost of the program into context of the benefits. The Consortium worked with SCDNR to discuss valuation methods including travel cost surveys and input-output analysis, and connected SCDNR with the Office of Tourism Analysis (OTA) at the College of Charleston.

RESULTS: The Consortium, OTA, and SCDNR worked together to outline a concept of surveying transient boaters through email after their visits to estimate travel expenses for input into an IMPLAN model. Surveys are being implemented in spring and summer 2023. For costs, a selection of marinas (geographically spread, different sizes) that have received BIG funds will be interviewed for a breakdown of their infrastructure investments to capture the economic impacts of these projects.

PARTNERS: S.C. Department of Natural Resources, College of Charleston

S.C. Sea Grant Consortium and Partners Continue to Provide Accredited Training Program to Real Estate Professionals

Susan Lovelace, April Turner, Emmi Palenbaum, and Amanda Guthrie, S.C. Sea Grant Consortium
Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

RECAP: The S.C. Sea Grant Consortium (Consortium) and partners taught a series of accredited continuing education courses for 269 real estate professionals, with 11 trainings providing information and resources about important coastal issues for agents to share with clients. The Consortium is working with partners on program expansion to commercial real estate professionals and additional residential topics for future trainings.

RELEVANCE: As the number of people moving to coastal South Carolina continues to steadily increase, real estate professionals (REPs) are often the primary contact for new residents and business owners. Training REPs bridge an education and outreach gap, providing an opportunity for information and resource sharing. And in turn, REPs can share this knowledge as they interact with coastal newcomers to enhance scientific literacy, especially as it relates to flooding, sea-level rise, erosion, and tides.

RESPONSE: The Consortium with S.C. Coastal Information Network partners continued teaching “Calling the Coast Home.” This four-course series offered to coastal REPs as continuing education electives covers the topics of coastal ecosystem/biodiversity, water quality, flooding and flood maps, and building regulations in coastal zone critical areas. The Consortium continued to coordinate the program, overseeing program administration and renewal process for course modules and instructors. The program expanded coast-wide and is now offered through three realtor associations.

RESULTS: Eleven courses were taught by the Consortium and partners, with 269 attendees in total. Participants indicated that 78% increased their subject knowledge “a lot” and 70% are interested in taking additional courses. In September, the program was nationally recognized with the Superior Outreach Programming Award. These trainings are estimated to have provided an economic benefit of \$15,495. The Consortium is working on program

expansion to address commercial real estate professionals and additional residential topics.

S.C. Sea Grant Consortium Assists with National Working Waterfront Network Conference

April Turner, S.C. Sea Grant Consortium

RECAP: Through the activities of the Coastal Communities specialist as part of the National Working Waterfront Network, the Consortium has continued to support efforts to help ensure the economic viability and sustainability of working waterfronts and waterways.

RELEVANCE: As many traditional working waterfronts become vulnerable to high-end residential development, commercial activity, and climate change, much of the commercial seafood industry has been affected by changes in waterfront property use. The Consortium recognizes the importance of maintaining viable working waterfronts and supports efforts to help ensure the economic viability and sustainability of waterfront-dependent industries.

RESPONSE: The Consortium continued to support sustainable and economically viable working waterfronts through its involvement with the National Working Waterfront Network (NWWN), a nationwide network of businesses, industry associations, nonprofits, local governments, state and federal agencies, universities, Sea Grant programs, and individuals dedicated to supporting, preserving, and enhancing our nation's working waterfronts and waterways. The Coastal Communities specialist has provided technical guidance and leadership service, as part of the NWWN Advisory Committee since 2017.

RESULTS: The Coastal Communities Specialist assisted with conference planning, serving on the Program and Field Trip committees, moderating a panel session, and delivering presentation at the 2022 NWWN Conference, *Working Waterfronts: Traditions and Transitions*, in Boston, MA in July 2022. Nearly 300 attended this national event which provided participants opportunities to interact, share experiences, and advance knowledge, enabling coastal communities/stakeholders to make informed decisions, balance diverse uses, ensure access, and plan for the future of their working waterfronts.

Consortium Provided Oversight for S.C. Coastal Information Network to Coordinate Member Organization Efforts

April Turner and Emmi Palenbaum, S.C. Sea Grant Consortium

RECAP: For the past 15 years, the S.C. Sea Grant Consortium (Consortium) has managed the S.C. Coastal Information Network (SCCIN), which enhances coordination of outreach efforts among various federal, state, regional, and local network members and the strategic dissemination of information to coastal communities (including accredited continuing education courses for real estate professionals and stormwater management trainings and tools).

RELEVANCE: Communication and coordination among coastal South Carolina agencies and organizations providing outreach education to coastal communities has been challenging in the past. Information providers were often unaware of other similar outreach efforts underway targeting community leaders, local government staff, and residents. There was a need to avoid duplication of efforts, leverage scarce resources, and maximize program benefits.

RESPONSE: To improve communication and coordination among coastal outreach providers, the Consortium organized the SCCIN in 2006. SCCIN consists of more than 20 representatives from federal and state agencies, regional and local governments, and private organizations. The Consortium continued to work with SCCIN partners to serve the network's common audiences in a more organized, coordinated, and efficient manner while providing quality trainings and resources to coastal South Carolina constituents.

RESULTS: The Consortium continued to coordinate the accredited continuing education courses for real estate professionals, as well as work with SCCIN partners to provide pond conferences, stormwater management trainings, and tools. The Consortium continued to facilitate and organize network meetings (February 10 and June 20, 2022 and January 6, 2023) and maintain the SCCIN website event calendar and resource portal (www.sccoastalinfo.org), with 5,768 page views from visitors accessing the site's resources, training opportunities, and other events.

Strengthening Partnerships through National Extension Tourism

April Turner, S.C. Sea Grant Consortium

National Extension Tourism Design Team

RECAP: The S.C. Sea Grant Consortium (Consortium) and partners continue to encourage greater integration of research, education, and outreach within Cooperative Extension and Sea Grant as well as strengthen participation among members of the National Extension Tourism (NET) Network.

RELEVANCE: Tourism plays a significant role in the economies of our coastal and Great Lake states, with significant contributions to jobs, tax revenues, and quality of life. Sea Grant working with NET partners has the opportunity to greatly increase the well-being of coastal communities by taking on a prominent role in tourism, outdoor recreation management science, and community training through its research, extension, outreach, and communication programs.

RESPONSE: The Consortium with other state Sea Grant program staff, and NET design team partners worked to build and strengthen relationships with Land Grant Extension and other NET partners engaged in tourism-related programming.

RESULTS: The Consortium's coastal community specialist continued to serve as a regional representative on the NET design team—participating in quarterly meetings, as a member of the communications committee, assisting with NET website enhancements, including developing a resource library section; and is part of the 2023 Conference Planning Committee. More recently, an article highlighting Consortium tourism-related programs and co-authored with the assistant director for development and extension was featured in the extension foundation publication.

S.C. Sea Grant Consortium Provides Leadership to Nature-Based Tourism in South Carolina

April Turner, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium (Consortium) has continued to support the S.C. Nature-Based Tourism Association, through the activities of the coastal communities specialist, providing technical assistance, conference planning, and small business promotion to help ensure the economic viability and resource sustainability of the South Carolina nature-based tourism industry as demand for nature-based and outdoor recreation experiences steadily increases.

RELEVANCE: Tourism is an important economic driver for S.C., with the estimated impact climbing to \$29 billion in 2022. Demand for nature-based tourism and outdoor recreation has continued to steadily increase. Increasing numbers of people are drawn to the state, with both residents and tourists taking advantage of the abundant opportunities South Carolina's natural and cultural resources provide. It is vital to ensure that the S.C. nature-based tourism industry is both economically viable and sustainable.

RESPONSE: The Consortium continued to support sustainable statewide, nature-based tourism and outdoor recreation through its involvement with the S.C. Nature-Based Tourism Association (SCNBTA). The Consortium's coastal communities specialist serves on the SCNBTA board of directors, providing technical guidance and leadership service (including website administration and program planning for quarterly board meetings, annual conferences and workshops, as well as coordinating and developing marketing and membership strategies).

RESULTS: The Consortium's coastal communities specialist served as the conference co-chair responsible for organizing and facilitating the SCNBTA's 2022 conference in Myrtle Beach. The specialist served as website administrator, updating content and assisting new members with getting the most out of website features and other SCNBTA benefits. She continued to serve on the membership and communication committees, focusing efforts on newsletter creation and distribution and member marketing and promotion (including new banners and postcards).

Researchers Demonstrate Utility of Virtual Reality to Study Social Perspectives on Mariculture Development

William Norman, Lauren Duffy, and Jeffrey Hallo, Clemson University

RECAP: Scientists use virtual-reality headsets to demonstrate the potential locations and size of oyster farms on the South Carolina coast to study public perception of this economically important mariculture.

RELEVANCE: South Carolina's shellfish aquaculture industry has increased by 3,326% (2012–2019) in wholesale value. A S.C. Sea Grant Consortium (Consortium) objective is to provide tools and information to enhance waterfront economic growth, including aquaculture, while ensuring the sustainability of coastal environments and local cultural identities. This ongoing research effort informs decision-makers of sustainable mariculture growth by meeting Consortium strategy to "identify the potential economic, societal, and environmental effects of expanding and new uses of the nearshore."

RESPONSE: Consortium researchers administered 372 surveys and conducted 32 assessments using virtual-reality scenarios to measure public acceptability levels of oyster mariculture. This method was tested against traditional use of manipulated photographs. The results of this study will be shared with Charleston County Parks, Beaufort County Parks, the Town of Bluffton, and oyster growers.

RESULTS: Consortium researchers presented initial results at the Southeast, Environmental & Recreation Research Conference in March 2022. A student on the project has been accepted as a visiting professor at Eckerd College. Before the research program concludes in summer 2023, additional surveys will be collected and analyzed. Study information will guide oyster mariculture along SC coastlines; while the research design (using virtual reality to assess stakeholder views) will be applicable to the greater research community.

PARTNERS: Charleston County Parks, Beaufort County Parks, Town of Bluffton, Bluffton Farmers Market, Sea Island Farmers Market, Southeastern Wildlife Exposition

Consortium Researchers Identify Steps to Facilitate Beach and Park Access for Children with Autism Spectrum Disorder

Daniel Guttentag, College of Charleston

Wayne Smith, Toronto Metropolitan University

RECAP: Working with parents of children with autism spectrum disorder (ASD), S.C. Sea Grant Consortium (Consortium) researchers identified solutions to mitigate barriers for children with ASD to visit parks, playgrounds, and beaches. The study identified actions to facilitate park and beach usage, including fencing, easily accessible parking and restrooms, special calming areas, designated spaces and times for special needs children, and education about neurodiversity.

RELEVANCE: Research has demonstrated that children with ASD benefit from outdoor recreation; with outcomes including better communication, social interactions, and positive emotions. However, children with ASD are less likely than their peers to be taken to outdoor activities. This study by Consortium researchers focused on the parents of children with ASD to understand perceived barriers to using parks with playgrounds and beaches in South Carolina and identify solutions to mitigate these barriers.

RESPONSE: Consortium researchers conducted semi-structured interviews with parents of children having ASD and conducted surveys of parents with or without children with ASD. The interviews and surveys focused on family experiences, concerns of safety and public perception, cost, and usability of the public spaces.

RESULTS: The study found that despite barriers, families with children with ASD are frequent users of parks and beaches. The study identified actions to facilitate park and beach usage, including fencing, easily accessible parking and restrooms, special calming areas, designated spaces and times for special needs children, and education about neurodiversity. Study results were presented at the 2022 S.C. Sea Grant Consortium Research Symposium, a peer-review article, and a report for state parks and tourism organizations.

PARTNERS: College of Charleston, Toronto Metropolitan University

Consortium Researchers Work with Counties and HOAs to Establish Nutrient Reduction Study of Stormwater Ponds

Annie Bourbonnais and Erik Smith, University of South Carolina

RECAP: S.C. Sea Grant Consortium (Consortium)-funded researchers are working with residents and county stormwater managers to analyze the potential of nitrogen (N) input removal within coastal stormwater ponds to determine the role that pond vegetation and constructed wetlands can play in the removal of excess N.

RELEVANCE: South Carolina coastal development relies on stormwater pond construction and maintenance to control excess flooding and maintain water quality for receiving water systems and downstream coastal systems. While ponds can effectively remove or retain particle-associated pollutants, dissolved pollutants (such as excess N) can pass to connected waterways and cause issues such as harmful algal blooms and hypoxia (low oxygen in water). Identifying approaches to enable better N retention that are also acceptable to homeowners is critical.

RESPONSE: Consortium-funded researchers are measuring N removal rates in coastal ponds and wetlands to determine which conditions maximize N removal. They are testing the hypothesis that more vegetation around ponds will enhance N removal. The information will benefit pond owners (homeowners associations and property

owners associations) and stormwater engineers/managers to determine whether pond vegetation or other retrofitting can benefit systems by reducing N input.

RESULTS: Preliminary findings demonstrate higher nitrogen removal rates in more vegetated stormwater control measures.

PARTNERS: Georgetown and Horry County (stormwater departments), Waccamaw Management, Willow Bay Home Owners Association, Summerall Oaks Home Owners Association

Consortium Researchers Investigates Socio-Economic Impacts of Flooding in Regional Study

Robert Carey, Marzieh Motallebi, Tom Williams, and Amy E. Scaroni, Clemson University

RECAP: S.C. Sea Grant Consortium (Consortium) researchers are conducting a regional study (from North Carolina to Florida) that uses case studies of extreme weather and “sunny day” flooding to quantify the social and economic impacts of flooding on access to infrastructure through a combination of modeling and community surveys, with a focus on underserved communities.

RELEVANCE: Coastal flooding in the southeast Atlantic (U.S.) impacts communities and businesses through restriction of access to infrastructure—this particularly affects under-resourced communities who may not have access to resources to encumber adaptive strategies or recover after extreme events. A holistic study that encompasses flood event measurements, flood modeling, case studies of impacted communities, and development options is needed for decision-managers to understand decisions that enhance equitable resilience.

RESPONSE: Consortium-funded researchers are participating in a regional (North Carolina to Florida) multi-disciplinary study that examines: 1) observed and predicted flood data and effects within case study areas such as Georgetown County; 2) economic impacts to businesses and residents affected by flood events; and 3) costs associated with grey and green infrastructure strategies. Outreach activities are under development such as focus groups, maps, websites, and case study scenarios based on the Low-Impact Development Suitability Index ([clemson.maps.arcgis.com/apps/MapJournal/index.html?appid=175de90065eb4cc1816d57981baa43ba](https://maps.arcgis.com/apps/MapJournal/index.html?appid=175de90065eb4cc1816d57981baa43ba)).

RESULTS: Preliminary results suggest that property losses in Georgetown County increases gradually over time due to sea-level rise reaching close to \$500,000,000 by 2060. All industry sectors will suffer with the greatest impact on real estate and the arts, entertainment and recreation sectors experiencing the greatest losses. Government entities will face increasing losses in property tax.

PARTNERS: Georgetown County, Bucksport, SC, Debordieu Colony, North Inlet-Winyah Bay NERR, Winyah Rivers Alliance, American Rivers, Coastal Conservation League, Carolina Wetlands Association, North Carolina Sea Grant, Georgia Sea Grant, Florida Sea Grant

WEATHER AND CLIMATE RESILIENCE

IMPACTS

S.C. Sea Grant Consortium Compiles Archive of State Resilience Planning Efforts

Taylor Allred, Susan Lovelace, and Matt Gorstein, S.C. Sea Grant Consortium

RECAP: The South Carolina Resilience Planning Archive is a new research tool on the S.C. Sea Grant Consortium website that provides easy access to recent resilience planning documents from local governments and other entities and has been used by the SC Office of Resilience in the development of a statewide resilience plan.

RELEVANCE: The archive was developed for the South Carolina Office of Resilience (SCOR) and State Climatology office. Prior to launch, SCOR struggled to answer the question, “what is everyone doing on resilience?” The archive is the first central hub for South Carolina resilience plans and resolves the impracticality of local planners needing to search for hundreds of plans individually to identify best practices.

RESPONSE: The S.C. Sea Grant Consortium graduate resilience assistant Taylor Allred gathered, coded, and uploaded relevant reports available online from local governments, state and federal agencies, and non-governmental organizations. Allred also developed an online resilience plan submission form and reviewed the included plans to determine and code in the archive whether they considered future environmental conditions, considered affordable housing, when the next plan update is expected, among other fields.

RESULTS: As of April 10, 2023, the archive contains 542 plans. The archive is being used by the South Carolina Office of Resilience in the ongoing development of the first Strategic Statewide Resilience and Risk Reduction Plan. Communications rack cards have been sent to every public planner in S.C. and another set has been developed for residents to learn how their community is planning for resilience.

PARTNERS: Carolinas Integrated Sciences and Assessments, S.C. Department of Natural Resources, S.C. Office of Resilience

S.C. Sea Grant Consortium Engagement Leads to New Sandbag Locations During the Run-up to Tropical Cyclone Events

Sarah Watson and Susan Lovelace, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium (Consortium) identified a gap in the City of Charleston’s (City) preparation for tropical cyclone events in their distribution of sandbag locations prior to impacts.

RELEVANCE: A common method used in South Carolina to mitigate impacts of storm and tide flooding is to use sandbags to seal off the lower level of entryways as temporary flood barriers. Before tropical cyclone events, the City has several locations where they regularly dump sand and provide empty bags to residents to fill up and take back to their properties to prepare for flooding.

RESPONSE: The Consortium, working with partners, including the City of Charleston, developed engagement

sessions as part of a 2016 NOAA Resilience Grant. Through conversations with community members, it was identified that people in the eastside neighborhood of the City, a neighborhood consisting of predominately African American residents, felt that their access to sandbags was limited.

RESULTS: During the run-up to Hurricane Ian impacting South Carolina in 2022, the City used that information and placed a sand bag location near the eastside neighborhood to provide better access to these resources for the residents there.

PARTNERS: City of Charleston

Consortium Provides Coordination and Technical Assistance for Beaufort County Long-Term Resilience Strategy

Sarah Watson, Matt Gorstein, Amanda Guthrie, and Crystal Narayana, S.C. Sea Grant Consortium
Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

RECAP: Beaufort County (County) developed a long-term resilience strategy plan and updated its comprehensive plan with technical assistance from S.C. Sea Grant Consortium (Consortium).

RELEVANCE: Beaufort County has substantial vulnerabilities to flooding and sea-level rise. As such, the County has worked with the Consortium since 2012 on sea-level rise planning. The Consortium developed (in partnership with the former Carolinas Integrated Sciences and Assessments) a sea-level rise action plan for the County in 2015—recommendations from which were incorporated in the County’s comprehensive plan.

RESPONSE: The Consortium provided technical guidance and reviewed the County’s draft of the long-term resilience plan to the County for it to revise and finalize. The Consortium has partnered with the County on a research grant awarded by the Adaptation Sciences grant program through NOAA’s Climate Program Office that will evaluate climate impacts on groundwater.

RESULTS: The County has finalized a new long-term resilience plan that highlighted specific steps the County can take to increase resilience. Municipalities that served on the task force can incorporate the recommendations into their future planning work. Several recommendations in the draft plan have been woven throughout the comprehensive plan which was adopted in fall 2021.

PARTNERS: Beaufort County

Consortium Conducts Tidal Vulnerability Assessment for Town of Pawleys Island Sea-level Rise Adaptation Plan

Landon Knapp and Duncan Williamson, S.C. Sea Grant Consortium and College of Charleston
Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University
Norman Levine, College of Charleston

RECAP: In response to increasing flood vulnerabilities, the S.C. Sea Grant Consortium (Consortium) responded to a request from the Town of Pawleys Island, S.C., to conduct a high-resolution flood mapping analysis of the barrier island community. Results of the analysis drove the selection of planning horizons by the town and were incorporated into a sea-level rise adaptation plan (which is currently under review for adoption by Town Council).

RELEVANCE: Pawleys Island is a small, low-lying barrier island that is experiencing impacts from flooding and sea-level rise. The Town's economy is entirely dependent on the water that surrounds it, while flooding has been identified as one of the top issues needing to be addressed. In May 2022, the town began an effort to plan for adaptation to sea-level rise and requested the Consortium's support to provide science-based information to guide the process.

RESPONSE: The Consortium (in collaboration with the College of Charleston) conducted a high-resolution, local flood mapping analysis of the Town of Pawleys Island. The study analyzed the vulnerability of key community assets such as roads, parcels, buildings, and businesses to tidal flooding (including future sea-level rise conditions). Results were communicated to town administrators and residents at an engagement event using touch screen monitors and via an interactive online tool.

RESULTS: The Town of Pawleys Island utilized the results of the Consortium's flood mapping analysis to draft a sea-level rise adaptation plan (which has been finalized and is currently under review for adoption by Town Council). Results of the tidal vulnerability analysis conducted by the Consortium revealed a tipping point at 2-ft of sea-level rise, which the town subsequently selected as their planning target over the next 30 years. The plan draft can be found at this link <https://www.townofpawleysisland.com/wp-content/uploads/2022/12/6C.-Pawleys-SLR-Adaptation-Plan-Draft-v5-1.pdf>.

PARTNERS: College of Charleston, Town of Pawleys Island, SC, Elko Coastal Consulting

Assessing Flood Risk in Rosemont, S.C., Through Water Quality Analysis, Hydrology Mapping, and Bioremediation

Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

Lara Noren, National Oceanic and Atmospheric Administration

Brian Walter, Charleston Community Research to Action Board

Omar Muhammed, Lowcountry Alliance for Model Communities

Sheelah Bearfoot, Anthropocene Alliance

Norman Levine and Vijay Vulava, College of Charleston

RECAP: The S.C. Sea Grant Consortium (Consortium) is collaborating with researchers from the College of Charleston to conduct flood assessments and water quality analyses for a situationally vulnerable and historically underserved community.

RELEVANCE: Rosemont is a historic neighborhood in Charleston, S.C., bordering salt marshes, the Ashley River, and a major interstate. This community faces acute threats from legacy industrial pollutants, poor air quality, and flood risk that is exacerbated by sea-level rise.

RESPONSE: The Consortium is collaborating with researchers from the College of Charleston to conduct water quality analyses and hydrologic mapping of tidal and precipitation-based flooding. A citizen science program has been designed and is being implemented where community members are being trained to collect and store water samples for analysis. Funding and permitting for installation of a water level sensor have been secured for a tidal creek within the community (which will be installed in 2023).

RESULTS: A citizen science program has been designed and is being implemented where community members are being trained to collect and store water samples for analysis. Funding and permitting for installation of a water level

sensor have been secured for a tidal creek within the community (which will be installed in 2023).

PARTNERS: Charleston Community Research to Action Board, Lowcountry Alliance for Model Communities, AGU Thriving Earth Exchange, National Oceanic and Atmospheric Administration, Anthropocene Alliance, College of Charleston, Rosemont Community Association

S.C. Sea Grant Consortium Conducts Groundwater Table and Marsh Vulnerability Studies to Guide Nature-Based Solutions

Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

Lee Bundrick, Kiawah Conservancy

Norman Levine, College of Charleston

RECAP: With the growing importance of understanding characteristics of the groundwater table for both hazard mitigation and environmental health, S.C. Sea Grant Consortium (Consortium), alongside a team of experts, conducted a long-term monitoring study with the installation of a network of groundwater wells across a barrier island system and mapping the vulnerabilities of the salt marsh system and mitigation options.

RELEVANCE: While much attention is paid to the flow and accumulation of surface water, little is known about the characteristics of the groundwater table and its influence on the plant, animal, and human communities in coastal areas. The depth and salinity of subsurface groundwater are major factors influencing the health of coastal ecosystems and flood conditions impacting people. The marsh also provides critical ecosystem services to humans and wildlife and faces a variety of stressors.

RESPONSE: The Town of Kiawah Island and National Fish and Wildlife Foundation funded a collaborative research project led by the Consortium, Kiawah Conservancy, and the College of Charleston. The project funded graduate-level students to install 18 monitoring wells to sample groundwater conditions across different elevations, soil types, and locations. Five wells additionally recorded salinity. The vulnerability of salt marsh habitat was mapped with recommendations for oyster-based living shoreline implementation to mitigate marsh losses.

RESULTS: The Kiawah Conservancy (with support from the Consortium) published the *Nature-Based Solutions Manual for Kiawah Island*, which focused on highlighting novel concepts and solutions for addressing community resilience. The manual includes best practices for addressing challenges to the changing coastal environment through nature-based solutions, in addition to methods and results of the collaborative studies. The manual was utilized in the creation of the Town of Kiawah Island comprehensive marsh management plan, released in November 2022.

RESULTS: The Kiawah Conservancy (with support from the Consortium) published the *Nature-Based Solutions Manual for Kiawah Island*, which focused on highlighting novel concepts and solutions for addressing community resilience. The manual includes best practices for addressing challenges to the changing coastal environment through nature-based solutions, in addition to methods and results of the collaborative studies. The manual was utilized in the creation of the Town of Kiawah Island comprehensive marsh management plan, released in November 2022.

PARTNERS: Kiawah Conservancy, College of Charleston, Town of Kiawah Island

ACCOMPLISHMENT

S.C. Sea Grant Consortium Researchers Create Real-Time Road Flooding Map for Charleston Area Businesses and Residents

Norman Levine, Lancie Affonso, and Kendra Stewart, College of Charleston
Emma Paz, City of Charleston

RECAP: To provide a user-friendly app of likely road closers around the Charleston area, a database was created using pre-modeled tidal flooding severity for every road in Charleston County, linking intervals of tide height to corresponding flood intensity for each road segment. A digital elevation model incorporating 8,000 culverts in the study area was shared with NOAA-OCM for incorporation into the Sea Level Rise Viewer.

RELEVANCE: Road closures and flood-based hazardous conditions are a significant threat to safety and mobility in the South Carolina Lowcountry, with significant and frequent disruptions for Charleston-area residents and businesses. A usable tool that combines road structure elevation with predictions to coastal flood conditions and rain events would enable municipal decision-makers to prioritize street closures and drivers to find alternative routes in real time. Additionally, such a tool could be used to prioritize infrastructure maintenance and changes.

RESPONSE: S.C. Sea Grant Consortium-funded researchers developed an online spatial database (including Android and Apple platforms) to model the likelihood of flooding under precipitation and tidal conditions for every road within Charleston County. NOAA-OCM's Coastal Change Analysis Program provided 1-m resolution land cover data and NOAA's NWS advised the project team on NWS tidal prediction and precipitation methodologies. In addition to a published report, 12 professional presentations associated with the project were given.

RESULTS: A digital elevation model incorporating 8,000 culverts in the study area was shared with NOAA-OCM for incorporation into the Sea Level Rise Viewer and as a supplemental dataset for use by the Coastal Change Analysis Program. These datasets and models were shared on the SCGIS laboratory online portals and made accessible to all groups that requested data for their projects, including the GIS Public Lowcountry Users Group and the county-level Coastal GIS Users Group.

PARTNERS: ESRI, NOAA-OCM, NOAA-NCCOS

S.C. Sea Grant Consortium Creates Coastal Watershed Community Engagement Specialist Position

Ke'Ziyah Williamson, Susan Lovelace, and Matt Gorstein, S.C. Sea Grant Consortium
Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

RECAP: The S.C. Sea Grant Consortium (Consortium) secures funding to create a coastal watershed community engagement specialist position to continue valuable programs and implement new ones.

RELEVANCE: Increasingly, decision makers (including the S.C. Office of Resilience) are considering watershed scales in their priorities. On top of that, inland underserved communities that live near rivers within the coastal watershed need information on nearby water levels to help inform planning and disaster response efforts, having been highly impacted by Hurricanes Matthew and Florence.

RESPONSE: Recognizing that watersheds that drain into the coast encompass communities that are further inland than coastal counties themselves, the Consortium hired Ke’Ziyah Williamson as a Community Engaged Intern (CEI) in 2022 to expand a network of real-time water level sensors to underserved communities in the Pee Dee River region.

RESULTS: Leveraging funds from the Southeast Coastal Ocean Observing Regional Association (SECOORA) and other grant funds Williamson has stayed on full time as the coastal watershed community engagement specialist to continue identifying possible locations and working with communities to install water level sensors., She is also the engagement lead on a project examining community experiences with and perceptions about buyout programs.

PARTNERS: Francis Marion University, Southeast Coastal Ocean Observing Regional Association

Consortium and Collaborators Expanding Water Level Sensor Network in the Pee Dee Watershed

Ke’Ziyah Williamson, S.C. Sea Grant Consortium

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Paul Gayes, Coastal Carolina University

Jeff Steinmetz, Francis Marion University

Debra Hernandez, Southeast Coastal Ocean Observing Regional Association

RECAP: The S.C. Sea Grant Consortium collaborated with the Southeast Coastal Ocean Observing Regional Association (SECOORA), Francis Marion University (FMU), and Coastal Carolina University (CCU) to install water level sensors in situationally vulnerable communities throughout the Pee Dee watershed to provide decision-support for communities and provide data to enhance flood modeling.

RELEVANCE: South Carolina’s low-lying coastal region is highly vulnerable to tidal flooding, having experienced repeated impacts from extreme and chronic flooding over the last decade. The complexity of tidal systems combined with the lack of widely distributed monitoring equipment has resulted in poor understanding of the preparation and response needed for local communities. The connection of tidal systems with upland watersheds calls for the installation of water level sensors throughout the Pee Dee watershed.

RESPONSE: As part of the Consortium’s Community Engaged Internship Program, an intern was hired to build connections in communities interested in water level sensors. The intern connected with five communities. A specialist (in partnership with SECOORA) was then hired to continue the work, resulting in connecting with two additional communities. This initiative aims to enhance flood modeling throughout the Pee Dee watershed while providing communities the tools to understand and respond to localized water level changes.

Results: The Grant Consortium identified and collaborated with five counties, Lancaster, Marlboro, Florence, Marion and Lee. After coordinating with researchers at Coastal Carolina University, the county and the S.C. Department of Transportation, plans are near completion to install the first of these in Bennettsville, S.C.

PARTNERS: Southeast Coastal Ocean Observing Regional Association, Francis Marion University, and Coastal Carolina University

Understanding the Perceptions and Impacts of Buyout Programs as a Mitigation Response for Resilience in Rural Communities

Ke'Ziyah Williamson, S.C. Sea Grant Consortium

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

Scott Curtis, The Citadel

Jennifer Helgeson, National Institutes for Standards and Technology

Jamie Kruse, Anurdha Mukherji, and Ausmita Ghosh, East Carolina University

RECAP: The S.C. Sea Grant Consortium partnered with East Carolina University, The Citadel, and the National Institute of Standards and Technology to examine the full impact of buyout programs in two rural communities in the Carolinas. Ultimately, rural communities should be better prepared for and recover sooner from compound flood events and coastal inundation.

RELEVANCE: Many of the low-income, rural communities of S.C. have been underserved by past environmental initiatives. Several of the rural counties in the state also experience chronic flooding and are currently undergoing buyout programs as a response to flooding from extreme events such as Hurricane Matthew and Florence.

RESPONSE: Following engagement with the S.C. Office of Resilience, Bennettsville, S.C., was chosen for an impacts of buyout programs study (as it is a rural, flood-prone, low-income community undergoing the buyout process). In fall 2022, a specialist was hired to build connections and trust within the community, resulting in built connections with four community leaders and grassroots organizations. This team will conduct one-on-one interviews with community leaders and host focus groups with community members.

RESULTS: The team is engaging and building partnerships with programs such as the Center for Heir's Property and S.C. State University Extension Program for assistance in contacting and interviewing community leaders and householders.

PARTNERS: The Citadel, East Carolina University, National Institutes for Standards and Technology

S.C. Sea Grant Consortium and Partners Conduct Beach Erosion Research and Monitoring

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Paul Gayes, Coastal Carolina University

RECAP: The S.C. Sea Grant Consortium and Coastal Carolina University calculated the sediment volume change on beaches at Surfside, Garden City and North Myrtle Beach to help characterize and manage erosion as part of annual survey profiles required to determine future work in the Grand Strand Renourishment Project by the U.S. Army Corps of Engineers. Volume changes were also conducted as a result of Hurricane Ian impacting the area in September 2022.

RELEVANCE: The Grand Strand beaches in Horry County are major tourist destinations that support the local and state economy. The beaches experience shoreline changes from various coastal processes. The health of the beaches is important to track and maintain in order to help communities manage their shoreline changes. The U.S. Army of Engineers requires that Horry County and the City of North Myrtle Beach monitor annually to assist in their future renourishment project planning.

RESPONSE: The Consortium processed and analyzed the beach profile surveys for 83 transects covering 19 miles of

oceanfront shoreline within Horry County.

RESULTS: Two separate reports were produced that provided graphical and textual explanations of the shoreline changes observed in 2021 and 2022. For Horry County, a third report was also developed to explain changes post Hurricane Ian. These reports were delivered to Horry County, City of North Myrtle Beach, and U.S. Army Corps of Engineers to assist in determining timing of the next renourishment event.

S.C. Sea Grant Consortium and Partners Use Virtual Reality Storm Surge Simulations to Increase Risk Awareness

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Amanda Guthrie, S.C. Sea Grant Consortium

Jill Gamble and Nina Sassano, Marine Extension and Georgia Sea Grant

Sun Joo Ahn, University of Georgia

Matt Browning, Clemson University

RECAP: The S.C. Sea Grant Consortium (Consortium) and its partners provided training and piloted a tandem virtual reality simulation to help drive home the concepts and risks associated with storm surge for individuals throughout coastal Georgia and South Carolina.

RELEVANCE: Storm frequency and coastal populations in the Southeast are increasing, but many people have not experienced a hurricane. They are unfamiliar with storm surge, the damage it can cause, and actions they can take to protect their home. Using a virtual reality storm surge simulation offers the chance to “redo” the experience after taking preventative actions. This project is important in improving how extreme weather risks and their associated preparative actions are conveyed.

RESPONSE: The Consortium continued to provide expertise on the development of the virtual reality simulation in addition to the training modules on storm surge and mitigation actions.

RESULTS: Consortium staff developed and distributed a survey to state, county, and local emergency managers to collect feedback on the preferred format and topics of the training modules to be developed. Five main topics were identified: introduction to hurricanes, hurricane risks & changing conditions, short-term hurricane preparation, resilience to hurricanes, and post hurricane recovery.

Consortium Identifies Two Locations to Deploy Temporary Weather Towers Ahead of Storms Expanding Multi-State Effort

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Brian Phillips, University of Florida

Britt Raubenheimer, Woods Hole Oceanographic Institution

RECAP: S.C. Sea Grant Consortium established two locations in South Carolina to expand the Project Sentinel effort, which deploys temporary weather towers before landfall of a tropical cyclone in order to measure real-time wind speed, water depth, and wave heights.

RELEVANCE: Existing monitoring stations generally report wind or hydrodynamic conditions, but not both. Further, these monitoring stations may not be close to the landfall of a hurricane or are not engineered to operate during

extreme conditions. The data collected from Project Sentinel stations provides real-time data to weather apps, news outlets, and emergency operations centers, and can be used for modeling. This project has partners in North Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas.

RESPONSE: The coastal processes specialist contacted seven cities and towns in SC to identify communities who would like to host a tower. The opportunity was shared at the S.C. Beach Advocates meeting and city council meetings. Field visits occurred with interested cities to determine the most accessible and appropriate location. Finally, coordination occurred to write a protocol for install, encompassing who within the city would be notified (including turtle patrol).

RESULTS: The Consortium was able identify two potential sentinel tower locations at Folly Beach and North Myrtle Beach. Written agreements and deployment procedures with these cities were established in the event that either city is in the path of a hurricane. The plan was to deploy during Hurricane Ian in September 2022; however, the deployment team (based in Florida) was severely impacted by Hurricane Ian and unable to mobilize in time.

S.C. Sea Grant Consortium Coordinates New Coastal Processes Extension Advisory Committee

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

RECAP: The Consortium's coastal processes program specialist continues to build meaningful programs with input from external partnerships within the established Coastal Processes Extension Advisory Committee.

RELEVANCE: In October 2021, the Consortium hired a coastal processes specialist to establish a sustainable extension program within the Weather and Climate and Resilience programmatic focus area to address issues related to the connection between coast and inlands of South Carolina. Building a successful extension program requires inclusive and constructive collaboration with partners throughout the state to enhance the reach into the communities served.

RESPONSE: In March 2022, the Consortium convened a Coastal Processes Extension Advisory Committee meeting. The purpose of the committee is to discuss and identify current issues impacting coastal natural resources and the communities dependent upon them while assisting with the formulation of solutions to address the identified needs of constituents through strategic planning priorities. Several relevant stakeholder groups with an interest in weather and climate resilience participated, resulting in a committee of five partners.

RESULTS: Feedback was gathered through the initial 2022 meeting, specifically focused on efforts within the Coastal Climate and Resilience program. 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 Coastal Processes Extension program.

S.C. Sea Grant Consortium Assess Sea-Level Rise and Climate Change Impacts on Groundwater in Beaufort County

Amanda Guthrie, Sarah Watson, Brita Jessen, and Susan Lovelace, S.C. Sea Grant Consortium

Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

Abi Locatis Procheska, ACE Basin NERR and S.C. Department of Natural Resources

Alicia Wilson and Dami Abioye, University of South Carolina

Norman Levine, Matt Nowlin, Duncan Williamson, and Lauren Greenwood, College of Charleston
Robert Merchant and Kristen Forbus, Beaufort County

RECAP: The S.C. Sea Grant Consortium (Consortium) and partners received funds from the NOAA Climate Program's Adaptation Sciences Program to assess groundwater levels and its impact on communities and on underground infrastructure in Beaufort County (County). Fifteen ground water wells were installed along with community engagement.

RELEVANCE: Coastal communities have approached planning for sea-level rise in varying ways. However, many of these methods focus on flooding without necessarily connecting surface inundation with what happens below ground and to the systems that allow communities to function in built environments. Co-production methods are being increasingly emphasized as means to achieve advancements in resilience to climate change.

RESPONSE: The Consortium formed an interdisciplinary team of researchers and extension professionals to investigate the "so what" part of how sea-level rise affects communities by studying how these systems may be disrupted by extreme events and sea-level rise. By taking a proactive approach, we can help communities better plan for these failures and reduce the disruption and damage that will come as sea level continues to rise.

RESULTS: Fifteen groundwater wells were installed across four communities in Beaufort, South Carolina. The groundwater data can inform County priorities and policies to reduce climate change impacts. One community meeting was held to share information about the project and learn about community experiences and priorities. Additionally, the Consortium was interviewed and published in Yale Climate Connections ([yaleclimateconnections.org/2023/03/rising-seas-could-cause-septic-system-failures-in-beaufort-county-south-carolina/](https://climateconnections.org/2023/03/rising-seas-could-cause-septic-system-failures-in-beaufort-county-south-carolina/)).

PARTNERS: ACE Basin NERR, S.C. Department of Natural Resources, University of South Carolina, College of Charleston, Beaufort County

S.C. Sea Grant Consortium Works to Address Heat Health Concerns in the City of Charleston

Amanda Guthrie and Susan Lovelace, S.C. Sea Grant Consortium
Scott Curtis, The Citadel James B. Near Center for Climate Studies
Geno Olmi, NOAA Southeast and Caribbean Region Team
Janice Barnes, Climate Adaptation Partners

RECAP: The S.C. Sea Grant Consortium and partners received funds from the NOAA Climate and Equity Roundtable funding opportunity to assess heat health risk within the City of Charleston. Led by the Consortium, the team worked with residents in a public housing neighborhood to assess temperatures in a variety of areas in the neighborhood as well as coming from building materials.

RELEVANCE: In the United States, heat kills more people than any other weather-related hazard. Due to climate change, days and nights will be hotter, creating an additional stressor that will harm outdoor workers, low wealth and marginalized communities, people with chronic health conditions, and many others. As heat is seen as a normal part of life in the Southeast, there is an increasing need to raise awareness of and reduce heat health impacts.

RESPONSE: The Consortium has partnered with state and federal agencies to better assess heat within the City of Charleston. After the Charleston Peninsula was mapped to identify heat islands, additional funding was secured

through the NOAA Climate and Equity Roundtables to more equitably reduce heat island effects and heat-health stress in the city.

RESULTS: In collaboration with local residents and volunteers, the project team, which included graduate students from multiple Consortium member institutions, measured the different temperature of different building materials and materials used at other outdoor spaces (e.g., playgrounds, trees) at a public housing complex. They also measured the thermal stress due to sun radiation, wind, temperature, and humidity at multiple points within the complex. Further, a tabletop planning exercise will be developed to help the City of Charleston formally develop a heat-reduction plan.

PARTNERS: City of Charleston, The Citadel, Climate Adaptation Partners, Medical University of South Carolina, NOAA Southeast and Caribbean Region Team, University of South Carolina and National Weather Service

S.C. Sea Grant Consortium Supports Discussions and Collaborations About Climate-Induced Displacement and Relocation

Amanda Guthrie and Susan Lovelace, S.C. Sea Grant Consortium
Mona Behl, UGA Marine Extension and Georgia Sea Grant

RECAP: The S.C. Sea Grant Consortium (Consortium) served on the overall research team and on the steering committee for the Southeastern and Gulf of Mexico workshop for the People on the Move in a Changing Climate (PEMOCC). The workshop held in December 2022. provided an opportunity for researchers, practitioners and government agencies to explore climate migration in the region.

RELEVANCE: Climate change impacts have and will continue to make some places unlivable (permanently or temporarily) in coastal regions. One consideration to address these changes is for people to relocate from at-risk areas. There is a lack of knowledge on how socioeconomic, cultural, political, and environmental processes impact these population shifts. As climate-induced retreat can be a controversial topic, this strategy is not often discussed or shared among communities, practitioners, and researchers.

RESPONSE: Led by Georgia Sea Grant workshops were held as part of the People on the Move in a Changing Climate (www.pemocc.org/) research coordination network. These workshops facilitated transdisciplinary collaborations among researchers, practitioners, resource managers, and coastal stakeholders to improve understanding of how climate change drives human populations both towards and away from coastal regions. The Consortium served on the steering committee for the Southeast and Gulf of Mexico workshop and hosted panels with experts in the field.

RESULTS: Over 40 people attended a workshop held in Atlanta, GA, to discuss climate-induced displacement and relocation within the Southeast and Gulf of Mexico. S.C. Sea Grant Consortium hosted two panels at the workshop. Since the closure of the December workshop, the workshop attendees have met to discuss follow-up steps that were formulated during the workshop.

PARTNERS: UGA Marine Extension and Georgia Sea Grant, Florida State University, Alaska Sea Grant, New Jersey Sea Grant Consortium, USC Sea Grant, Delaware Sea Grant, Illinois-Indiana Sea Grant, National Sea Grant Law Center, Pennsylvania Sea Grant, Ohio Sea Grant, Washington Sea Grant

S.C. Sea Grant Consortium Provides Technical Assistance to S.C. Office of Resilience for Statewide Resilience Planning

Susan Lovelace, Amanda Guthrie, Matt Gorstein, and Sarah Watson, S.C. Sea Grant Consortium
Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

RECAP: The S.C. Sea Grant Consortium (Consortium) provided technical assistance and guidance to the S.C. Office of Resilience (SCOR) to advise development of a strategic statewide resilience and risk reduction plan.

RELEVANCE: The S.C. governor and state legislature recognized the need to address community resilience with a dedicated state agency after repeated flooding impacts. SCOR has been directed to develop, implement, and maintain a strategic statewide resilience and risk reduction plan (the first SC statewide resilience plan). The plan is intended to serve as a framework to guide state investment in flood mitigation projects and the adoption of programs and policies that protect South Carolina's people and property.

RESPONSE: The Consortium aided in training sessions on climate science and implications of climate change in S.C.; a presentation to SCOR's advisory task force; an analysis of out-of-state sea-level rise and climate planning scenarios; an analysis of plans to help SCOR identify the state of resilience activities; and communications training. The Consortium assisted in the development of a S.C. climate report. Consortium staff served on the Resilience Plan Advisory Committee and several ad hoc committees.

RESULTS: SCOR drafted a strategic statewide resilience and risk reduction plan with guidance from the Consortium, which is planned for completion on July 1, 2023. In collaboration with the Consortium, SCOR was awarded a grant (\$750,675) from the National Fish and Wildlife Foundation to conduct resilience planning at the watershed level (a main tenant of the draft statewide resilience plan).

PARTNERS: S.C. Office of Resilience

S.C. Sea Grant Consortium Researchers Develop Tool to Identify Real-Time Impacts of Coastal Hazards and Storms

Mostafa Batouli and Deepti Joshi, The Citadel

RECAP: Locally relevant vulnerabilities and impacts from coastal hazards and storms can be detected by combining social network data (e.g., Twitter) with Census, geographic, and infrastructure mapping. The study reveals that there are differences in how racial and ethnic groups perceive vulnerability (which should be addressed in communications).

RELEVANCE: Coastal storms and hazards (e.g., flooding) result in different impacts to communities based on locally relevant socio-economic, geographic, and infrastructure factors. Understanding how communities describe and respond to these impacts requires real-time social data combined with locally relevant mapping. Combined, the socio-economic and geo-spatial data can inform better decision making and prioritization of resources and actions.

RESPONSE: Consortium-funded researchers created a tool using "social sensing," based on Twitter data obtained following Hurricane Dorian (2019) combined with demographic, socioeconomic, and occupation data collected at the Census Tract level to develop a database of community characteristics. Locally specific flood events and power outages were detected through this method, providing a novel tool for on-time decision-making by disaster management agencies. The identification of both socioeconomic and physical vulnerabilities in affected regions also enables better hazard mitigation.

RESULTS: This project developed a novel approach for identifying the physical and socioeconomic vulnerabilities in areas affected by natural disasters based on social sensing. The method was tested for the impacts of the 2019 hurricane Dorian on South Carolina. The results showed the promising capabilities of the method in near real-time detecting of events such as flooding and power outages as well as identifying different types of vulnerabilities among various socioeconomic groups.

PARTNERS: The Citadel

S.C. Sea Grant Consortium Awarded \$500K Grant to Assess Feasibility of Thin Layer Placement in South Carolina

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Matt Gorstein and Brita Jessen, S.C. Sea Grant Consortium

Giulio Mariotti, Louisiana State University

Andrew Tweel, S.C. Department of Natural Resources

Ellie Lovellette, College of Charleston

RECAP: The S.C. Sea Grant Consortium (Consortium) was awarded nearly \$500,000 over four years from a joint grant competition of the NOAA National Sea Grant College Program and the U.S. Coastal Research Program to develop an assessment framework on the benefits and feasibility of thin layer placement (TLP) in SC. An advisory committee was established to guide the group evaluating TLP as a beneficial restoration technique to increase marsh resilience to sea-level rise and storms.

RELEVANCE: Chronic (e.g., sea-level rise) and episodic (e.g., storm impact) changes to the south Atlantic coast are increasing the vulnerability of coastal wetlands, past marshes' ability to recover naturally. TLP is a process where sediment removed from navigation channels during dredging is transported to a marsh and sprayed on the surface of the marsh. This sediment addition to marshes can be beneficial as a dredge material disposal site and increasing marsh resilience.

RESPONSE: The Consortium and partners will develop a multisectoral framework to assist in decision making for potential TLP sites in S.C. Potential TLP locations will be assessed from an economic, regulatory, ecological, and socio-cultural lens, and then representative sites will be implemented in a geomorphological model (MarshMorpho2D) to evaluate the potential for success.

RESULTS: An advisory committee has been formed to guide the project including representatives from academia, federal and state government, and Army Corp of Engineers as well as environmental, tourism and community organizations.

S.C. Sea Grant Consortium Establishes Coast Snap Station in Horry County

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Ian Conery, U.S. Army Corps of Engineers, Engineer Research and Development Center

RECAP: The S.C. Sea Grant Consortium continued working with the U.S. Army Corps of Engineers Research and Development Center and installed a Coast Snap station in Horry County. The station allows people to take and submit photos of the shoreline from the same vantage point to measure how the beach is responding to various events such as king tides, storms, and sea-level rise.

RELEVANCE: The Grand Strand beaches in Horry County are major tourist destinations that support the local and state economy. The beaches experience shoreline changes as a result of various coastal processes. The numerous visitors to the beaches provide a valuable citizen science resource to assist in monitoring how areas are affected by various events. This project also presents an opportunity to educate the public on shoreline erosion and renourishment events.

RESPONSE: The Consortium with assistance from Coastal Carolina University students facilitated the installation process—students will continue to be involved in maintaining and processing the incoming data from the Coast Snap station. Future work will continue to refine how to most effectively disseminate the images and information from the Coast Snap station.

RESULTS: In November 2022, the coastal processes specialist installed a Coast Snap station on the Cherry Grove Fishing pier in North Myrtle Beach. The pier experienced damage during Hurricane Ian; however, the pier remains committed to participation, anticipating more engagement with the station in the following year (beyond the hurricane damage and station install occurring post-tourist season). Discussions are underway to install another Coast Snap station in Charleston County in 2023.

S.C. Sea Grant Consortium Participates in Development of Living Shorelines Education Course

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Abi Locatis Prochaska, ACE Basin NERR and S.C. Department of Natural Resources

Kim Morganello, Carolina Clear and Clemson Extension

RECAP: An online 4-week course is being developed to better educate coastal property owners and contractors on where living shorelines are suitable and best practices for installation. The course content is being developed by various education partners and being led by S.C. Department of Natural Resources (SCDNR) and Clemson Extension.

RELEVANCE: South Carolina coastal property owners and other stakeholders had expressed an increased interest for options to naturally stabilize shoreline within the estuarine environment. As a result (in 2016) the S.C. Department of Health and Environmental Control embarked on a five-year strategy to develop a regulatory definition and project standards for living shorelines in South Carolina. The living shoreline regulations were introduced to the S.C. General Assembly and became effective in May 2021.

RESPONSE: In an effort to educate contractors and other stakeholders on various aspects of installing living shorelines, SCDNR and Clemson Extension brought together education partners to develop an online 4-week, go-at-your-own-pace course with an accompanying field day.

RESULTS: The coastal processes specialist developed a module to explain site access during construction. This module covers best practices for limiting disturbance in the critical area and the best way to transport materials, stage materials, and work within the site. The full 4-week course offerings are expected to be available in the summer of 2023.

S.C. Sea Grant Consortium and College of Charleston Train GIS Students by Working on Real-World Issues

Landon Knapp, S.C. Sea Grant Consortium and College of Charleston

Norman Levine, College of Charleston

RECAP: The S.C. Sea Grant Consortium partnered with the College of Charleston to provide geographic information system (GIS) mapping resources to coastal communities by having student projects focus on real-world issues communicated by communities and collaborators.

RELEVANCE: Coastal communities of South Carolina require GIS mapping and analyses to address increasing community and environmental hazards, but many lack the necessary technical and financial resources.

RESPONSE: Partnering with Norman Levine at the College of Charleston, students learning GIS conducted class projects on issues of importance to coastal communities/collaborators. During spring 2022, an introductory vulnerability assessment was conducted for the communities of Pawleys Island and Murrells Inlet, SC. In fall 2022, an analysis of possible marsh migration routes was conducted based on ecological, geological, and societal factors.

RESULTS: The introductory vulnerability assessment for Pawleys Island and Murrells Inlet was used as the foundation for a full tidal vulnerability assessment for the Town of Pawleys Island. That assessment was utilized by The Town of Pawleys Island to draft a sea-level rise adaptation plan (which has been finalized and is currently under review for adoption by Town Council, <https://www.townofpawleysisland.com/wp-content/uploads/2022/12/6C.-Pawleys-SLR-Adaptation-Plan-Draft-v5-1.pdf>). The marsh migration analysis was communicated to stakeholders representing environmental organizations in South Carolina.

PARTNERS: College of Charleston

SUSTAINABLE FISHERIES AND AQUACULTURE

IMPACTS

S.C. Sea Grant Consortium Hosts Aquaculture Toolkit Webpage, Provides Technical Knowledge to New Growers

Graham Gaines, Matthew Gorstein, Crystal Narayana, and Sarah Pedigo, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium (Consortium) hosts an aquaculture toolkit webpage to provide informational documents and spreadsheet tools for prospective and current aquaculturists to reference when working through processes to establish an aquaculture operation.

RELEVANCE: The absence of a fully fledged aquaculture training program in S.C. may hinder industry entrance given the process of establishing an aquaculture operation involves multifaceted and often difficult objectives (including identifying an area of water space to lease, completing permitting requirements, creating a profitable business model, and gaining technical knowledge). The toolkit provides a basis of information to aid industry entrants in navigating complexities of establishing an operation and lessens uncertainties of pursuing aquaculture in S.C.

RESPONSE: The Consortium consolidated informational materials into an aquaculture toolkit webpage and offers technical assistance to prospective industry entrants. The toolkit materials include an updated aquaculture permitting guide, a mariculture seed purchase and importation process document, shellfish mariculture finance resources, a cage flipping economics tool (developed from a previous study), an oyster farm budget tool, and existing map applications for site selection.

RESULTS: The toolkit has been used to consult with prospective aquaculturists directly. The webpage enables resources to be accessed freely and serves as a contact point to Consortium technical assistance.

Consortium Partners with Minorities in Aquaculture 501c3 to Offer On-Farm Internships to Women of Color

Imani Black, Minorities in Aquaculture

Sarah Pedigo and Matthew Gorstein, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium (Consortium) partners with Minorities in Aquaculture, 501c3, to offer hands-on aquaculture training to women of color through internships on South Carolina oyster operations. Minorities in Aquaculture has the vision to “bridge the gap between women and sustainable seafood by providing support for women of color in high school, college, and beyond.” Three university women of color conducted internships on SC oyster farms in 2022.

RELEVANCE: The aquaculture industry is underrepresented by historically marginalized groups. Access may be restricted due to inequitable barriers to entry and lack of training opportunities. Through the internship, women of color enrolled in S.C. colleges and universities were provided hands-on training opportunities on S.C. oyster aquaculture farms. The internships allowed interns to gain basic skills in aquaculture, gain access to the industry,

and expanded potential career opportunities in marine science and the seafood sector.

RESPONSE: The Consortium established a partnership with Minorities in Aquaculture, 501c3, to carry out the MIA internship. Consortium extension specialists recruited women of color from South Carolina colleges and universities as well as off-bottom oyster operations in the state to serve as host farms, and the specialists facilitated connections of interns to farms sites in the summer of 2022.

RESULTS: Three women of color received hands-on aquaculture training and three South Carolina off-bottom aquaculture operations received supplemental labor through the Minorities in Aquaculture summer internship program in the summer of 2022. Three students, from Consortium member institutions, included two undergraduates and a Ph.D. candidate. They conducted a full range of aquaculture activities throughout the internship, resulting in workforce training that equipped interns to enter and support the industry.

ACCOMPLISHMENTS

S.C. Sea Grant Consortium Co-leads Community Focus Groups for Gullah Geechee Seafood Trail Project Development

Matt Gorstein, S.C. Sea Grant Consortium

Marilyn Hemingway, Gullah Geechee Chamber of Commerce

Jannie Harriot and Dawn Dawson-House, WeGOJA Foundation

Queen Quet, Gullah Geechee Sea Islands Coalition and Gullah Geechee Fishing Association

Alli Crandell, Coastal Carolina University

RECAP: The S.C. Sea Grant Consortium (Consortium) works with Gullah Geechee Chamber of Commerce (Chamber) to conduct focus groups to learn from community members throughout the development of the Gullah Geechee Seafood Trail.

RELEVANCE: Identifying strategies to promote equity in sustainable economic opportunity is necessary for maintaining the well-being of coastal communities. In an era of climate change, it is critical to address environmental justice issues and to understand the experiences of historically marginalized communities. As lucrative coastal industries (such as tourism, fishing and harvesting, and seafood dining) continue to grow in South Carolina, it's important to ensure that economic benefits are realized across the social and demographic spectrum.

RESPONSE: The Consortium developed a partnership with the Chamber, an organization currently working to promote businesses owned by Gullah Geechee community members in South Carolina and enhance economic opportunity for the Gullah community. The Consortium collaborated with the Chamber to foster project ideas that further both organization's goals and developed a proposal to establish a Gullah Geechee Seafood Trail to promote Gullah-owned seafood businesses and to share stories of maritime cultural heritage.

RESULTS: In 2022, the Consortium supported the Chamber and other partners by co-developing key informant interview and focus group questions, obtaining IRB approval, and co-leading focus group implementation. Four focus groups were held (Beaufort, Charleston, Georgetown, Kingstree), and 43 participants attended in total. Key themes discussed included land and water stewardship, sweetgrass basket weaving, seafood harvesting and preparation techniques, culturally significant geographic locations, and how knowledge is passed down to younger generations.

PARTNERS: Gullah Geechee Chamber of Commerce, WeGOJA Foundation, Gullah Geechee Sea Islands Coalition, Gullah Geechee Fishing Association, Coastal Carolina University

Next Gen Seafood Industry: Consortium Builds Off Commercial Seafood Workforce Development Planning Efforts

**Graham Gaines, Matt Gorstein, Sarah Pedigo, and Jocelyn Juliano, S.C. Sea Grant Consortium
Steve Richards, Clemson University**

RECAP: In response to a declining commercial fisheries workforce, and to prepare for anticipated federal funds to implement projects that address this decline, the S.C. Sea Grant Consortium (Consortium) organized three regional focus groups, conducted a feasibility study for a commercial seafood training center in McClellanville, and organized a learning exchange where South Carolina fishermen visited the Commercial Fisheries Development Center in Rhode Island.

RELEVANCE: An aging workforce is one of several challenges facing the commercial fishing industry in the Southeast. Variability in operations and structure, lack of training pathways, fragmented industry organizations, and increased costs of entry with little access to resources/capital make this issue particularly challenging.

RESPONSE: The Consortium engaged representatives from the South Carolina commercial seafood industry (in McClellanville, Georgetown, and Beaufort) to co-produce sets of short- and long-term workforce development solutions. Major sectors included commercial shrimpers, oyster and clam harvesters, and crabbers. Topics addressed included barriers to entry; insurance obstacles; wages; work ethic variation across generations; and race, culture, and heritage.

RESULTS: Seventeen industry members attended the focus groups. Several follow-up engagements after the Rhode Island learning exchange led to the creation of a new oyster growing co-op; and the feasibility study has led to multiple grant proposals that the team of extension specialists and stakeholders is waiting to hear back on.

PARTNERS: Clemson University

S.C. Sea Grant Consortium Conducts Consumer Surveys on Perceptions of Direct Marketing Seafood Products

**Graham Gaines, Matt Gorstein, Sarah Pedigo, and Jocelyn Juliano, S.C. Sea Grant Consortium
Pravin Nath and Scott Swain, Clemson University**

RECAP: Master of business (MBA) students and associate professors at Clemson's Marketing Department joined S.C. Sea Grant Consortium staff to interview leaders in the state's seafood businesses to understand the marketing challenges and potential for increased direct marketing of seafood products.

RELEVANCE: The COVID-19 pandemic exposed the vulnerabilities of the South Carolina shellfish industry's reliance on restaurants as the primary market/channel for their produce, making it important to explore other marketing opportunities. In addition, trends such as buying local and fresh produce, eating healthy, being sustainable, and an acceptance of direct-to-consumer marketing suggest an unexplored potential for mariculture farmers through creative strategies.

RESPONSE: Consortium specialists and MBA students met with five seafood businesses to understand the primary

challenges and obstacles to transition to more direct to consumer sales (DTC) of the products. This information was used to develop two sets of consumer surveys—one on willingness to pay and another on perceptions, attitudes, and behaviors.

RESULTS: Survey results indicate that there is a preference for local products; mixed levels of consumer awareness of where their seafood comes from; in-person and online are the most common methods of DTC consumption; oysters are a better candidate for online and delivery sales compared to clams, crabs, and shrimp; and that sauces and spices are more valued as add-ons when compared to recipes.

PARTNERS: Clemson University

Consortium Researchers Make Progress on Estimation of Atlantic Red Snapper Abundance in Region

Susan Lovelace and Jocelyn Juliano, S.C. Sea Grant Consortium
William Patterson, University of Florida

RECAP: S.C. Sea Grant Consortium researchers are progressing with population size estimates of age 2+ Atlantic red snapper from North Carolina to Florida via two approaches: close-kin mark-recapture (CKMR); and Bayesian hierarchical modeling of remotely operated vehicle (ROV), camera-trap and habitat data. After a second allocation of funds from Congress, additional work has been approved to estimate discards in the U.S. Atlantic red snapper fishery as well as enhance the population size estimates.

RELEVANCE: Red snapper (*Lutjanus campechanus*) is an ecologically and economically significant reef fish in U.S. Atlantic waters between North Carolina and south Florida, where it has been estimated to be overfished since the early 1980s. Regulations aimed at rebuilding the Atlantic red snapper stock have not met the necessary requirements to declare the stock no longer overfished, which causes challenges for natural resources managers and commercial and recreational fishers.

RESPONSE: S.C. Sea Grant Consortium-funded researchers are estimating the population size of Atlantic red snapper independent of the stock assessment. With the additional allocation of funds, the research team will enhance the population size estimate portion of the study with increased sample size as well as estimate the number of discards in the U.S. Atlantic red snapper fishery (as this is uncertain but has a known substantial effect on fisheries stock assessment and management).

RESULTS: Additional ROV surveys were conducted (including paired camera-trap samples). Video samples from ROV and camera-trap surveys were analyzed. Additional fin-clip samples were taken from fisheries independent and dependent sources for CKMR sequencing. Bayesian integrated modeling development and data entry from year 1 began.

PARTNERS: University of Florida, S.C. Department of Natural Resources

Regional Effort to Develop a Reef Fish Extension/Communications Outreach Fellowship Program

Graham Gaines and Jocelyn Juliano, S.C. Sea Grant Consortium
Scott Baker, North Carolina Sea Grant

Bryan Fluech, UGA Marine Extension and Georgia Sea Grant

Angela Collins, Florida Sea Grant

RECAP: South Carolina, North Carolina, Georgia, and Florida Sea Grant programs hired a fellow to implement an outreach program aimed at increasing awareness, knowledge, and use of best fishing practices (BFPs) that will improve the survival of released fish.

RELEVANCE: Sea Grant offices, federal and state agencies, nonprofits, and fishermen themselves strive to collect and understand the best available science to promote stewardship and wise use of recreational species. Yet data collection, analysis, and knowledge dissemination regarding federally managed recreational fisheries is challenging. There is often a disconnect between the information and guidance needed to inform BFPs and messaging and communications regarding stewardship goals (which require consistency and a boots-on-the-ground approach).

RESPONSE: This fellowship extends the best available science directly to the fishermen themselves and works with fishermen to craft their own communications content to share among their networks. The reef fish outreach and communications fellow has visited bait/tackle shops and fisheries events from North Carolina to the Florida Keys, speaking with stakeholders and sharing BFPs. Media tours across the region have been arranged to disseminate stewardship-based content across various media outlets.

RESULTS: The fellow has worked under the guidance of the South Atlantic Marine Fisheries Council (SAFMC) in Charleston to create and disseminate BFPs educational material and tutorials. The fellow visited 70 tackle shops, hosted seminars and booths at angler events, gave multiple presentations, and hosted a media charter trip in the Outer Banks educating and promoting the use of BFPs.

PARTNERS: North Carolina Sea Grant, UGA Marine Extension and Georgia Sea Grant, Florida Sea Grant, Texas Sea Grant, Louisiana Sea Grant, Mississippi-Alabama Sea Grant Consortium, South Atlantic Fishery Management Council

S.C. Seafood Alliance and S.C. Sea Grant Consortium Publishes Commercial Fisheries Infrastructure Needs Assessment

Graham Gaines, Matthew Gorstein, and Jocelyn Juliano, S.C. Sea Grant Consortium

Amy MacKown, S.C. Seafood Alliance

Kathryn Rowe, College of Charleston

RECAP: The S.C. Sea Grant Consortium has partnered with the S.C. Seafood Alliance, a professional association representing seafood industry stakeholders across multiple sectors, on a USDA Local Food Promotion Program to conduct a commercial fisheries infrastructure needs assessment.

RELEVANCE: A convergence of obstacles over recent years (including regulatory changes, import substitutes, and declines in working waterfront sites) has transformed the South Carolina seafood sector into a more stressed and vulnerable industry. For South Carolina seafood producers to become more significant providers of regional nutrition and protein, the industry must take stock of its infrastructure and the gaps that work against viable production. This requires assessment aims to identify those needs and gaps.

RESPONSE: Seafood business owners, dealers, and fishermen have been interviewed to document the state of seafood production infrastructure and operational needs, including working waterfront assets, vessels and vessel conditions, value-added production equipment, logistics, and other fisheries most critical needs. Findings will help

fishermen, communities, associations, and government agencies to prioritize expenses and investments.

RESULTS: Through semi-structured interviews with dock owners and lessees across a range of coastal counties in South Carolina, this assessment identified the critical needs, threats, and impediments the commercial fishing industry faces. Overall, total infrastructure needs are estimated at \$2.8 million to \$5.3 million, where 80% of this cost is needed for docks, icehouses/freezers, and adjacent buildings; and the remaining 20% is needed for unloading equipment, packaging/processing equipment, and transportation for the product.

PARTNERS: S.C. Seafood Alliance

Consortium Engages with Commercial Shrimpers to Document Perceptions for the Lowcountry Shrimp Research Project

Robert Dunn, North Inlet-Winyah Bay NERR and University of South Carolina

Maeve Snyder, North Inlet-Winyah Bay NERR and University of South Carolina

Joshua Stone, University of South Carolina

Jocelyn Juliano, S.C. Sea Grant Consortium

Bryan Fluech, UGA Marine Extension and Georgia Sea Grant

RECAP: S.C. Sea Grant Consortium researchers explore the importance of different estuarine habitat types and variable environmental conditions on the shrimp population in the southeast for better manage of this multi-million-dollar fishery in the future.

RELEVANCE: Commercial shrimp species rely on estuarine environments for multiple life stages and given the annual scale of their life history they are sensitive to changing environmental conditions and available habitat. With highly variable commercial shrimp landings over the past two decades, the effects of environmental factors on shrimp abundances and distributions across the Lowcountry remain unclear.

RESPONSE: To better understand changes in shrimp abundance in response to environmental variability (due to changing climate conditions, weather events, and habitat modifications) researchers will utilize ongoing, long-term data collections within estuaries across South Carolina and Georgia and conduct additional sampling for shrimp and their prey. To complement the biological and environmental research, project team members will engage with commercial shrimpers through semi-structured interviews to gain their perceptions of changes in environmental conditions and shrimp abundance.

RESULTS: In year two of the project, long-term temperature and salinity environmental datasets from the NERR System Wide Monitoring Program underwent analyses for spatial and temporal patterns. A semi-structured interview instrument was created and interviews began with commercial shrimper stakeholders. Additionally, funding was identified for compensating shrimpers for their interview time.

PARTNERS: North Inlet-Winyah Bay NERR, University of South Carolina, S.C. Department of Natural Resources, UGA Marine Extension and Georgia Sea Grant, Coastal Carolina University, ACE Basin NERR, Sapelo Island NERR, South Atlantic Fisheries Management Council

S.C. Sea Grant Consortium Develops Seafood Seasonality Chart for Consumers

Jocelyn Juliano and Crystal Narayana, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium created a seafood seasonality chart that lists fresh, local seafood to be found in South Carolina markets.

RELEVANCE: Buying local and in-season supports commercial fishermen, reduces carbon footprints, and ensures the finfish and shellfish that consumers buy are harvested or grown sustainably.

RESPONSE: To help consumers make educated decisions about the seafood they purchase, a seafood seasonality chart was developed that lists finfish and shellfish that are caught or grown sustainably and locally (www.scseagrant.org/wp-content/uploads/South-Carolina-Seafood-Seasonality-Chart.pdf).

RESULTS: The seasonality chart was the second most liked post on S.C. Sea Grant Consortium's Instagram platform in 2022, and over 20 followers were gained from the first of monthly seasonality chart posts.

S.C. Sea Grant Consortium Partners with University of South Carolina to Develop Mariculture GIS-Based Siting Tool

Zhenlong Li and Cuizhen Wang, University of South Carolina

Sarah Pedigo and Matthew Gorstein, S.C. Sea Grant Consortium

Caitlyn Bierce, College of Charleston

RECAP: The S.C. Sea Grant Consortium (Consortium) partnered with University of South Carolina Geography Department to develop a geographic information systems-based (GIS) mariculture site mapping tool to aid in selecting appropriate locations for shellfish mariculture leases.

RELEVANCE: Site selection for a mariculture lease must consider regulations, potential human-use conflicts, environmental parameters, and economic feasibility. Spatial data regarding regulatory boundaries are offered through various GIS-map applications, but there is a need for resources consolidated into one location. Additional considerations (e.g., environmental, social) are outside the purview of regulatory agencies and represent potential layers to be added. The lack of multi-perspective site selection information increases uncertainty in operation feasibility, and can hinder industry entrance.

RESPONSE: The Consortium competed and awarded a study group project to University of South Carolina Geography Department to develop the GIS tool, facilitated engagement with aquaculture permitting entities as well as industry to solicit feedback on siting needs through stakeholder meetings, and provided technical knowledge to the project team for the development and refinement of the GIS tool.

RESULTS: The GIS-based siting tool has an estimated completion date of summer 2023 and will be hosted on the Consortium's aquaculture toolkit webpage.

Consortium Partners with the Aquaculture Industry and Resource Managers to Develop Proposal to Collect Data to Inform Resubmergence Policy

Sarah Pedigo and Matthew Gorstein, S.C. Sea Grant Consortium

Peter Kingsley-Smith and Gary Sundin, Lauren Faulk, S.C. Department of Natural Resources

Mike Marshall, South Carolina Department of Health and Environmental Control

Matthew Nowlin, College of Charleston

RECAP: The S.C. Sea Grant Consortium (Consortium) coordinated a project team of South Carolina Department of Natural Resources researchers, South Carolina Department of Health and Environmental Control shellfish sanitation managers, and College of Charleston social scientists to submit a proposal to collect baseline vibrio data in several resubmergence protocols to evaluate potential policy changes in s South Carolina oyster aquaculture.

RELEVANCE: Oyster growers must strike a balance between maximizing production efficiency and providing a safe, sustainable product. The two-week resubmergence requirement SC growers must follow in summer months is based on national protocol versus state specific data, and may be causing growers to incur additional costs and labor. This project would allow SC conditions specific data collection, document interagency communications, and develop policy recommendations to maximize sustainability and efficiency for the oyster mariculture industry in SC.

RESPONSE: The Consortium responded to a need identified by the oyster mariculture industry by establishing a project team to develop a proposal to submit to the Southern Sustainable Agriculture Research and Education program to evaluate the time it takes for oysters to return to ambient vibrio levels after air exposure during Vibrio control months. The Consortium facilitated partnerships with industry members to plan to conduct on-farm research to gather data.

RESULTS: The Consortium was requested to submit a full proposal to the Southern Sustainable Agriculture Research and Education program, and moved forward with project planning and full proposal development and submission in November 2022.

Consortium Facilitates an Information Exchange Workshop Between the Aquaculture Industry and Management Entities

Sarah Pedigo and Matthew Gorstein, S.C. Sea Grant Consortium

Ben Dyar and Henry Davega, S.C. Department of Natural Resources

RECAP: The S.C. Sea Grant Consortium hosts an aquaculture information exchange to facilitate a detailed and structured discussion (to share updates, needs, and solutions on improving efficiency and well-being of operations) between the South Carolina mariculture industry and the South Carolina Department of Natural Resources (SCDNR) Mariculture Section.

RELEVANCE: The mariculture industry and the SCDNR Mariculture Section expressed a need for an information exchange. Mariculture industry members noted difficulties and inefficiencies with logistics and protocols concerning seed importation and difficulties in the permitting process and licensing. The Consortium noted barriers to advancing applied research capacity that (if enhanced) would provide local science directly to the industry. This conversation allowed all entities to understand barriers and opportunities and to work toward facilitating optimal mariculture processes.

RESPONSE: The Consortium interfaced with the mariculture industry to determine topics to be discussed then coordinated and scheduled an in-person meeting in December 2022 for industry members including representatives from the East Coast Shellfish Growers Association, S.C. Shellfish Growers Association, and the SCDNR Shellfish Mariculture Section. Consortium extension staff facilitated the detailed discussion between the two entities.

RESULTS: A series of action items were documented to enhance mariculture permitting, compliance, and seed importation processes. A pathway to increase access to seed within the state was also identified, and at least three

growers who attended the meeting have placed orders to acquire seed through this entity in 2023.

PARTNERS: S.C. Department of Natural Resources, East Coast Shellfish Growers Association, S.C. Shellfish Growers Association

Consortium Shellfish Aquaculture Specialist Completed the Program's First Advisory Committee Meeting

Sarah Pedigo, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium's (Consortium) shellfish aquaculture specialist collects needs, issues, and opportunities from the established external advisory committee to structure meaningful aquaculture-focused programs.

RELEVANCE: In May 2021, the Consortium hired the shellfish aquaculture specialist to establish an aquaculture-focused program within the sustainable fisheries and aquaculture focus area aimed at extending science-based aquaculture information to the industry. Added capacity within this focus area will allow direct attention to be devoted to supporting a healthy and expanding aquaculture industry in South Carolina.

RESPONSE: In February 2022, the specialist convened the first Shellfish Aquaculture Program Advisory Committee meeting. The committee consists of aquaculture industry representatives and shellfish management and research entities. The purpose of the committee is to discuss and document needs, issues, and opportunities to maintain a healthy aquaculture industry as well as to inform strategic planning priorities. The committee consists of 10 partners total.

RESULTS: Feedback was gathered during an initial meeting held February 2022 to document current constraints within the industry. In addition, the meeting focused on strategic planning, where aquaculture-focused priorities were identified. The committee will be sought continually to structure program efforts.

S.C. Sea Grant Consortium Serves on the South Carolina Aquarium's Good Catch Advisory Committee

Sarah Pedigo, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium extension specialist becomes a member of the South Carolina Aquarium's Good Catch Advisory Committee.

RELEVANCE: The South Carolina Aquarium's Good Catch program leads initiatives to increase demand for local seafood, educates and encourages communities to choose local sources of seafood that are responsibly harvested, and works to make local seafood accessible to everyone. The South Carolina Aquarium is preparing to re-launch the Good Catch Program and invited Consortium extension specialists to serve on the program advisory committee alongside seafood business and industry members, eco-tour operators, aquarium personnel, and local chefs.

RESPONSE: Consortium extension specialists attended biannual meetings during 2022 to contribute input to the design of the Good Catch Program tiers (which outline sustainability standards that local restaurants agree to adopt to be recognized as an advocate for pursuing and using sustainable seafood sources). A new aspect will be for members to commit to reducing use of single-use plastic items.

RESULTS: Consortium extension specialists were provided opportunities to network with local businesses and restaurants through serving in an advisory capacity, and the specialist will continue to support the Good Catch Program as it is re-launched in spring 2023.

S.C. Sea Grant Consortium Researchers Discover Previously Unreported Bain Parasite of Atlantic Tripletail

Jason Broach, Michael Denson, and Erin Levesque, S.C. Department of Natural Resources

RECAP: While undergoing a study of Atlantic tripletail for cultivation in shellfish ponds, researchers discovered that fish collected from Florida were infected with both harpacticoid copepods and a unique digenean parasite encysted on the brains and brought in a parasite expert to report a case study.

RELEVANCE: Conducting novel mariculture studies requires successful collection and grow-out of wild-caught stock. It is impossible to account for circumstances outside of mariculture control (structures such as infections affecting the wild stock). Researchers of both wild populations and mariculture settings need up-to-date reporting on infection prevalence for potential stock species.

RESPONSE: Of the nine fish that survived from the initial group of 34 individuals collected, eight eventually showed signs of brain infection from digenean parasites (lethargy, listlessness, blindness, and lack of appetite). The researchers brought in a parasite expert (Isaure De Buron, College of Charleston) to examine the issue.

RESULTS: Isaure De Buron submitted a peer-review article to the *Journal of Parasitology* and the team gave four presentations about this study. De Buron initiated a collaboration with S.C. Sea Grant Consortium staff at the S.C. Sea Grant Consortium Research Symposium to develop a proposal for an inaugural South Carolina "Parasite Blitz."

PARTNERS: College of Charleston, National Institute of Standards and Technology

S.C. Sea Grant Consortium Researchers Work with Local Breweries to Reuse Grains as Nutritional Feed for Fish Production

Aaron Watson, S.C. Department of Natural Resources

Fabio Casu, National Institute of Standards and Technology

Michael Denson, NOAA/NCCOS

RECAP: Working with local breweries in the Charleston area, S.C. Sea Grant Consortium (Consortium)-funded researchers examined the utility of spent grains as a nutrition source for red drum (an important mariculture species) by providing protein and adequate tolerance and digestibility. Analysis of the spent grains after 12 monthly samples are promising for using this byproduct.

RELEVANCE: Determining cost-effective feed for important mariculture species (e.g., red drum) is important to support local aquaculture industries. Combining this objective with a sustainable approach (i.e., reusing spent grain) bolsters the sustainability of the aquaculture industry while providing economic links between disparate industries (aquaculture, breweries, and grain mills). As proof of concept, an experimental analysis is needed to compare nutritional values of different grain sources and determine the digestibility and palatability for juvenile red drum.

RESPONSE: Researchers collected 12+ months of monthly samples from each of the three partner breweries and analyzed these samples for proximate (protein, lipid, ash, fiber) composition, amino acid profile, fatty acid profile,

and NMR-based metabolite profiles. Throughout this collection period there have been no observed significant differences in profiles either between the three breweries or over time, which is a positive finding for the potential ability to collect and utilize this material from multiple breweries without significantly changing the nutritional profile.

RESULTS: Results of this Consortium-funded project are promising for the ability to obtain, process, and incorporate craft brewery spent grains into feeds for red drum and potentially other species. After conducting several experiments using different mixtures of feed containing spent grains, the researchers determined that future work should focus on palatability enhancement in feeds containing spent grains.

PARTNERS: Local breweries (Holy City Brewing, Tradesman Brewing, and Low Tide Brewing), U.S. Fish and Wildlife Service, AquaRange, Cargill, Inc., Manildra Milling

S.C. Sea Grant Consortium Researchers Develop New Model to Enhance Spotted Seatrout Stock Enhancement and Management

Tanya Darden and Erin Weeks, S.C. Department of Natural Resources

RECAP: S.C. Sea Grant Consortium (Consortium) researchers are developing a genetic-based model to evaluate hatchery management decisions in order to help guide the responsible stock for spotted seatrout.

RELEVANCE: Management of spotted seatrout in South Carolina depends on accurate forecasting of stocking densities that allow population recovery while maintaining the health and adaptability of wild populations following reductions due to cold winter events. The integration of a genetic model into S.C. Department of Natural Resource's spotted seatrout stock enhancement research will allow for a unique evaluation of a stock enhancement program and provide a framework suitable for adaptive management of the species.

RESPONSE: Consortium researchers are creating a model using demographic and genetic components to help resource managers conduct spotted seatrout conservation and restoration following cold events. This will result in quantitative recommendations for the optimal balance of preserving genetic diversity of the wild population and promoting speedy recovery of population abundance. Researchers worked with a coding contractor to rebuild the r-metasim model in Python and are currently conducting final model validation.

RESULTS: Researchers developed a new python-based version of the IBM model to replace the metasim-based one they have previously used due to lack of software support.

S.C. Sea Grant Consortium Researchers Investigate Reliable Genetic Markers for Determining Sex of Cobia Fish

Tanya Darden, Matt Walker, and Erin Weeks, S.C. Department of Natural Resources

RECAP: S.C. Sea Grant Consortium (Consortium)-funded researchers are developing a molecular tool to identify sex and other genomic markers for cobia that can be used in to understand a wild stock and/or enable more successful hatchery breeding of this recreationally important fish in South Carolina.

RELEVANCE: A non-fatal method of determining sex ratios and life histories of economically important fish enables both hatchery managers to optimize broodstock sex ratios and other programs aiming to maximize genetic diversity, production, and/or profitability.

RESPONSE: Consortium-funded researchers are investigating a microsatellite genotyping panel currently used to assess the genetic health and hatchery contribution to cobia in South Carolina. Preliminary analysis of the new data for markers indicate a reliable sex marker for cobia.

RESULTS: Researchers have successfully identified a preliminary sex-linked DNR markers to assess genetic health of cobia.

S.C. Sea Grant Consortium Researchers Refine Methods to Determine White Shrimp Reproductive Status in Field Settings

Michael Kendrick, Peter Kingsley-Smith, Jeff Brunson, Chris McDonough, and Graham Wagner, S.C. Department of Natural Resources

RECAP: S.C. Sea Grant Consortium (Consortium)-funded researchers are developing a system to determine shrimp life stages and estimate reproductive capacity in the field without laboratory equipment and techniques. Researchers are currently modifying a field guide for use in the field.

RELEVANCE: Determining the ovarian development of white shrimp under field conditions can enable natural resource managers to quickly assess the population development and reproductive capacity; therefore, informing managers of the state of this commercially important stock. At present, only laboratory-based procedures (e.g., microscopy) are widely accepted methods to determine the reproductive status of shrimp.

RESPONSE: Consortium-funded researchers are investigating correlations between microscopic and macroscopic characterizations to determine stages of development of shrimp. Their work will culminate in a publicly available field guide to describe the major stages of development and the characteristics used to distinguish each stage. The guide will allow any fisheries participant to make a simple assessment of shrimp developmental stage in the field.

RESULTS: Microscopic observations revealed sub-stages of development and breakdown in female shrimp that have not previously been described, leading to a more detailed understanding of their reproductive development cycle. Coupling macro- and microscopic examinations with high resolution images, the work will culminate in a publicly available field guide to describe the major stages of development and the characteristics used to distinguish each stage. The guide will allow any fisheries participant to make a simple assessment of shrimp developmental stage in the field.

SCIENTIFIC LITERACY AND WORKFORCE DEVELOPMENT

IMPACTS

S.C. Sea Grant Consortium Efforts Encourage Youths to be Ambassadors of Community Hurricane Resilience

Susan Lovelace and Amanda Guthrie, S.C. Sea Grant Consortium

Merrie Koester, University of South Carolina Center for Science Education

RECAP: The S.C. Sea Grant Consortium (Consortium) supported a Consortium researcher in developing and hosting a workshop to train youth educators about hurricanes. The workshop included numerous NOAA resources and culturally responsive activities for students to learn about the science behind hurricane formation and steps to be more resilient during a storm.

RELEVANCE: Studies on hazard risk communication reveal that unless messaging is consistent with the beliefs, needs, and goals of a given social group, it is not likely to be acted upon. With few exceptions, historically marginalized communities are at greater risk in disaster situations, while community-based organizations that serve and represent these marginalized communities are not well-linked with community-wide disaster loss reduction and preparedness efforts.

RESPONSE: A Consortium researcher expanded upon the Kids Teaching Flood Resilience program (www.kidsteachingfloodresilience.com/), developed in response to a key challenge noted in the City of Charleston's 2015 Sea Level Rise Strategy Plan. A workshop was held in September 2022 to train youth educators how to teach about hurricanes and improve science literacy and hurricane resilience.

RESULTS: Sixth-grade teachers from seven schools attended a workshop in September 2022 (covered topics: how to teach hurricane formation, coastal tides and storm surge, NOAA resources to track storms, and hurricane safety). The workshop activities were culturally responsive and the activities integrated art and science to enhance science literacy. Teachers implemented the training in fall 2022 and developed/enhanced several projects in Title 1 schools aimed at educating students and communities of the risks of sea-level rise.

PARTNERS: University of South Carolina Center for Science Education

S.C. Sea Grant Consortium's Environmental Education Certification Program Leads to New Paid Position

E.V. Bell, S.C. Sea Grant Consortium

RECAP: The growth of the Palmetto Environmental Education Certification (PEEC) program necessitates the creation and hiring of an Environmental Education Association of South Carolina (EEASC) part-time executive director to assist with fiscal oversight and programmatic coordination.

RELEVANCE: In 2014, the S.C. Sea Grant Consortium (Consortium) provided leadership in the development of PEEC, South Carolina's first environmental education certification program. Launched in 2018, this two-year

program requires attendance at four workshops, completion of eight online modules and 90 hours of electives, and the implementation of a capstone project. Between 2018 and 2021, PEEC was fiscally administered and programmatically coordinated by the Consortium. As PEEC grows, there are future capacity considerations to support long-term sustainability.

RESPONSE: The EEASC (the Consortium is a long-standing board member) is a founding member of PEEC. EEASC serves as the state affiliate for the North American Association for Environmental Education. Because of the organization's growth and PEEC's mission alignment, the EEASC board of directors unanimously voted in 2021 to adopt PEEC as one of the flagship offerings. As an official offering of EEASC, the organization assumed fiscal responsibility and co-coordination of the program with the Consortium.

RESULTS: To meet the needs of a growing organization, EEASC launched a robust fundraising campaign in 2021 and 2022 to raise monies for the hiring of a part-time executive director. Part of the impetus to create this new position was based on the adoption of the PEEC program and the increased personnel needs to oversee the program. In 2022, EEASC formally hired their first-ever part-time executive director who spends 50% of their time on PEEC-related aspects.

PARTNERS: Environmental Education Association of South Carolina

Consortium Enters into Memorandum of Agreement to Transition the Environmental Education Certification Program to EEASC

E.V. Bell, S.C. Sea Grant Consortium

RECAP: A Memorandum of Agreement was signed by the S.C. Sea Grant Consortium (Consortium) and the Environmental Education Association of South Carolina (EEASC) to formalize the process by which to transfer fiscal and programmatic responsibility and coordination.

RELEVANCE: In 2014, the Consortium provided leadership in the development of PEEC (Palmetto Environmental Education Certification), South Carolina's first environmental education certification program. Launched in 2018, this two-year program requires attendance at four workshops, completion of eight online modules and 90 hours of electives, and the implementation of a capstone project. The Consortium fiscally administered and programmatically coordinated PEEC in 2018–2021. As PEEC continues to grow, there are future capacity considerations to support its long-term sustainability.

RESPONSE: The EEASC (the Consortium is a long-standing board member) is a founding member of PEEC. EEASC serves as the state affiliate for the North American Association for Environmental Education. Because of the organization's growth and PEEC's mission alignment, the EEASC board of directors unanimously voted in 2021 to adopt PEEC as one of the flagship offerings. As an official offering of EEASC, the organization assumed fiscal responsibility and co-coordination of the program with the Consortium.

RESULTS: The Consortium entered into a memorandum of agreement (MOA) with EEASC in 2022, which was agreed upon by both organization's executive directors. The MOA outlined a timeline and deliverables for the transfer of fiscal and programmatic administration of the PEEC program from the Consortium to EEASC. The fiduciary aspects of the PEEC program fully transferred to EEASC in December of 2022 with the programmatic coordination to follow by 2024.

PARTNERS: Environmental Education Association of South Carolina

S.C. Sea Grant Consortium's Beach Sweep/River Sweep Litter Cleanup Saves Taxpayers \$203,711 in 2022

Susan Ferris Hill, S.C. Sea Grant Consortium

RECAP: Beach Sweep/River Sweep has economic, environmental, and societal benefits. In 2022, 2,092 coastal volunteers collected over 4 tons of litter, and covered 94 miles of South Carolina's beaches, marshes, and waterways. There were 65 site captains at 39 cleanup locations in the coastal counties. The number of volunteer hours was 6,406. The dollar value of volunteers' time equals \$203,711. The state's natural resources are cleaner, safer, and more beautiful for all to enjoy.

RELEVANCE: Natural resources account for \$33.4 billion in annual economic output for the state (S.C. Department of Natural Resources, 2016). And according to the S.C. Department of Parks, Recreation, and Tourism, tourism spending reached \$29 billion in 2022. Clean beaches, marshes, and waterways are critical to support commercial and recreational boating and fishing, wildlife viewing, tourism, and other industries. A litter-free environment also contributes positively to quality of life.

RESPONSE: The S.C. Sea Grant Consortium and S.C. Department of Natural Resources organize the Beach Sweep/River Sweep litter cleanup. Through the use of volunteers, the cleanup contributes to the economic, environmental, and societal well-being of the state. Participants and the public are more informed about natural resource issues, such as litter's detrimental effects on the landscape and wildlife, and people are empowered to take action and become environmental stewards.

RESULTS: In 2022, 2,092 coastal volunteers collected over 4 tons of litter, covered 94 miles of beaches, marshes, and waterways, and recycled as much as possible. There were 65 site captains at 39 cleanup locations. The number of coastal volunteer hours was 6,406. The dollar value of volunteers' time equals \$203,711 (Independent Sector, 2023).

PARTNERS: S.C. Sea Grant Consortium and S.C. Department of Natural Resource

ACCOMPLISHMENTS

S.C. Sea Grant Consortium Completes First Round of Community Engaged Internship Program in South Carolina

Matt Gorstein and Brita Jessen, S.C. Sea Grant Consortium

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University

Jeff Steinmetz, Francis Marion University

RECAP: The S.C. Sea Grant Consortium completes first round of Community Engaged Internship (CEI) program in South Carolina, hosting three interns in the summer of 2022.

RELEVANCE: There is a need to broaden participation in marine and coastal professions by providing training and mentorship to the next generation of scientists, decision-makers, and citizens. Specifically, efforts toward cultivating meaningful, positive, and compensated internship experiences for students of color and those who come from underserved communities are necessary in this process.

RESPONSE: Following recent implementation by other Sea Grant programs, the Consortium established a

CEI Program in SC to provide opportunities for undergraduate students from marginalized and underserved communities to conduct summer community-based projects that focus on community environmental and resilience needs as aligned with the Consortium's strategic plan.

RESULTS: Three undergraduate summer interns worked on three separate projects in 2022. One from the College of Charleston worked on a project to code and analyze qualitative data collected through focus groups as a part of the Gullah Geechee Seafood Trail; one from Francis Marion University worked to identify locations for water level sensors in underserved communities; and one from NC State A+T worked to develop communications materials for a groundwater monitoring project in Beaufort County.

PARTNERS: Francis Marion University, Gullah Geechee Chamber of Commerce

S.C. Students Gaining Immersive Experiences in Coastal Conservation Careers

Julie Binz, Jessica Kinsella, and Olivia Bueno, S.C. Department of Natural Resources

RECAP: S.C. Sea Grant Consortium (Consortium) staff and researchers are working with public school teachers, counselors, and state partners to develop the Coastal Conservation Careers Network, the Coastal Conservation Careers Toolkit, and engage with the STEMersion program to increase students' interest in pursuing a coastal conservation career. This project has created five full-time jobs for two months as summer internships with the South Carolina Department of Natural Resources (SCDNR) Marine Resources Division.

RELEVANCE: Science, technology, engineering, and math (STEM) fields lack racial, ethnic, socioeconomic, ability, and gender diversity. Underrepresented communities have limited scientific literacy, preventing students from pursuing scientific and other coastal conservation careers (such as ecotourism, fisheries, or environmental communications). Students need a STEM identity, or ability to "see themselves as scientists," to consider it professionally. Therefore, students must have hands-on experiences to maintain interest and build skills needed for a sustaining coastal career.

RESPONSE: Consortium staff and partners built the Coastal Conservation Careers Network encompassing several school districts, S.C. Chamber of Commerce, Gullah Geechee National Heritage Corridor, and South Carolina Aquarium. The team hosted a focus group with educators to discuss early careers in coastal conservation. The Coastal Conservation Careers Toolkit (developed as a website for youth and mentors) will include conservation organizations in SC, types of careers, scholarship and college information, and skills needed to pursue a conservation career.

RESULTS: In addition to over 1,500 students participating in coastal education and career showcases, five college students participated in a summer internship with the S.C. Department of Natural Resources, working for Coastal Reserves and Outreach, Reef Fish Survey, Inshore Fisheries, South Carolina Oyster Recycling and Enhancement, and Mariculture sections. Interns received weekly professional training such as resume writing, boat trailering, oyster reef building, and job searching. All mentors received training on cultural humility and inter-generational mentorship.

PARTNERS: South Carolina Aquarium, S.C. Department of Commerce

S.C. Sea Grant Consortium Builds Capacity Within Heritage Academy and Helps Them Apply for Federal Funding

Matt Gorstein and EV Bell, S.C. Sea Grant Consortium

Alana Jenkins, Heritage Academy

Marilyn Hemingway, Gullah Geechee Chamber of Commerce

RECAP: The S.C. Sea Grant Consortium (Consortium) partnership with the Gullah Geechee Chamber of Commerce (Chamber) results in more partnerships and more avenues for organizations led by members of underserved communities to apply for federal funding.

RELEVANCE: Communities in the Beaufort area have been impacted by climate hazards and extreme weather conditions. Also relevant is how sea-level rise, coastal development, and privatization of water-adjacent land are limiting access to traditional fishing and harvesting grounds of Gullah Geechee community members. This threatens community way of life and well-being from a subsistence and cultural perspective as agriculture and fishing are important to both livelihood and culture.

RESPONSE: The Consortium developed a partnership with the Heritage Academy, a place-based charter school slated to open in 2024 to apply for funding from the NOAA Office of Education to implement a place-based environmental literacy course. The Consortium assisted the Heritage Academy in the grant writing, concept development, and budgeting process—culminating in their first successfully submitted federal grant application for \$391,000 through the Chamber as the fiscal sponsor.

RESULTS: The proposal received favorable reviews, and is on the waitlist to receive funding.

PARTNERS: Heritage Academy, Gullah Geechee Chamber of Commerce

S.C. Sea Grant Consortium Extension Team Contributes to Multiple Trainings at Annual ACE Basin NERR Symposium

Matt Gorstein and Brooke R. Saari, S.C. Sea Grant Consortium

C. Guinn Wallover, Clemson University

RECAP: The S.C. Sea Grant Consortium (Consortium) extension team lead two roundtable trainings at the ACE Basin NERR symposium—one on best practices for researchers engaging with extension professionals and another on estimating the economic benefits of workshops and trainings conducted by coastal science outreach programs.

RELEVANCE: Building effective and meaningful coastal science projects that have direct user outcomes require ample planning and coordination throughout. If a research team is not familiar with the end users they are producing products for, successful outcomes are less likely. Additionally, organizations that conduct coastal science outreach programs have to report on their work, often times including information on economic benefits.

RESPONSE: Members of the Consortium extension team worked to develop resources and best practices for researchers to use when engaging extension professional in their area; and the team developed a training and list of resources to use when estimating the economic benefits of workshops and trainings—with the goal in mind of using of these metrics in communications products and for reporting requirements.

RESULTS: Twenty-five participants attended each of the trainings.

PARTNERS: SCDNR Ace Basin National Estuarine Research Reserve, Clemson University

S.C. Sea Grant Consortium Launches “Careers” Microsite to Broaden Reach to Diverse Undergraduate and Graduate Students

Louis Heyward, S.C. Sea Grant Consortium

RECAP: Developed by the Consortium’s Diversity, Equity, and Inclusion Workgroup to reach a diverse population of undergraduate and graduate students about job opportunities at the S.C. Sea Grant Consortium, the new “Careers” website provides information about jobs, fellowships, and internships, as well as an opportunity to match students with a mentor on the Consortium staff. Mentors answer questions about what Sea Grant and related jobs are needed, career and fellowship opportunities, and education requirements.

RELEVANCE: There is a need to engage a diverse population of undergraduate and graduate students in S.C. Sea Grant Consortium’s research, fellowships, internships, mentorships, and professional staff opportunities (including 45 business management, accounting, communications, graphic design, and human resources positions). There is also an increasing demand for a workforce skilled in Science, Technology, Engineering, Art, and Math (STEAM) disciplines to accommodate the industrial growth of South Carolina and to meet workforce needs in ocean science fields.

RESPONSE: In September 2021, the Consortium’s Diversity, Equity and Inclusion Workgroup launched a “Careers” microsite (careers.scseagrant.org) for undergraduate and graduate students who may be interested in job opportunities, fellowships, internships, and locating a mentor in their field of study. The website introduces students to the Consortium, lists member institutions, describes the variety of job needs in Sea Grant, and encourages students to be matched with a mentor on staff.

RESULTS: During this reporting period 27 students contacted the Consortium via the Career microsite. In total 61 students have reached out to the S.C. Sea Grant Consortium via the website, and each of these individuals were contacted by Sea Grant staff. As a result, the majority of these students were given consults regarding their career paths, and 19 have been paired with a Sea Grant mentor. The students contacted have been interested in water conservation, economics, environmental policy, environmental law, and public health.

S.C. Sea Grant Consortium Educator Wins 2022 SCMEA President’s Choice Award

E.V. Bell, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium’s (Consortium) marine education specialist won her third President’s Choice Award from the South Carolina Marine Educators Association (SCMEA).

RELEVANCE: The SCMEA provides opportunities for learning about and connecting with the coastal environment. Established in 1988, SCMEA operates via a board of directors, of which the Consortium has served in a leadership capacity for many years. The Consortium also supports SCMEA classroom grants and scholarships, maintains professional membership and representation within the organization, and actively participates during the annual conference by presenting on current projects.

RESPONSE: During the annual SCMEA conference, two awards are given out to current members, one of which is the President’s Choice Award. This award is given out at the discretion of the current president to a member they want to recognize for their contributions to the organization.

RESULTS: The 2022 President's Choice Award was given to the Consortium's marine education specialist for her assistance to the organization with the conference, mentorship of board members, and collaborative project planning with other environmental education organizations.

PARTNERS: South Carolina Marine Educators Association

S.C. Sea Grant Consortium Awards Two Diversity Scholarships for Palmetto Environmental Education Certification Course

E.V. Bell, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium (Consortium) awards two diversity, equity, and inclusion scholarships for participation in the 2022–2024 Palmetto Environmental Education Certification (PEEC) course.

RELEVANCE: Based on 2019 U.S. Census Bureau data, 37.4% of SC identifies as a person of color; however, a lack of diversity persists within the careers of environmental sciences, education, and interpretation. In 2018, the PEEC program launched SC's first environmental education certification program for formal/nonformal educators. One of the goals of PEEC is to support diversity in the environmental education field. In 2021, PEEC was adopted by the Environmental Education Association of South Carolina (EEASC).

RESPONSE: On behalf of the EEASC, the Consortium secured funding from the North American Association for Environmental Education (NAAEE) ee360 grant program in 2021 to support a variety of environmental education efforts. A portion of the funding was earmarked for two diversity scholarships for participation in the PEEC program. The scholarship amount totaled \$1,200 and covered the registration cost of the two-year course for two individuals.

RESULTS: The two diversity scholarships were awarded upon review of the applicants to the 2022–2024 cohort. The criteria for the awards was based on a variety of factors including: completion of the general PEEC application, letter of recommendation, whether an individual identified as part of a historically marginalized group, and/or if their primary teaching audiences identified as such.

PARTNERS: Environmental Education Association of South Carolina

Consortium Graduates 11 Educators from the Environmental Education Certification Program and Welcomes New Cohort

E.V. Bell and Morgan Treon, S.C. Sea Grant Consortium

RECAP: The Palmetto Environmental Education Certification (PEEC) program graduates 11 educators from the 2020–2022 cohort and accepts 15 educators for the 2022–2024 cohort. As of 2021, PEEC was formally adopted as a program offering of the Environmental Education Association of South Carolina.

RELEVANCE: In 2014, the S.C. Sea Grant Consortium (Consortium) disseminated a state-wide needs assessment to gauge interest in an environmental education certification program. Based on 2014–2018 results, a Consortium-led team of 15 individuals (representing various state, higher education, non-profit organizations) developed the state's first environmental education certification course, PEEC. This two-year program requires attendance at four workshops, completion of eight online modules and 90 hours of electives, and the implementation of a capstone project.

RESPONSE: PEEC graduated its first cohort of 13 educators in August 2020 after pivoting mid-course to an online format due to COVID-19. In August 2022, a second cohort of 11 educators received their PEEC certification, which brings the total PEEC graduates to 24. The application period opened in August 2022 for the third cohort (2022–2024).

RESULTS: More than 30 applications were submitted for the third PEEC cohort (2022–2024). The application materials (online application, self-assessment, and letter of recommendation) were distributed to an external review team for their feedback and scoring. Based on those results, invitations to join the upcoming current cohort were extended to 15 formal and nonformal educators.

PARTNERS: Environmental Education Association of South Carolina, Charleston County Park and Recreation Commission, Francis Marion University, College of Charleston, S.C. Department of Natural Resources, Lynches River County Park

S.C. Sea Grant Consortium Engages 100 Volunteers in Community Science Salt Marsh Restoration Project

E.V. Bell, S.C. Sea Grant Consortium

Peter Kingsley-Smith, Ph.D., S.C. Department of Natural Resources

RECAP: The S.C. Sea Grant Consortium (Consortium) coordinated the engagement of more than 100 volunteers in salt marsh restoration activities within the Charleston watershed.

RELEVANCE: Salt marshes in South Carolina face pressure from rising seas and increasing coastal populations. Living shoreline projects can mitigate impacts, revitalize degraded areas, and provide stewardship opportunities. In 2019, the Consortium, Clemson University, and the South Carolina Aquarium partnered with the S.C. Department of Natural Resources (SCDNR) on a National Oceanic and Atmospheric Administration-funded living shoreline project that engages Charleston-area community members in oyster and *Spartina alterniflora* restoration and supports the development of new resources.

RESPONSE: The Consortium coordinated community volunteer events related to *Spartina alterniflora* cultivation, transplanting, and long-term monitoring at a restoration location within the Charleston watershed. These events included: recruitment of volunteers, *S. alterniflora* seed collection and planting, transplanting of mature *S. alterniflora* plants to designated restoration areas, and monitoring efforts documenting the establishment and growth of the transplanted plants.

RESULTS: More 100 volunteers participated in nine community events resulting in the planting of 6,175 *S. alterniflora* plants for a total of .91 acres of restored marsh for the entire project.

PARTNERS: S.C. Department of Natural Resources, Clemson University, and South Carolina Aquarium

S.C. Sea Grant Consortium Hosts First Science-Educator Symposium

E.V. Bell, S.C. Sea Grant Consortium

RECAP: More than 70 scientists and educators attended the first REconnect (Researcher-Educator) Symposium hosted at the South Carolina Aquarium in partnership with the S.C. Sea Grant Consortium (Consortium).

RELEVANCE: Within South Carolina, there are few opportunities that provide a platform for a two-way exchange of information between scientists and educators. Coastal scientists are not often aware of opportunities to extend their research and resources to educators; conversely, educators are often not aware of the scientific experts and opportunities in their area. Providing a platform where both educators and scientists can exchange information, needs, and ideas provides a wholesome and transformative learning experience for all participants.

RESPONSE: The Consortium partnered with the South Carolina Aquarium to host the first Reconnect Symposium. Hands-on displays, specimens, demonstrations, and other engaging methods to convey research topics were encouraged. The Consortium created a “Scientist Tip Sheet” for best information delivery practices. Research aligned with the 2021 *College and Career Ready Science Standards* and scientists’ abstracts available via QR code. Educators were provided scientists’ backgrounds, alignment of research to the state standards, and suggested ways to facilitate conversation.

RESULTS: Seventeen scientists representing nine organizations and more than 55 formal and nonformal educators from across the state attended the first REconnect Symposium hosted by the S.C. Sea Grant Consortium and the South Carolina Aquarium in July 2022 at the aquarium.

PARTNERS: South Carolina Aquarium

S.C. Sea Grant Consortium Provides Quarterly Diversity Staff Trainings

Marlena Davis, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium (Consortium) provided quarterly staff trainings on topics related to incorporating diversity, equity, and inclusion (DEI) into agency-wide and program-specific projects.

RELEVANCE: Increasing diversity among staff members, stakeholders, and end-users continues to challenge not only the Consortium but geosciences-based organizations across the country. Along with increasing diversity, ensuring that programs, resources, and opportunities are equitable and inclusive adds important layers for consideration and implementation. Diversity statistics continue to be low among career geoscientists, and end-users of scientific information for personal and community decision-making are often not reflective of the larger community.

RESPONSE: In June 2020, the Consortium initiated efforts to create an agency-wide diversity plan based on input from staff. Of interest to the majority of staff were diversity training opportunities for personal and professional growth. Using this feedback, four diversity staff trainings were scheduled: March 2022, Agency directed DEI work plan review; May 2022, Consortium’s Research Symposium (Part 1) and Reflection (Part 2); August 2022, LGBTQ Awareness.

RESULTS: During the 2022, four diversity, equity, and inclusion trainings were held for Consortium staff, during which more than 75% of staff attended.

S.C. Sea Grant Consortium Launches New Diversity, Equity, and Inclusion Staff Enrichment Opportunity

Marlena Davis, E.V. Bell, Louis Heyward, and Emmi Palenbaum, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium (Consortium) created an Employee Resource Group (ERG) as part of the

agency's efforts to broaden their diversity, equity, and inclusion efforts.

RELEVANCE: Increasing diversity among staff members, stakeholders, and end-users continues to challenge not only the Consortium but country-wide geosciences-based organizations. Along with increasing diversity, developing a culture of inclusivity and equity ensuring that programs, resources, and opportunities are equitable and inclusive adds important layers for consideration and implementation. Diversity statistics continue to be low among career geoscientists, and end-users of scientific information for personal and community decision-making are often not reflective of the larger community.

RESPONSE: In June 2020, the Consortium initiated efforts to create an agency-wide diversity plan based on input from staff (which was voted on and accepted by the board of directors in September 2020). The majority of staff were interested in diversity training and engagement opportunities for personal and professional growth. Using this feedback, an employee resource group was developed to provide enrichment opportunities for staff to celebrate and explore the diversity within our community and staff.

RESULTS: As part of the ERG's efforts, a lunch series, "Courageous Conversations," is hosted on a monthly or bi-monthly basis. During this time, staff are invited (optional) to join during their lunch break to discuss different DEI-related topics. To facilitate these discussions, conversations cards are used that provide suggested topics. During this reporting period, there have been three "Courageous Conversations" hosted for between 8 and 15 staff.

S.C. Sea Grant Consortium's Youth Salt Marsh Restoration Program Included in Two-Year, Title 1 Education Program

E.V. Bell and Morgan Treon, S.C. Sea Grant Consortium
Michael Hodges, S.C. Department of Natural Resources

RECAP: The S.C. Sea Grant Consortium's (Consortium) From Seeds to Shoreline® (S2S) program serves as foundational component in a two-year education initiative at a Title 1 Elementary School, Edith L. Frierson Elementary School (Frierson)—a rural, Title 1 school that is located less than one mile from the nearest salt marsh and has a majority historically marginalized student body.

RELEVANCE: Opportunities for schools—that are socio-economically disadvantaged (e.g., Title 1 status) and/or host a predominantly historically marginalized population—to connect environmental education with recreational fishing are limited across S.C. While there are salt marsh ecosystem-focused environmental education programs as well as a multitude of recreational fishing businesses, there is little collaboration. Combining environmental education and ethical recreational fishing practices deepens not only youth environmental stewardship, it connects on a cultural level (for many S.C. communities).

RESPONSE: In 2022, the S.C. Department of Natural Resources (in partnership with the Consortium, Coastal Conservation Association, Ocean Aid 360, and recreational fishing businesses) submitted a proposal to the National Oceanic and Atmospheric Administration's (NOAA) Restoration Center to support a two-year program working with Frierson to provide salt marsh education and recreational fishing opportunities. The Consortium's S2S youth salt marsh restoration program is the foundation of the education effort, where students cultivate and transplant *Spartina alterniflora*.

RESULTS: The S.C. Department of Natural Resources received \$155,000 in funding from NOAA to support the two-year habitat restoration and recreational fishing education project at Frierson. The project launched in fall

2022 with partners leading a variety of classroom salt marsh education activities and journaling for 150 PreK–5 grade students. Through the S2S program, the students planted *Spartina alterniflora* seedlings at a campus-located greenhouse and will cultivate these seedlings to transplant in spring 2023.

PARTNERS: S.C. Department of Natural Resources, Edith L. Frierson Elementary School, National Oceanic and Atmospheric Administration

S.C. Sea Grant Consortium's *The Lettered Olive* E-newsletter Keeps Educators Informed on Opportunities and Resources

E.V. Bell and Susan Ferris Hill, S.C. Sea Grant Consortium

RECAP: Five issues of the *The Lettered Olive* education e-newsletter were produced and delivered to 812 individual stakeholders with an average open rate of 37% and click-through rate of 3.8%.

RELEVANCE: There is a need to deliver timely, frequent, and effective communication to formal and nonformal educators across the state regarding the S.C. Sea Grant Consortium's (Consortium) professional development opportunities, K-12 student resources, and employment opportunities.

RESPONSE: The communications and education services staff continue to produce and deliver *The Lettered Olive* (the Consortium's education e-newsletter) to 812 individuals through the platform Constant Contact. Each newsletter begins with a short feature about a native plant or animal species found within the coastal plain and follows with information regarding upcoming workshop trainings, educator and student resources, grant and employment opportunities, and other relevant information.

RESULTS: Five issues of *The Lettered Olive* education e-newsletter were produced and delivered during FY22-23. The average open rate was 37%, mirroring the industry average. The click rate was 3.8%, which was nearly double the industry average of 2%.

S.C. Sea Grant Consortium Designs and Edits 58 Products to Support Mission

Susan Ferris Hill, Crystal Narayana, and E.V. Bell, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium designed, edited, and facilitated the development of 58 products in support of the agency programs and focus areas. Digital communications and news products as well as flyers, brochures, reports, and guides were produced to support programs and projects conducted by Consortium staff, researchers, and partners.

RELEVANCE: As South Carolina's coastal population continues to grow and experiences the impact of climate change, there is a continuous need to build public awareness, understanding, and scientific literacy about the complexities of living, working, and playing in coastal South Carolina. The future of the conservation and management of coastal resources depends on a robust effort to foster stewardship and increase public awareness about the societal value and ecological function of South Carolina's coastal resources.

RESPONSE: S.C. Sea Grant Consortium's Communications and Education Team assisted with the development of 58 products to support administration, extension, communications, and education programs.

RESULTS: Fifty-eight digital and printed products included mini-websites, guides, reports, workshop flyers,

brochures, e-newsletters, and magazines. Programs supported include From Seeds to Shoreline, Beach Sweep/ River Sweep, and the Healthy Ponds Series, as well as products for programmatic areas (including nature-based tourism, sustainable development, water quality, weather and climate vulnerability and resilience, and fisheries and aquaculture).

S.C. Sea Grant Consortium Produces Graphics That Inspire Participation

Crystal Narayana, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium produced graphics and branded products to support programs and the agency's mission.

RELEVANCE: Well-designed, attractive products increase their use in educational settings and promote participating in programs. Branded designs enhance the reach of the S.C. Sea Grant Consortium and promote the brand as a source of science-based information that can be relied on.

RESPONSE: Communications staff worked with extension staff and their partners to design 32 promotional items including flyers, handouts, and signs, and designed 4 guides and reports as well as supporting materials such as charts and social media tiles.

RESULTS: Communications staff consistently produced collateral products that meet the recognition and educational needs of programs. This included materials for programs such as the SCSGC Research Symposium, S.C. Nature Based Tourism Association, From Seeds to Shoreline, and the Healthy Ponds Series. Publications designed included *Beaufort County Long Term Resilience Strategy Report*, *South Carolina Commercial Fisheries Infrastructure Needs Assessment*, and *Benefits of Increased Mariculture*.

S.C. Sea Grant Consortium Website Continues to Expand in Content and Access

Susan Ferris Hill and Crystal Narayana, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium added 32 news articles and 73 content pages to the website (www.scseagrant.org), a source of science-based information for decision-makers and the public. In FY22-23, the website received 127,192 page views, a 5.8% increase from FY21-22.

RELEVANCE: Decision-makers and the public should be informed about the coastal and marine environment and related community issues. The S.C. Sea Grant Consortium website continues to be a significant source of this information. The website provides information about Consortium-funded and partnered research, education, and outreach programs.

RESPONSE: The Communications staff maintained the Consortium's website (www.scseagrant.org) and updated the content regularly with input from staff and Consortium member institutions. Additions included news articles, research project updates, and information about extension and education projects. Information about projects were added as they were started (with reports, data, and other information added as they were produced). *Coastal Heritage*, an issue-based magazine written in long form, although a print product, was also formatted for online reading.

RESULTS: The website received 127,192 page views, a 5.8% increase from FY21-22. The *Coastal Heritage* publications drew over 51,000 views, with *Coastal Heritage's* "Carolina's Gold Coast: The Culture of Rice and Slavery" receiving the

most at 13,869. In addition, 32 news articles and 73 content pages were added to the website this reporting year.

S.C. Sea Grant Consortium's *CoastalScience@Work* E-newsletter Builds Awareness of Agency's Programmatic Efforts

Susan Ferris Hill and E.V. Bell, S.C. Sea Grant Consortium

RECAP: Nine issues of *CoastalScience@Work* e-newsletters were produced and delivered to an average of 970 individual subscribers. The average open rate was 44.6% and the average click-through rate was 4.2%, both of which are considerably higher than averages for all industries.

RELEVANCE: There is a need to deliver timely, frequent, and effective communications to inform target audiences and the general public about the Consortium's science-based products, programs, and staff and institutional changes.

RESPONSE: The Communications and Education Services staff continue to produce and deliver *CoastalScience@Work*, the Consortium's e-newsletter, to an average of 970 individual subscribers through the platform Constant Contact. Email lists are segmented and include the Board of Directors and alternates; Program Advisory Board; VIPs; Extension and Education advisory committees; research and finance liaisons; National Sea Grant Office; member institution PIOs; S.C. African American Heritage Commission members; S.C. General Assembly members; U.S. Congressional staff; Consortium staff; and the general public.

RESULTS: Nine issues of *CoastalScience@Work* were produced and delivered to an average of 970 individual subscribers during FY22-23. The average open rate was 44.6%, which is over 20% higher than the average of 37% for all industries. The average click-through rate is 4.2%, which is about 50% higher than the average click-through rate of 2% for all industries.

S.C. Sea Grant Consortium Fosters Student Support Through Internships, Fellowships, and Research Opportunities

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

RECAP: The S.C. Sea Grant Consortium (Consortium) continues to substantially contribute to workforce development through internships, fellowships, and research opportunities.

RELEVANCE: Supporting undergraduate and graduate students and early career professionals in earth and marine sciences leads to an informed, engaged, and well-trained workforce. The Consortium is involved in initiatives that support educational and professional development for these individuals.

RESPONSE: Sixty-two Knauss SC fellows have been selected since 1984, and 20 SC coastal management fellows have been placed since 1997. The Consortium and the S.C. Space Grant Consortium partners to support the Kathryn D. Sullivan Earth and Marine Science Fellowship, to increase trained scientists and to enable graduate students to conduct NASA- and NOAA-related research. Additionally, Community Engaged Internships, Margaret A. Davidson Resilience Scholars Program, and the Minorities in Aquaculture Internship Program were implemented.

RESULTS: In 2022, the Consortium supported 35 undergraduates, 32 master's-level students, and 11 Ph.D. students in conjunction with Consortium-funded research, internships, and fellowships. Forty-five were new to Sea Grant support and 33 received continued support. Four of the graduate students were Consortium interns. Two Sea

Grant-nominated student were selected for the Knauss fellowship and another, the Sullivan award. Student support has improved student and early professional ocean and coastal literacy, while encouraging success in securing employment.

S.C. Sea Grant Consortium Expands Audience Engagement Through Social Media

Emmi Palenbaum, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium (Consortium) has built and significantly expanded an online social media presence for information sharing among the audiences the Consortium serves, including South Carolina residents, community leaders, educators, partnering agencies and organizations, and member institutions. In 2022, the Consortium's Facebook page gained 532 followers to reach a total of 1,900, increasing engagement 39%. Instagram saw a 109.5% increase in following, totaling nearly 600.

RELEVANCE: The Consortium continues to grow audience following and engagement across Facebook, Twitter, and Instagram (among groups such as residents, community leaders, educators, partnering agencies and organizations, and member institutions). This intentional effort on social media broadens the reach of science-based information and increases awareness of relevant Consortium-led events, research, educational programs, and connections to statewide and coastal communities.

RESPONSE: Following the relaunch of existing social media platforms and the addition of Instagram in 2021, the Consortium has enhanced continuity and consistency across all platforms to create a cohesive digital identity and voice. Platforms and content are strategically managed by the coastal public information coordinator, a new role hired within the communications and education services department in September 2022.

RESULTS: In 2022, the Consortium's Facebook page gained 532 followers to reach a total of 1,900, increasing engagement 39%. Instagram saw a 109.5% increase in following, totaling nearly 600. Content consistently performed highest towards the end of the calendar year, indicating a trend of continued growth into the future. The Consortium also plans to explore opportunities to expand into additional social media platforms.

To Improve Transparency and Accountability, Consortium Creates Coastal Public Information Coordinator Position

Susan Lovelace and Emmi Palenbaum, S.C. Sea Grant Consortium

RECAP: The S.C. Sea Grant Consortium (Consortium) secures funding from the S.C. Legislature to create and hire a coastal public information coordinator position to improve accountability and transparency of the Consortium's activities with our constituents.

RELEVANCE: The state of S.C. is increasing in population. There is increasing need to communicate the results of science that will enable residents to improve their environmental, social, safety, and economic conditions through maintaining a high-quality coastal environment. Additionally, in a changing and challenging communications environment, it is important to identify best practices for reaching all of our stakeholders and constituents, taking the lead on development of social media and video content for the Consortium.

RESPONSE: The Consortium management team developed a proposed position and (after approval of our Board of Director's chairman) engaged the Governor's office and the S.C. Legislature to explain the need and benefits for this position.

RESULTS: The Legislature provided and funded a permanent state position to provide additional communications for the Consortium. The Consortium advertised and interviewed well-qualified applicants for the position. Emmi Palenbaum, a former consortium extension graduate assistant, successfully competed for the position.

S.C. Sea Grant Consortium Researchers Create STEAM-centered Performances to Engage Children in Ocean Science

Michael Childress, Clemson University

Meghnaa Tallapragada, Temple University

Brian Thill, South Carolina Aquarium

Kathy Prosser, Educational Entertainment, LLC

RECAP: The Something Very Fishy STEAM program engaged children in a positive, informal learning environment where they experienced ocean literacy principles through music, theater, a virtual field trip, and meeting university students portraying different careers in marine science.

RELEVANCE: Elementary school students can build their interest and capacity to address climate change issues through career choices. An emerging approach to teaching this complex topic is to create an informal space where scientists interact with children and teachers as ambassadors rather than as an authority. By motivating children and their families to take actions in ocean conservation, significant strides can be made to address climate change and encourage future careers in science.

RESPONSE: To increase climate and ocean awareness in elementary schools (grades K-5), S.C. Sea Grant Consortium-funded researchers developed an informal musical theater marine science STEAM program called Something Very Fishy that combines a musical theater performance with an imaginary field trip under the ocean manned by university students studying marine science education. Exhibitions were provided in-person or virtually.

RESULTS: A comparison of pre-post program assessments demonstrates that after attending the program, children were more likely to include humans and human artifacts as part of their ocean drawings and were more likely to select STEM and arts careers in a follow-up survey. Summaries were given at two national meetings and the S.C. Sea Grant Consortium Research Symposium and a book chapter is in press.

PARTNERS: Temple University, Florida State University, South Carolina Aquarium, S.C. Space Grant, S.C. Arts Commission