



SOUTH CAROLINA SEA GRANT CONSORTIUM

Impacts and Accomplishments

FY 2023-2024



S.C. Sea Grant Consortium
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HEALTHY COASTAL ECOSYSTEMS

ACCOMPLISHMENTS

S.C. Sea Grant Consortium and Partners Complete and Release SC Water Quality Monitoring Portal

Brooke Saari, S.C. Sea Grant Consortium; Landon Knapp, S.C. Sea Grant Consortium and College of Charleston; Norm Levine, College of Charleston; Duncan Williamson, College of Charleston Graduate Student and S.C. Sea Grant Consortium

Associated Goal: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment.

Project Number: A/E-1e

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

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

RESPONSE: Funding was realized and a student was hired. After a kick-off workshop for stakeholder 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. The tool was created based on this input with user interface updates and hosting capabilities.

RESULTS: The new tool was completed and released in fall 2023. Beta testing feedback and updates are continually considered. The final tool debuted a user direction story map and video that was updated in 2024. In addition, a rack card to be used for promotion was designed and printed, as well as the final editing on a peer reviewed publication about the tool creation process, to be published in spring 2024.

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

Brooke Saari, S.C. Sea Grant Consortium; Katy Smith, University of Georgia Marine Extension and Georgia Sea Grant; Cathy Janasie, National Sea Grant Law Center; Lola Renauer, University of South Carolina graduate student; Hailey Connell, College of Charleston graduate student

Associated Goal: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment.

Project Number: R/CEC-1

RECAP: The S.C. Sea Grant Consortium and partners are studying contaminants of emerging concern and their reactions to various climate drivers, with early work focused on literature review, legal scans and gap analysis, leading up to a request for proposals that drew 12 proposals.

RELEVANCE: Interactions of increased pollution and extreme climate variation has put pressure on water quality in the southeast United States, necessitating research to address contaminant and climate hazards on human and ecosystem health.

RESPONSE: The project team conducted a literature review and legal scan and identified research gaps, then created a primer document. A multi-state, diverse advisory committee was convened to identify priorities for new research. These research gaps and end-user determined needs were used to create and release a request for proposals (RFP) to fund \$300,000 in research on these identified priorities related to CECs and climate.

RESULTS: Over 100 verified documents were evaluated as part of the literature review, combined with an extensive legal scan of the study area (South Carolina, Georgia, Florida). Fourteen advisory members attended meetings over summer 2023 to determine needs and priorities. The RFP was widely distributed, with 12 proposals submitted in winter 2023, representing all three states. A nationwide panel of 13 experts was to convene virtually in February 2024 for final review and project selection.

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

Brooke Saari and April Turner, S.C. Sea Grant Consortium; Ellen Sturup Comeau, Beatriss Calhoun and Samantha Porzelt – Clemson Extension; Kaitlyn Dirr, SCDNR/A.C.E. Basin National Estuarine Research Reserve; Maeve Snyder, North Inlet-Winyah Bay Estuarine Research Reserve

Associated Goal: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment.

Project Number: A/E-1e

RECAP: The S.C. Sea Grant Consortium co-organized a pond management conference that provided training and technical assistance to 50 stormwater professionals, academics, and local government officials and staff in the Beaufort 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 December 6, 2023, extending the latest stormwater pond scientific information, resources, and tools to pond managers, researchers, and owners. Goals of this event were to increase awareness of pond maintenance methods, provide information and tools to overcome common pond management challenges, and provide continuing education unit (CEU) opportunities for practitioners.

RESULTS: Fifty participants, including property managers, homeowners' association representatives, and pond management professionals, attended the conference. Sixteen participants received up to five CEU credits. The project team aimed specifically for a technical audience, a change that was made due to past evaluation data of coastal pond programming.

S.C Sea Grant Consortium and Partners Coordinate a Social Media Campaign for South Carolina Stormwater Awareness Week

Brooke R. Saari and Emmi Palenbaum, South Carolina Sea Grant Consortium; Samantha Porzelt, Catherine Watts, and Ellen Sturup Comeau, Clemson University Cooperative Extension; Maeve Snyder, North Inlet - Winyah Bay National Estuarine Research Reserve; Kaitlyn Dirr, ACE Basin National Estuarine Research Reserve/SC Department of Natural Resources

Associated Goal: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment.

Project Number: A/E-1e

RECAP: S.C. Sea Grant Consortium joined with municipal stormwater and education partners to produce a comprehensive social media campaign for Stormwater Awareness Week, a week-long effort from Sept. 25-29, 2023, that reached new audiences in South Carolina.

RELEVANCE: Social media campaigns are a way to target new audiences such as younger generations who are less likely to be engaged in community stormwater issues. Conventional outreach methodologies like workshops, field days, written materials, and virtual programming were likely not reaching audiences not already aware of stormwater issues and organizations. Local stormwater partners identified a need to utilizing supplemental engagement methods.

RESPONSE: S.C. Sea Grant Consortium, Clemson Extension's Carolina Clear program and the two state National Estuarine Research Reserves partnered on creating a social media campaign called Stormwater Awareness Week. The goal was to highlight stormwater topics across South Carolina to increase knowledge and encourage action among residents and communities. Consortium team members combined and distilled the information from partners into the five topic areas and coordinated two giveaways to increase engagement through call-to-action pieces.

RESULTS: The team worked together to determine the content focus, engagement options, and marketing plan. More than 18,000 were reached across Facebook and Instagram. We had 20,178 Impressions, 86 post shares, 237 link clicks and 18,298 reach in combined Facebook and Instagram impacts. That represents more link activity and sharing of posts than typical on the platforms. Our stormwater team increased reach and engagement, in addition to winning a national award for the effort.

South Carolina Wetlands Programming Addresses the Gap of Cultural History and Values for Decision-Making

Maeve Snyder, North Inlet-Winyah Bay National Estuarine Research Reserve; Brooke Saari, South Carolina Sea Grant Consortium; Amy Scaroni, Ph.D., Clemson Extension; Abigail Locatis Prochaska and Kaitlyn Dirr, ACE Basin National Estuarine Research Reserve/S.C. Department of Natural Resources

Associated Goal: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment.

Project Number: A/E-1e

RECAP: The S.C. Sea Grant Consortium contributed to a multi-organization team that provided stakeholder wetlands education opportunities, including a two-part webinar series called Cultural History of Wetlands in Coastal South Carolina in May and June of 2023.

RELEVANCE: South Carolina has approximately 4.5 million acres of freshwater and coastal wetlands. Though wetlands are widely recognized, their benefits may be less so. Wetlands are vital to wildlife habitat, management of water quality and quantity, and carbon sequestration. Increases in development have led to great losses of the state's wetland assets. Consistent messaging and general outreach opportunities are needed to further wetland knowledge.

RESPONSE: Our team continually collaborates on wetlands education opportunities. An overlooked area for education and outreach efforts was the cultural value of wetlands. Recognizing that decision-makers often work in separate silos of wetland science, community engagement, or human dimensions, we developed a two-part webinar series to bridge these gaps. These webinars focused on rice culture influences on landscapes and wetland management throughout history. Content featured wetland interaction background information, stakeholder engagement best practices, and cultural connections.

RESULTS: Approximately 200 participants attended the webinar series. In the evaluation survey, participants indicated that the webinars were a good use of time and were applicable to them. Through an analysis of the evaluation qualitative feedback, themes were identified on participant motivations and knowledge applications, which included fostering wetland stewardship in their work and communities. The program earned a national webinar award.

S.C. Sea Grant Consortium Expands Trawl2Trash Program to Support Shrimpers and Reduce Marine Debris

Brooke R. Saari, Sarah Pedigo, Jocelyn Juliano, 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 Angel Parson, Gullah Geechee Cultural Heritage Corridor

Associated Goal: Restored and enhanced productivity of ecosystems.

Project Number: R/MD23-3

RECAP: The S.C. Sea Grant Consortium received a \$300,000 Community Action Coalition grant to expand the Trawl2Trash program, which was originally developed by Georgia Sea Grant and expanded to the Consortium in

2021 to help commercial shrimpers 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/ Georgia Sea Grant developed and received a NOAA Marine Debris proposal for expansion of the Trawl2Trash program. Coalition building and bag construction were started for year one of the program. In addition, a summer intern worked to update engagement materials and communication products.

RESULTS: Consortium staff distributed 300 stow bags to volunteers cleaning up litter in waterways, partners, and the public so they could collect and dispose of marine debris. New partners were brought on board for bag construction, expanding across the coastal counties, resulting in 600 bags by seven shrimper industry members. A summer intern created content for the website build and a bag-making video was created to help shrimpers with bag construction logistics.

S.C. Sea Grant, Partners Gain Funding to Evaluate Natural Alternatives to Plastic Use in Coastal Environmental Sectors

Susan Lovelace, Matt Gorstein, Brooke Saari, Amanda Guthrie, and Sarah Pedigo, S.C. Sea Grant Consortium; Bill Strosnider, Bruce Pfirrmann, Baruch Marine Field Lab University of South Carolina; Sarah White and Mik Carbajales-Dale, Clemson University; Joshua Robinson, Robinson Design Engineers; Rob Lowe and Scott Schneider, University of Dayton; Mark Dugo, Johnson C. Smith University

Associated Goal: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment.

Project Number: R/MD23-1

RECAP: The S.C. Sea Grant Consortium in partnership with University of South Carolina Baruch Marine Field Lab, Clemson, University of Dayton, Johnson C. Smith University, and Robinson Design Engineers were awarded funds through the National Sea Grant Infrastructure Investment and Jobs Act Marine Debris Challenge Competition in April 2023 to evaluate alternatives to plastic use in three coastal sectors: water quality, restoration, and aquaculture.

RELEVANCE: Natural materials have a long history of traditional use in aquaculture, water quality protection, and shoreline restoration industries but have been displaced by non-biodegradable proprietary alternatives that accumulate and persist in marine and estuarine environments. Although the specific amount of plastic waste produced by these sectors is unknown, evidence suggests that the use of plastics in these sectors can contribute to the deterioration of the ecosystems they aim to protect.

RESPONSE: The Consortium and partners will identify, test, and disseminate information on a series of biodegradable materials that may be used as alternatives in the three coastal sectors. In October 2023 the project team convened a stakeholder-focused advisory council meeting, with 26 participants, to identify plastic materials of focus. Lab testing, mesocosm, and field testing will commence in 2024. Iterative feedback with the advisory council will be utilized throughout the duration of the project.

South Carolina Water Chats Deliver Research in Special Issue of Journal

Brooke Saari, S.C. Sea Grant Consortium; Amy Scaroni, Clemson University; C. Guinn Wallover, Mount Pleasant Water Works (formerly of Clemson Cooperative Extension)

Associated Goal: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment.

Project Number: A/E-1e

RECAP: As part of the Water Chats program, the S.C. Sea Grant 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 an outlet for Water Chats content in addition to 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. 12 letters of intent led to 10 articles for publication. Throughout 2023, these 10 author teams went through the review process which led to all 10 articles being accepted for publication. This special issue is slated for publication in February 2024.

South Carolina Water Chats Earns Awards, Begins Work on Second Season

Brooke 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

Associated Goal: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment.

Project Number: A/E-1e

RECAP: The first season of Water Chats, 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, was implemented in 2022, and preparation for the second season began in 2023.

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: Water Chats' season one successes culminated in national recognition through award submissions and presentations in forums throughout the year. In addition, the planning team kicked off preparation for the upcoming new season through analyzing survey and evaluation materials and reconvening the Water Chats Advisory Council in November 2023.

RESULTS: Presentations were given to approximately 35 people at two national meetings to highlight the Association Natural Resource Extension Professionals first-place promotional materials national award and the collaborative strengths of the program. In a follow-up post-program survey, previous attendees and committee members were surveyed nine months after the first season, resulting in 53 responses, a 10% response rate. These evaluations, surveys, and kick off discussions are being utilized to inform the upcoming 2024 season.

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

Associated Goals: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment; Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities.

Project Number: R/CF-27

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

RELEVANCE: Horseshoe crabs 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, and the crabs are then returned to the collection location. 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: The research found little evidence that age or water temperature affected horseshoe crab blood histochemistry or mortality in bled crabs. Both age and water temperature affected metabolomic profiles. Analyses showed older horseshoe crabs and those held at higher water temperatures had higher levels of lactate, among other markers, indicating increased oxidative stress. The results suggest stress responses in horseshoe crabs that may not be immediately visible at the cellular level are measurable at the metabolomic level.

Microplastics Documented in Tidal Creeks by S.C. Sea Grant-supported Researchers, Leading to Education Materials

Andrew Tweel: S.C. Department of Natural Resources

Associated Goals: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment.

Project Number: P/M-2a

RECAP: The S.C. Sea Grant Consortium funded a study to examine the prevalence of microplastics in S.C. creeks, bays, and harbors, as well as commercial shrimp, in order to document areas of highest microplastic concentration, and the information gathered informed educational outreach materials.

RELEVANCE: Microplastics have become ubiquitous in coastal and marine habitats, as well as in economically valuable seafood. Marine managers and seafood consumers need information on the prevalence of microplastics in order to make informed decisions about environmental health and potential human safety. This research quantifies microplastic concentration in coastal and marine sediments as well as shrimp.

RESPONSE: Researchers with the S.C. Department of Natural Resources, the College of Charleston, and The Citadel collaborated to identify microplastics in tidal creeks, bays, and harbors, as well as concentrations within shrimp. The research identified highest concentrations within tidal creek habitats and within shrimp digestive tracts; a part often removed before consumption.

RESULTS: Information from this research program, including physical examples of microplastic types and laminated one-page infographic sheets, was incorporated into educational material for the S.C. Department of National Resources's outreach programs for use in their school group and camp visits.

PARTNERS: College of Charleston; The Citadel.

S.C. Sea Grant Consortium Researchers Identify Pathways for Methane Emissions in Salt Marsh and Impounded Wetlands

Georgia Seyfried, Thomas O'Halloran: Clemson Baruch Institute of Coastal Ecology and Forest Science

Associated Goals: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment.

Project Number: M/PM-2D

RECAP: A S.C. Sea Grant Consortium-funded study evaluated the emission of methane gas, an important component of atmospheric greenhouse gases, at different levels within salt marsh and impounded wetland ecosystems under different seasonal and biological conditions.

RELEVANCE: Greenhouse gas inventories at the state and federal levels rely on field data to quantify the amount of carbon emissions within various habitats and conditions. To date, methane emissions have been under-quantified compared with other carbon data.

RESPONSE: This study by S.C. Sea Grant-funded researchers compares methane flux for salt marsh and impounded

wetland sites under different seasons, day/night conditions, and sediment depth. The data will help build more robust models of greenhouse gas flux.

RESULTS: The results of this study indicate that season (related to temperature and plant growth rates), location (salt marsh or impounded wetland), and soil depth are drivers of methane production rates. Two manuscripts are in development from this study.

S.C. Sea Grant Consortium Researchers Produced an Updated Stormwater Pond Inventory for Eight Coastal Counties of S.C.

Denise Sanger, Andrew Tweel, S.C. Department of Natural Resources; Erik Smith, University of South Carolina

Associated Goals: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment; Coastal communities manage and conserve the resources needed to sustain their diversity and quality of life in light of rapid population growth, land-use change, and variations in climate and weather.

Project Number: M/PM-2I

RECAP: S.C. Sea Grant Consortium researchers updated a geospatial inventory of constructed ponds in the eight coastal counties of South Carolina for the first time since 2013, using 2021 imagery from the U.S. Department of Agriculture's National Agriculture Imagery Program.

RELEVANCE: Stormwater ponds are prevalent in the Southeast coastal plain due to the region's shallow water table, flat topography and storm-driven rainfall events. They are most heavily associated with large residential planned unit developments. Ponds are an increasingly valuable source of fill material and an increasingly popular aesthetic amenity that often serve to increase residential property values. However, ponds may also be "hot spots" of nutrient pollution, noxious algae, and microplastic retention.

RESPONSE: The most recent previous inventory of coastal S.C. stormwater ponds was conducted in 2013. In this new study, a geospatial inventory of constructed ponds in the eight coastal counties of South Carolina was developed based on 2021 U.S. Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP) Imagery. The geospatial inventory of constructed ponds from 2013 was reviewed and new ponds were hand digitized.

RESULTS: The study found that since 2013 development-related ponds increased 32% in number and 33 % in cumulative surface area. Development-related ponds are clearly clustered in the Beaufort, Charleston and greater Myrtle Beach areas, the major population centers of coastal South Carolina. Especially in the southern portion of the state, these development-related ponds are predominantly located in the state's OCRM Critical Area.

S.C. Sea Grant-Funded Researchers Examine Urban Stormwater Runoff as a Source of Microplastics in Coastal Waterways

Peter van den Hurk, Clemson; John Weinstein, The Citadel; Barbara Beckingham, College of Charleston

Associated Goals: Sound scientific information is available to support ecosystem-based approaches to land

use and resource management decision-making throughout the coastal and ocean environment; Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: R/ER-52

RECAP: The S.C. Sea Grant Consortium funded research on the prevalence of microplastics (particularly tire wear particles) in densely-populated areas with stormwater ponds in order to understand how pond sediments and fauna are retaining the particles, as well as the toxicity of microplastics in two estuarine species.

RELEVANCE: Microplastic particles can potentially cause negative effects on aquatic species and eventually humans, but little is known about the movement of microplastics in the environment. This project sought to determine how microplastics, especially microrubber derived from wear and tear of car tires, are moving through stormwater conduits into the estuarine environment, and what kind of effects these particles can have on estuarine organisms.

RESPONSE: Samples were collected in and near four stormwater ponds in the Mount Pleasant area to measure what kind of particles are present in road dust, and if and how these particles are retained in stormwater ponds. Additionally, fish and invertebrates living in these stormwater ponds were analyzed for uptake of microplastics. The chronic effects of exposure to tire particles was studied in grass shrimp and mummichog.

RESULTS: The study demonstrated that tire wear particles are prevalent in stormwater runoff. Tire rubber contains toxic chemicals that leach out of the particles and induce toxic effects in the organisms that are exposed to these particles. While stormwater ponds are effective in retaining microplastics, accumulation in these ponds deteriorates the water and sediment quality. Grass shrimp exposed to microplastics showed a delayed maturation time, and the fish displayed a number of sublethal effects.

PARTNERS: Town of Mount Pleasant Division of Stormwater Management; U.S. EPA; NOAA-Hollings Marine Laboratory.

S.C. Sea Grant-Funded Research Evaluates Nitrogen Pollution Removal Strategies in Stormwater Ponds of Coastal S.C.

Annie Bourbonnais and Erik Smith, University of South Carolina

Associated Goals: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment; Coastal communities manage and conserve the resources needed to sustain their diversity and quality of life in light of rapid population growth, land-use change, and variations in climate and weather.

Project Number: R/ER-53

RECAP: The S.C. Sea Grant Consortium funded research to evaluate nutrient pollution in stormwater runoff ponds and constructed wetland areas to determine how ponds and vegetation may play a role in retaining dissolved nutrients.

RELEVANCE: Stormwater runoff has been recognized as a major contributor to nonpoint source pollution in the coastal zone, delivering dissolved nutrients such as nitrogen. In excess amounts, nitrogen can lead to coastal eutrophication, harmful algal blooms, and coastal hypoxia. However, inorganic nitrogen can be removed from

the environment through several different microbially facilitated processes. Stormwater ponds and constructed wetlands are effective at removing particulates but may be much less effective at removing dissolved nutrients.

RESPONSE: The S.C. Sea Grant Consortium funded research to determine nitrogen removal rates across the sediment-water interface for a series of stormwater detention ponds with varying amounts of vegetation. Nine ponds and two natural forested wetland drainages were used as a comparison between constructed and natural stormwater conveyances.

RESULTS: Unvegetated stormwater ponds were not efficient at removing dissolved nitrogen; in contrast, these systems could further exacerbate harmful algal blooms and hypoxia in downstream waters by providing a new source of fixed nitrogen. The research suggests that planting native edge vegetation or floating vegetation (e.g., lily pad) through stormwater detention ponds can effectively remove dissolved nitrogen before the stormwater is being discharged to coastal environments.

PARTNERS: Horry County Stormwater Dept., Horry County Parks and Recreation Dept; Georgetown County Stormwater Dept., Summerall Oaks HOA, Grand Strand Health and Wellness.

S.C. Sea Grant Consortium Funds First Study and Educational Material on Coastal and Estuarine Acidification in State

Angelos Hannides, Danielle Viso, Susan Libes, Coastal Carolina University; Reimer and Hall, Southeast Ocean and Coastal Acidification Network

Associated Goals: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment.

Project Number: R/ER-55

RECAP: The S.C. Sea Grant Consortium funded research on coastal and estuarine acidification in the waters of Long Bay, the first acidification study in the state, and disseminated findings in professional, educational, and informal settings to increase public awareness of coastal acidification as a statewide coastal concern.

RELEVANCE: Coastal ocean acidification, which is declining pH levels, may impact the health of larval fish and shellfish. A major shellfishery in Long Bay has recently been closed due to water quality concerns. In addition to water quality issues, factors such as low freshwater input and high amounts of nutrient inputs have the potential to enhance acidification of the environment.

RESPONSE: The S.C. Sea Grant Consortium funded research to study the trends of local pH levels through a long-term monitoring station run by the Southeast Ocean and Coastal Acidification Network compared with water parameters collected locally. This study was the first effort to characterize temporal and spatial scales of coastal ocean acidification in Long Bay, a system already responding to multiple anthropogenic stressors.

RESULTS: During this reporting period, nine presentations by the principal investigators and graduate students were delivered on coastal and estuarine acidification in South Carolina at professional meetings and educator workshops. This included a presentation for the South Carolina Beach Advocates, an organization founded and run by mayors and administrators of the state's beach communities, during which mayors, town and county administrators, and state agency representatives had an opportunity to learn more about this topic.

PARTNERS: SECOORA/SOCAN; Waccamaw Watershed Academy; Mote Marine Laboratory; Horry County; City of

North Myrtle Beach; Georgetown County; ACE Basin NEER; North Inlet-Winyah Bay NEER; South Carolina Beach Advocates.

S.C. Sea Grant Consortium Develops National Forested Wetlands Conference

Brita Jessen and Amanda Guthrie, S.C. Sea Grant; Tim Callahan, College of Charleston; Jamie Duberstein, Clemson University; Ken Krauss, U.S. Geological Survey; Carl Trettin, U.S. Forest Service

Associated Goals: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment; State and local decision-makers possess the knowledge about the complex inter-relationships among the social, economic, and environmental characteristics of the coastal ocean (offshore) environment of the state and southeast region, and the tools necessary to manage emerging uses and optimize economic and environmental sustainability; Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery

Project Number: P/M-WOCO6

RECAP: Planning for the first *Tidal Forests of the Upper Estuary: Science and Management Advances* conference began this reporting period with a National Sea Grant workshops award and co-sponsorship from the U.S. Geological Survey and the U.S. Forest Service to host a two-day meeting on natural and social science and cultural connections with forested wetlands at the College of Charleston and a one-day field trip and workshop focused on the Waccamaw River in northern South Carolina.

RELEVANCE: Tidal freshwater forested wetlands serve as a transition zone between coastal marine habitat and the non-tidal watershed. These habitats provide essential ecosystem services for nearby human communities and connected ecosystems, including water quality improvement and sediment sequestration. In the Southeast U.S., these habitats were historically lost to reclamation of wetlands; the remaining areas are now subject to a suite of interacting drivers related to anthropogenic and environmental change and loss of legal protection.

RESPONSE: S.C. Sea Grant Consortium in partnership with the College of Charleston, Clemson University, the U.S. Forest Service, and U.S. Geological Survey will host the first inter-disciplinary conference focused on tidal freshwater forested systems, with international national and social scientists, community leaders and planners, and input from legal scholars. An additional day will be at the Baruch Institute and Waccamaw River, focused on decision-making for the Waccamaw watershed under climate change scenarios.

RESULTS: In addition to the conference, the organizers proposed and were accepted to edit a special issue of the journal *Estuarine, Coastal, and Shelf Science* focused on tidal freshwater forested wetland science.

PARTNERS: College of Charleston; U.S. Fish and Wildlife Service; Clemson Baruch Institute of Coastal Ecology and Forest Science; Coastal Expeditions.

S.C. Sea Grant Consortium Develops Southeast and Caribbean Blue Carbon Portal

Brita Jessen, S.C. Sea Grant Consortium

Associated Goals: Restored and enhanced function and productivity of coastal and ocean ecosystems; Coastal communities manage and conserve the resources needed to sustain their diversity and quality of life in light of rapid population growth, land-use change, and variations in climate and weather.

Project Number: M/PM-2

RECAP: The Southeast and Caribbean Blue Carbon Portal is a new project in development to identify coastal areas in need of restoration or conservation that may increase the benefit of carbon sequestration, educate stakeholders on the opportunities and challenges of coastal blue carbon project developments in the region, and build a local community of practitioners to help develop coastal blue carbon efforts across the southeastern U.S. and Caribbean region.

RELEVANCE: Conservation and rehabilitation of coastal habitats that store organic carbon (“blue carbon”) can enhance nature-based services for local communities and reduce atmospheric greenhouse gases. The development of a successful blue carbon project will depend on partnerships among land managers, restoration practitioners, regulators, investors, and scientists. A sharable tool that provides a regional inventory of potential blue carbon opportunities will provide an access point for these sectors to interact and plan.

RESPONSE: Two graduate research assistants have been hired to develop educational material, host webinar discussions, develop maps of coastal blue carbon assets and potential for loss in the southeastern U.S., and use the InVEST model (Stanford University) to estimate carbon stock changes. The results of this work will be shared through a report and online platform.

PARTNERS: University of South Carolina; Florida Fish and Wildlife Foundation; First Horizon Bank Foundation.

S.C. Sea Grant Contributes to the South Atlantic Salt Marsh Initiative Plan

E.V. Bell and Brita Jessen, S.C. Sea Grant Consortium

Associated Goals: Restored and enhanced function and productivity of coastal and ocean ecosystems; Coastal communities manage and conserve the resources needed to sustain their diversity and quality of life in light of rapid population growth, land-use change, and variations in climate and weather.

Project Number: N/A

RECAP: The South Atlantic Salt Marsh Initiative Plan, developed for the region from North Carolina through northeast Florida to protect and restore salt marsh under climate change and development threats, contains information on the research, education, and funding needs to ensure one million acres of salt marsh protection.

RELEVANCE: Southeastern coastal marshes are at risk of loss due to sea level rise and other pressures: According to a NOAA model, an estimated 14% to 34% of existing salt marshes along the South Atlantic could be lost by 2060 due to sea level rise alone. Protecting this coastal resource across state, federal, tribal, and private jurisdictions requires a comprehensive plan that includes education, research, and funding mechanisms.

RESPONSE: S.C. Sea Grant Consortium’s E.V. Bell participated in writing the education section of the plan and

participated in interviews for an associated educational video. Brita Jessen helped review sections of the plan and engaged in the educational video.

RESULTS: S.C.Sea Grant Consortium has been asked to lead the South Carolina state implementation planning for the South Atlantic Salt Marsh Initiative in the upcoming year.

PARTNERS: SASMI Coalition.

IMPACTS

Stormwater Ponds State of Knowledge Report Continues to Inform Users and Research

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

Associated Goal: Sound scientific information is available to support ecosystem-based approaches to land use and resource management decision-making throughout the coastal and ocean environment.

Project Number: A/E-1e

RECAP: Since publication, the State of the Knowledge Report on Stormwater Ponds continues to be a much-used and valued resource for South Carolina residents and researchers.

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 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. Researchers have used the gaps section to align their research portfolios.

RESULTS: The executive summary has been provided to various audiences since publication, with more than 300 copies distributed and 128 copies downloaded (10 in the past year). The SOK report has been accessed 748 times, and the PDF was downloaded 283 times (22 in the past year). These products have been used by other extension and outreach organizations such as Clemson Extension, the Ashley Cooper Stormwater Education Consortium, and the Low Country Partners Stormwater Education Consortium. As a result of the summary and resulting proposals, the Consortium funded three projects this year that include effects of phosphorus, nitrogen and floating treatment wetlands in stormwater ponds.

S.C. Sea Grant Consortium Co-Hosts First Blue Carbon Law Symposium and Develops Law Journal Issue

Brita Jessen, S.C. Sea Grant Consortium

Associated Goals: Restored and enhanced function and productivity of coastal and ocean ecosystems; Coastal

communities manage and conserve the resources needed to sustain their diversity and quality of life in light of rapid population growth, land-use change, and variations in climate and weather.

Project Number: M/PM-2

RECAP: S.C. Sea Grant Consortium partnered with Georgia Sea Grant and the University of Georgia School of Law to plan and host the first [Blue Carbon Law Symposium](#) held at the University of Georgia 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 U.S. has been convened to address these issues and convene a cross-disciplinary audience.

RESPONSE: Consortium staff and partners hosted a two-day conference that convened legal scholars, 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. Invited speakers included experts in law, ecosystem science, community engagement, and finance; a senior counsel at the Council for Environmental Quality; and the NOAA Chief Scientist.

RESULTS: In addition to the conference and law journal, two conference participants (First Horizon Bank Foundation and Fish and Wildlife Foundation of Florida) funded S.C. Sea Grant Consortium to develop a blue carbon project proposal for funding the Southeast and Caribbean Blue Carbon Portal project.

PARTNERS: Georgia Sea Grant; University of Georgia; National Sea Grant Law Center; Gullah Geechee Sea Islands Coalition; Gullah Geechee Chamber of Commerce; First Horizon Bank Foundation; Wicker Brammell Law; The Nature Conservancy.

SUSTAINABLE COASTAL DEVELOPMENT AND ECONOMY

ACCOMPLISHMENTS

Partnerships within Sea Grant and Land Grant Extension Strengthened through National Extension Tourism

April Turner, S.C. Sea Grant Consortium

Associated Goals: Healthy and viable coastal communities and economies include sustainable traditional and non-traditional economic opportunity and equity in coastal access.

Project Number: A/E-1b

RECAP: S.C. Sea Grant Consortium and partners encourage greater integration of research, education, and outreach within Cooperative Extension and Sea Grant, with tourism visioning funds supporting staff from seven state Sea Grant programs to attend the 2023 National Extension Tourism Conference.

RELEVANCE: Tourism plays a significant role in the economies of our coastal and Great Lakes states, with significant contributions to jobs, tax revenues, and quality of life. Sea Grant, working with National Extension Tourism (NET) partners, has an opportunity to 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 continued 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 served on the NET Design Team, participating in quarterly meetings. As a member of the Communications Committee, she assisted with NET website management, the NET newsletter, and organization of the 2023 NET Conference in Milwaukee, Wisconsin. National Sea Grant tourism visioning grant funds supported staff from seven Sea Grant state programs to attend the conference, providing opportunities for professional development and strengthening participation among members of the NET Network.

PARTNERS: Wisconsin Sea Grant, National Extension Tourism Design Team.

S.C. Sea Grant Consortium Managed the S.C. Coastal Information Network to Coordinate Member Organization Efforts

April Turner, S.C. Sea Grant Consortium

Associated Goals: Coastal communities manage and conserve the resources needed to sustain their quality of life in light of rapid population growth, land-use change, and variations in climate and weather.

Project Number: A/E-1b

RECAP: For more than 17 years, the S.C. Sea Grant Consortium has managed the S.C. Coastal Information Network,

which enhances coordination of outreach efforts among 25 federal, state, regional, and local network members and the strategic dissemination of information, including accredited continuing education courses for real estate professionals and stormwater management training sessions 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 S.C. Coastal Information Network (SCCIN) in 2006. SCCIN consists of 25 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 training sessions and resources to coastal South Carolina constituents.

RESULTS: The Consortium continued to coordinate the realtor accredited continuing education courses, as well as work with SCCIN partners to provide pond conferences, stormwater management training sessions, and tools. The Consortium continued to facilitate and organize network meetings (May 24 and October 6, 2023) and maintain the SCCIN website event calendar and resource portal (www.sccoastalinfo.org), with 3,000 page views from visitors accessing the site's resources.

PARTNERS: ACE Basin National Estuarine Research Reserve (NERR) Coastal Training Program, S.C. Department of Natural Resources, Adopt-A-Stream, Ashley Cooper Stormwater Education Consortium, Berkeley-Dorchester-Charleston Council of Governments, Carolina CLEAR, Clemson Extension, Clemson Baruch Institute of Coastal Ecology and Forest Science, Coastal Waccamaw Stormwater Education Consortium, Charleston Resilience Network, College of Charleston Graduate Program in Environmental Studies, Lowcountry Council of Governments, Lowcountry Stormwater Partners, Mount Pleasant Waterworks, National Oceanic and Atmospheric Administration Office for Coastal Management, North Inlet-Winyah Bay NERR Coastal Training Program, Port Royal Foundation, S.C. Department of Health and Environmental Control (SCDHEC) Bureau of Water, SCDHEC Office of Ocean and Coastal Resource Management, S.C. Forestry Commission, University of South Carolina-Beaufort, Urban Land Institute South Carolina, USDA Forest Service Southern Research Station Center for Forested Wetlands Research, Town of Mount Pleasant, Waccamaw Regional Council of Governments.

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

April Turner, S.C. Sea Grant Consortium

Associated Goals: Healthy and viable coastal communities and economies include sustainable traditional and non-traditional economic opportunity and equity in coastal access.

Project Number: A/E-1b

RECAP: Through the activities of the Coastal Communities specialist, the Consortium has continued to support the S.C. Nature-Based Tourism Association, providing technical assistance, conference planning, and small business promotion to help ensure an economically viable and resource-sustainable nature-based tourism industry in South Carolina in the face of ever-growing demand.

RELEVANCE: Tourism is an important economic driver for South Carolina, totaling an estimated \$29 billion in 2023, and the demand for nature-based tourism and outdoor recreation shows no signs of slowing. As more residents and tourists take advantage of South Carolina's abundant natural and cultural resource opportunities, it is increasingly important to ensure that the state's thriving 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 2023 conference in Oconee County. She 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 at regional outdoor expositions and festivals.

PARTNERS: Charleston County Park & Recreation Commission; S.C. Association of Tourism Regions (Historic Charleston, Lake Hartwell Country, Capital City/Lake Murray Country, Lowcountry & Resort Islands, Myrtle Beach and The Grand Strand, Old 96 District, Olde English District, Pee Dee Country, Santee Cooper Country, Thoroughbred Country, and The Upcountry); S.C. Department of Parks, Recreation & Tourism; S.C. Department of Natural Resources; nature-based tourism operators and businesses from across the state.

S.C. Sea Grant Consortium Researchers Document Barriers to S.C. Beach Access By Minoritized Communities

Daniel Guttentag, Steve Litvin, College of Charleston

Associated Goals: Healthy and viable coastal communities and economies include robust traditional and non-traditional working waterfronts, abundant recreation and tourism opportunities, and coastal access; Improve public understanding about the coastal and marine environment and related community issues.

Project Number: R/PM-4b

RECAP: As a step to promote welcoming and safe public coastal spaces for all communities, a S.C. Sea Grant Consortium-funded study was conducted to understand physical, economic, and social barriers to beach access by minoritized communities in S.C.

RELEVANCE: Prior research has demonstrated that beach recreation can promote mental, social, and physical wellbeing. However, research also has revealed that racial minorities tend to be less likely to engage in various forms of nature-based outdoor recreation, with a small number of studies suggesting this pattern may apply to beaches. The purpose of this study was to explore racial minorities' usage of beaches across South Carolina.

RESPONSE: S.C. Sea Grant Consortium-supported researchers examined barriers to beach access by minoritized groups. The first study objective was to determine the degree to which different racial groups visit the beach, and whether they use it in different ways. The second study objective was to explore how potential barriers to beach

visitation are experienced by different communities. Examples of barriers include swimming safety, a sense of belonging, and a sense of wellbeing through beach activities.

RESULTS: This study delivered an academic manuscript entitled “A day at the beach for everyone?: A race-based comparison of beach recreation patterns and participation barriers” in review at the *Journal of Leisure Research*. It also led to a practitioner-oriented report summarizing the study findings that was shared with the City of Isle of Palms, Charleston County Parks, Myrtle Beach Parks and Recreation, and the Town of Hilton Head Island Parks & Recreation Commission.

S.C. Sea Grant Consortium Researchers Examined Social Carrying Capacity for Mariculture Development on S.C. Coast

William Norman, Lauren Duffy, Jeffrey Hallo: Clemson University

Associated Goals: Healthy and viable coastal communities and economies include robust traditional and non-traditional working waterfronts, abundant recreation and tourism opportunities, and coastal access; Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities.

Project Number: R/A-36

RECAP: In order to enhance coastal shellfish mariculture siting decisions, S.C. Sea Grant-funded researchers surveyed coastal stakeholders in traditional and innovative (using virtual reality) techniques to determine their perceptions and potential conflicts to related to shellfish mariculture in S.C. coastal waterways.

RELEVANCE: Shellfish mariculture presents multiple economic and entrepreneurial opportunities for the South Carolina coastal region. However, the potential for expansion of oyster farming in the state might be at risk of increased opposition from waterway stakeholders because floating cages are more visible than bottom-planted oyster and clam mariculture. While S.C. has geospatial information on mariculture lease siting, it has not included a human dimension data component.

RESPONSE: S.C. Sea Grant funded this research to identify issues influencing stakeholder perceptions and attitudes toward the expansion of oyster mariculture, and develop a set of indicators that will serve as the basis for measuring social carrying capacity/societal acceptance of mariculture in Charleston and Beaufort counties. The study objective was to determine the societal acceptability of potential management actions for oyster mariculture development.

RESULTS: Study results were shared with members of the local advisory committee which includes representatives from local industries, management decision-makers, and non-governmental organizations.

PARTNERS: Bluffton Oyster Co., Coastal Conservation League, Charleston Fish Finder, S.C. Department of Natural Resources, S.C. Department of Health and Environmental Control, The Nature Conservancy, Charleston County Parks, Beaufort County Parks, Town of Bluffton.

IMPACTS

S.C. Sea Grant Consortium and Partners Provide Leadership to Strengthen/Build/Expand the S.C. Clean Marina Program

April Turner, Taylor Campbell, S.C. Sea Grant Consortium; Benjamin Stone, S.C. Department of Natural Resources; Liz Hartje and Kelsey Fogarty, S.C. DHEC-Office of Ocean and Coastal Management

Associated Goals: Healthy and viable coastal communities and economies include sustainable traditional and non-traditional economic opportunity and equity in coastal access.

Project Number: A/E-1b

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

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

RESPONSE: To help create a cleaner marine environment in South Carolina, the Consortium assumed the coordination of the S.C. Clean Marina Program (SCCMP) in 2020. The Consortium and its partners, both state agencies and marine industry professionals, have worked to redevelop and strengthen the program and increase the number of certified clean marinas in the state.

RESULTS: A certification training workshop was held on August 17, 2023, with 17 participants representing 10 marinas in attendance. As a result of this training, four marinas completed the certification process and were designated S.C. Clean Marinas. The S.C. Sea Grant Consortium and partners have continued to improve and expand the S.C. Clean Marina Program, by organizing training workshops, hosting technical team meetings, conducting site visits, and developing promotional and educational materials (e.g., rack cards).

PARTNERS: S.C. Department of Natural Resources, S.C. DHEC-Office of Ocean and Coastal Management, S.C. Clean Marina Technical Advisory Committee (seven marine industry members).

More than 270 Real Estate Professionals Receive Accredited Training from the S.C. Sea Grant Consortium and Partners

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

Associated Goals: Coastal communities manage and conserve the resources needed to sustain their quality of life in light of rapid population growth, land-use change, and variations in climate and weather.

Project Number: A/E-1b

RECAP: The S.C. Sea Grant Consortium and partners taught a series of accredited continuing education courses for 276 real estate professionals, with 12 training sessions providing information and resources about important

coastal issues for agents to share with clients, and the Consortium is working with partners to develop additional residential topics for future courses.

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 bridges 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, hosted through three coastal realtor associations and 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 the renewal process for course modules and instructors.

RESULTS: Twelve courses were taught by the Consortium and partners to a total of 276 REPs. Evaluations indicated 72% increased their subject knowledge “a lot” while more than 70% plan to reference/use this information in discussions with clients. Additionally, 75% are interested in taking additional courses. These training courses are estimated to have provided an economic benefit of \$16,446. The Consortium and partners continued to develop additional topics (e.g., freshwater wetlands) to expand program course offerings.

PARTNERS: ACE Basin and North Inlet-Winyah Bay National Estuarine Research Reserves, S.C. Department of Natural Resources, S.C. Department of Health and Environmental Control, Clemson University, Coastal Carolina University, University of South Carolina, S.C. Coastal Information Network, Charleston Trident Association of Realtors, Coastal Carolina Association of Realtors, Hilton Head Area Realtors.

WEATHER AND CLIMATE RESILIENCE

ACCOMPLISHMENTS

S.C. Sea Grant Consortium and Partners Begin Assessing the Benefits of Thin Layer Placement in South Carolina Marshes

Katie Finegan, S.C. Sea Grant Consortium/Coastal Carolina University; Lexi Watson, Matt Gorstein, Amanda Guthrie, Brita Jessen, and Ke'Ziyah Williamson, S.C. Sea Grant Consortium; Giulio Mariotti, Louisiana State University; Andrew Tweel, S.C. Department of Natural Resources; Ellie Lovellette, College of Charleston

Associated Goals: WCR Goal 2, HCE Goal 1

Project Number: A/CRP-1

RECAP: In 2023 the S.C. Sea Grant 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, a restoration technique used by engineers and coastal managers 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 the marshes' ability to recover naturally. thin layer placement (TLP) is a process in which sediment removed during dredging is transported to a marsh and applied to the surface of the marsh. This sediment addition to marshes can be beneficial as a dredge material disposal site and to support marsh resilience.

RESPONSE: The Consortium and partners will develop a multi-sectoral framework to assist in decision-making for potential TLP sites in South Carolina. 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: The Consortium and partners assembled an 11-member project advisory council to guide and provide feedback. The council consists of members from federal, state, private, and local groups, all with an interest in marsh restoration techniques. An in-person meeting was held with the team and council to relay progress from the first year, provide an opportunity to learn from a group in Georgia who conducted a pilot TLP project, and request potential locations to model.

S.C. Sea Grant Consortium and Partner Calculate Sediment Volume Change to Aid Beach Erosion Research and Monitoring

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

Associated Goals: WCR Goal 2.

Project Number: A/E-1f

RECAP: 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.

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: Three reports were produced which provided graphical and textual explanations of the shoreline changes observed annually between 2022 and 2023 and in an intermediary six-month survey. These reports were delivered to Horry County, City of North Myrtle Beach, and the U.S. Army Corps of Engineers to assist in determining timing of the next renourishment event. Nourishment is anticipated to occur in the summer of 2024.

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

Katie Finegan, S.C. Sea Grant Consortium and Coastal Carolina University; Amanda Guthrie, S.C. Sea Grant Consortium; Jill Gamble, Coastal Equity and Resilience (CEAR) Hub; Nina Sassano, Marine Extension and Georgia Sea Grant; Sun Joo Ahn, University of Georgia; Matt Browning, Clemson University

Associated Goals: WCR Goal 1

Project Number: A/E-1f

RECAP: S.C. Sea Grant Consortium and its partners developed training modules to work in tandem with a virtual reality simulation to help drive home the concepts and risks associated with storm surge for individuals throughout coastal Georgia and South Carolina.

RELEVANCE: Storms and coastal populations in the Southeast are increasing, but many people have not experienced a hurricane. They are unfamiliar with what storm surge is, the damage it can cause, and what actions they can take to protect their home. Using a virtual reality storm surge simulation and accompanying training modules, information is conveyed to explain extreme weather risks and their associated preparative actions.

RESPONSE: The Consortium developed 2.5 of five total training modules on introduction to hurricanes, hurricane risks and changing conditions, and post hurricane recovery. Each module includes a short video, PowerPoint presentation, and an activity (ie. discussion questions or interactive game). These training modules' intended audiences are state, county, and local emergency managers.

S.C. Sea Grant Consortium Establishes Coast Snap Station in Charleston 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

Associated Goals: WCR Goal 2, SLWD Goal 3

Project Number: A/E-1f

RECAP: The S.C. Sea Grant Consortium continued working with the U.S. Army Corps of Engineers Research and Development Center to install a Folly Beach Coast Snap station, which 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: Folly Beach in Charleston County is a major tourist destination that supports the local and state economy. The beach experiences shoreline changes due to various coastal processes. The numerous visitors to the beach provide a valuable citizen science resource to assist in monitoring how the shoreline is affected by various events. This project also presents an opportunity to educate the public on shoreline erosion and renourishment events.

RESPONSE: The Consortium involved students from College of Charleston in the installation process and will involve students from Coastal Carolina University in maintaining and processing the incoming data from the station. Future work will continue to refine how to most effectively disseminate the images and information from the Coast Snap station.

RESULTS: In September 2023 the Coastal Processes Specialist installed a Coast Snap station on the Edwin S. Taylor Fishing pier in Folly Beach. The pier was recently opened in 2023 after being closed for two years to repair damage from shipworms. The station averages 110 photos a month, it is anticipated that there will be more engagement with the station as information is disseminated.

S.C. Sea Grant Consortium Works with Coastal Carolina University Students to Investigate Marine Debris

Katie Finegan, S.C. Sea Grant Consortium/Coastal Carolina University; Reggie Bell, Coastal Carolina University

Associated Goals: WCR Goal 1, SLWD Goal 3

Project Number: A/E-1f

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 and provided mentorship to the team during the fall semester as they worked to brainstorm ideas to pursue in the spring semester.

RELEVANCE: Students in the engineering science program at Coastal Carolina University must have a culminating major engineering design experience that 1) incorporates appropriate engineering standards and multiple constraints and 2) is based on the knowledge and skills acquired in earlier course work. During the fall semester, students work on an 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 rivers.

RESULTS: During the fall semester, the Coastal Processes Specialist met with the student team regularly to provide input and feedback and answer questions for the team as they brainstormed the feasibility of potential solutions. The fall semester ended with the team deciding on a prototype design to build. 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 Works with Coastal Carolina University Students to Investigate Thin Layer Placement

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

Associated Goals: WCR Goal 1, SLWD Goal 3

Project Number: A/CRP-1

RECAP: The S.C. Sea Grant Consortium tasked a group of engineering students with developing recommendations for a pilot project for thin layer placement in South Carolina for their cornerstone project, a precursor to their senior capstone project, and then provided mentorship to the engineering student team during the spring semester.

RELEVANCE: Students in the engineering science program at Coastal Carolina University must have a culminating major engineering design experience that 1) incorporates appropriate engineering standards and multiple constraints and 2) is based on the knowledge and skills acquired in earlier course work. This cornerstone project prepares students for their senior capstone project.

RESPONSE: The Consortium developed a project description that tasked a team of students to come up with recommendations for implementing thin layer placement in South Carolina. Students were asked to identify best practices to employ in using this restoration technique and to identify suitable locations.

RESULTS: During the spring semester, the Coastal Processes Specialist met with the student team regularly to provide input and feedback and answer questions for the team as they learned more about the thin layer placement technique. The semester ended with the team presenting their ideas to the Coastal Processes Specialist in a final report.

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

Associated Goals: Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: RCG-5

RECAP: A S.C. Sea Grant Consortium study highlights the need for disaster response efforts to be tailored to the

needs and concerns of different population groups and to take into account the complex socioeconomic and cultural factors that can influence people's perceptions of risk and vulnerability to natural disasters.

RELEVANCE: Coastal storms and hazards (e.g., flooding) result in different impacts to communities based on locally-relevant socioeconomic, 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 socioeconomic 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: The study shows impending natural disasters can have a significant impact on sentiments expressed on social media, suggesting that social media can be an effective tool to monitor public sentiment and to communicate disaster-related information to the public. It also highlights the importance of considering the socioeconomic vulnerabilities of different population groups in order to build trust with historically marginalized groups and ensure they have access to the resources and information they need.

PARTNER: The Citadel

Consortium and Collaborators Expanding Southeast 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

Associated Goals: Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: A/E-1d

RECAP: The South Carolina Sea Grant Consortium collaborated with the Southeast Coastal Ocean Observing Regional Association, Francis Marion University, and Coastal Carolina University to install water level sensors for socioeconomically vulnerable populations in rivers and creeks throughout the Pee Dee watershed to provide communities with decision-making support during flooding events and to provide data to enhance flood modeling in the watershed.

RELEVANCE: The low-lying coastal region of South Carolina is highly vulnerable to tidal flooding and rain events, experiencing repeated impacts from extreme and chronic flooding over the past decade. The complexity of these tidal systems combined with the lack of widely distributed monitoring equipment has resulted in a lack of understanding of the scope of these events. Understanding the flow will allow communities to prepare for and protect public safety.

RESPONSE: To expand the water level sensor network in the Pee Dee watershed of South Carolina, sensors have been installed in Bennettsville, Marion, and McClellanville throughout 2023. Engagement began in Williamsburg and is continuing where installations have been completed to establish critical flooding thresholds. Also in 2023, the Consortium's specialist began coordinating the efforts of North Carolina, South Carolina, Georgia, and Florida to enhance engagement and make data more accessible across the region.

Understanding 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; Amanda Guthrie, S.C. Sea Grant Consortium; Scott Curtis, The Citadel; Jennifer Helgeson, National Institutes for Standards and Technology; Jamie Kruse, Anurdha Mukherji, and Ausmita Ghosh, East Carolina University

Associated Goals: Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: A/E-1d

RECAP: The South Carolina Sea Grant Consortium partnered with The Citadel, East Carolina University, and the National Institute of Standards and Technology to examine the impact of buyout programs of flood-prone properties in two rural communities, one in North Carolina and another in South Carolina. The study will help program managers understand many of the social and economic impacts of buyout programs. Ultimately, rural communities can be better prepared for such programs.

RELEVANCE: Many of South Carolina's low-income, rural communities have been underserved by past environmental initiatives. Several rural counties in the state also experience chronic flooding and are undergoing programs to buy out flood-prone properties and restore them to natural floodplain functions as a response to flooding from extreme events such as Hurricane Matthew and Hurricane Florence.

RESPONSE: Following engagement with the S.C. Office of Resilience, the community of Bennettsville was chosen for a study of the impacts of buyout programs, as it is a rural, flood-prone, low-income community currently undergoing the buyout process. As a result of trust and connections being built in 2022, a specialist completed 10 interviews with community leaders in the spring and summer of 2023, which led to one successful focus group with 13 participants.

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

Amanda Guthrie, Susan Lovelace, S.C. Sea Grant Consortium; Landon Knapp S.C. Sea Grant Consortium and College of Charleston; Abi Locatis Procheska, ACE Basin NERR, S.C. Department of Natural Resources; Alicia Wilson, Dami Abioye, University of South Carolina; Norm Levine, Matt Nowlin, Duncan Williamson, Lauren Greenwood, College of Charleston; Robert Merchant, Kristen Forbus, Juliana Smith, Beaufort County

Associated Goals: Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt

policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: A/E-1d

RECAP: The S.C. Sea Grant Consortium and partners received funds from the NOAA Climate Program's Adaptation Sciences Program to assess groundwater levels in Beaufort County and their impact on underground infrastructure.

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 us to live in places. 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 County and data collected throughout the year. The groundwater data has been used to create spatial models to inform county priorities and policies to reduce climate change impacts. The Consortium presented project findings to Beaufort County Council, All Joy Community Preservation Committee, and St. Helena Cultural Protection Overlay.

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

S.C. Sea Grant Consortium Established a Coastal Resilience Community of Practice, the Coastal Resilience Collective

Amanda Guthrie and Susan Lovelace, S.C. Sea Grant Consortium; Zachary Fogleman and Landon Knapp, S.C. Sea Grant Consortium and the College of Charleston

Associated Goals: Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: A/E-1d

RECAP: The S.C. Sea Grant Consortium evaluated and assessed current relationships and needs to establish the foundation for an emerging coastal resilience community of practice, called the Coastal Resilience Collective.

RELEVANCE: Coastal communities are facing many climate-induced changes and challenges but may not have the connections and resources to address current and future impacts. Applied research and climate solutions are being applied along the coast, and increased knowledge sharing and relationship building across the region and within coastal watersheds is possible.

RESPONSE: The Consortium formed an interdisciplinary team of researchers, government (local, state, federal) employees, non-profit organization employees, and extension professionals to guide the development of the Coastal Resilience Collective. Furthermore, a needs assessment survey was developed to evaluate the priorities and concerns of resilience professionals across the coastal region.

RESULTS: Through feedback opportunities and sharing about the program establishment, a confirmed need for enhanced collaboration and communication for resilience application and research across the coastal region was noted. A graduate student defended their thesis proposal based on the assessments used to form the Coastal Resilience Collective.

PARTNER: College of Charleston

S.C. Sea Grant Consortium Led a Resilience Workshop for Sea Grant Programs in the South Atlantic and Caribbean

Amanda Guthrie, Matt Gorstein, SC Sea Grant Consortium; Cayla Cothron, Frank Lopez, N.C. Sea Grant; Michelle Covi, UGA Marine Extension and Georgia Sea Grant; Holly Abeels, FL Sea Grant; Lillian Ramirez Durand, PR Sea Grant

Associated Goals: Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: A/E-1d

RECAP: The S.C. Sea Grant Consortium led a steering committee and a two-day workshop for resilience practitioners in the South Atlantic and Caribbean Sea Grant programs to foster regional collaboration on resilience topics and create a forum for peer sharing amongst Sea Grant staff working on coastal resilience issues.

RELEVANCE: The South Atlantic and Caribbean states and territories are facing similar climate change challenges and impacts. Increased communication and collaboration across the programs would be valuable for sharing resources and experiences to enhance resilience programs in the region.

RESPONSE: The Consortium led a steering committee with representatives for each Sea Grant program in the region, and convened an in-person twoday workshop for Sea Grant personnel to share knowledge and develop relationships. Six staff from the Consortium attended the workshop and engaged with other Sea Grant programs throughout the workshop. Four staff presented their work to other attendees.

RESULTS: Thirty-two attendees from Sea Grant programs in the region attended the workshop, including three attendees from NOAA or National Sea Grant. The feedback from the closing survey demonstrated that the workshop fostered increased networking for Sea Grant programs in the South Atlantic and Caribbean region. Based on continued conversations with attendees, this event has spurred additional meetings and knowledge-sharing opportunities.

PARTNERS: North Carolina Sea Grant, Georgia Sea Grant, Florida Sea Grant, Puerto Rico Sea Grant

S.C. Sea Grant Consortium Hires Coastal GIS Specialist

Shu-Mei Huang and Landon Knapp, S.C. Sea Grant Consortium and College of Charleston; Matthew Gorstein, S.C. Sea Grant Consortium; Timothy Callahan, College of Charleston; Norman Levine, College of Charleston

Associated Goals: Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt

policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: A/E-1d

RECAP: The S.C. Sea Grant Consortium expanded the technical capacity of the agency and the communities it serves by partnering with the College of Charleston to hire a Coastal GIS Specialist.

RELEVANCE: Coastal community members and managers recognize the importance of mapping information and applications for a range of decision-making needs and goals. Low resource and underserved communities often lack access to GIS technology and do not have the staff capacity to utilize these resources for their needs. Skilled GIS technicians are also often missing from research project teams, despite the ability of mapping products to communicate science to wide audiences.

RESPONSE: The Consortium partnered with the College of Charleston's Lowcountry Hazards Center to create a joint position with a goal of providing the technical expertise necessary to expand regional GIS capabilities.

RESULTS: A Coastal GIS Specialist was hired in the Fall of 2023 and is providing a wider range of services to the many constituencies requesting science-based information and technical assistance to enhance their resilience to coastal change.

PARTNER: College of Charleston

Consortium Finds the S.C. Resilient Coastal Communities Collaborative Program

Landon Knapp, S.C. Sea Grant Consortium and College of Charleston; Sophia Truempi, Ke'Ziyah Williamson, Amanda Guthrie, and Susan Lovelace, S.C. Sea Grant Consortium; Alex Butler, Hope Warren, Bradley Craig, and Andrew White, S.C. Office of Resilience; Nicole Elko, S.C. Beach Advocates

Associated Goals: Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: A/E-1d

RECAP: The Consortium created the S.C. Resilient Coastal Communities Collaborative Program to respond to the lack of planning capacity in underserved communities as well as the need for planning at the watershed scale.

RELEVANCE: There have been numerous studies, plans and initiatives focused on flood mitigation and resilience along the coast, but not all communities (such as those that may be situationally vulnerable and/or historically underserved) have access to the resources necessary to conduct such planning activities. Further, waterbodies often span political boundaries, which creates additional challenges as they connect communities with different priorities and lived experiences and also connect those at different stages in resilience planning.

RESPONSE: The Consortium partnered with the S.C. Office of Resilience and S.C. Beach Advocates to create the S.C. Resilient Coastal Communities Collaborative Program. The program will develop resilience and flood risk reduction plans for a major S.C. river basin. The project team will work with individual communities to co-produce 10 Community Risk and Vulnerability Reports with identified solutions. These will be integrated into a Watershed Resilience Plan which prioritizes actions that increase community and ecosystem resilience.

RESULTS: Funding (\$750,625) was obtained from the National Fish and Wildlife Foundation to establish the program. The Consortium hired a Coastal Community Resilience Planning Specialist in fall 2023 to lead the development and implementation of the program. Work began to analyze the current resilience planning efforts in the region as well as to identify community organizations and representatives for future engagement in the area. Communities will be selected for participation in the program in 2024.

PARTNERS: S.C. Office of Resilience, S.C. Beach Advocates

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

Landon Knapp and Shu-Mei Huang, S.C. Sea Grant Consortium and College of Charleston; Brooke Saari, S.C. Sea Grant Consortium; Norman Levine and Morgan Peshoff, College of Charleston; Amy Scaroni and Raghupathy Karthikeyan, Clemson University

Associated Goals: Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: A/E-1d

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 for use by watershed and stormwater managers to assess fecal bacteria pollution sources.

RELEVANCE: South Carolina has roughly 1,200 impaired water bodies, with bacteria the cause of more than 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 negative impacts on overall public health, economic health, and ecosystem health. Limited tools are 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, including data analysis and engagement with environmental organizations to ensure proper sourcing and application of pollution datasets.

RESULTS: Funding (\$22,281) was obtained 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. The tool completion date is planned for summer 2024, followed by training and outreach efforts for watershed and stormwater managers.

PARTNERS: College of Charleston, Clemson University

Flood Risk in Rosemont, S.C., Assessed 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; Norman Levine and Vijay Vulava, College of Charleston

Associated Goals: Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: A/E-1d

RECAP: The S.C. Sea Grant 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 in Charleston County.

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 in which community members are being trained to collect and store water samples for analysis. Funding and permitting for installation of a water level sensor were secured for a tidal creek within the community.

RESULTS: Community members are being trained to collect and store water samples for analysis as part of a citizen science program. A water level sensor was installed adjacent to a bridge which is the major artery for traffic in and out of the community. Consortium and College scientists collected survey data for the sensor, which is providing data in real-time to residents of the community and scientists identifying adaptation mechanisms to recurrent flooding.

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

IMPACTS

S.C. Sea Grant Consortium Conducts Vulnerability Assessment and Co-leads Community Engagement for City of Folly Beach

Landon Knapp and Duncan Williamson, S.C. Sea Grant Consortium and College of Charleston; Amanda Guthrie and Matt Gorstein, S.C. Sea Grant Consortium; Nicole Elko, Elko Coastal Consulting

Associated Goals: Widespread community understanding of the risks associated with living, working, and doing

business along the South Carolina coast encourages public and private decision-makers to create and adopt policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: A/E-1d

RECAP: The S.C. Sea Grant Consortium led the development of a tidal inundation and asset vulnerability assessment and mapping tool for the City of Folly Beach, provided technical assistance to the city in interpreting and applying sea level rise prediction data into their sea level rise adaptation plan, co-led community engagement events to collect public input into the planning process, and contributed to the publication of the city's 2023 Sea Level Rise Adaptation Plan update.

RELEVANCE: Folly Beach is a small and low-lying barrier island already experiencing substantial impacts from flooding and sea level rise, persistent street flooding from tidal flooding and heavy rain, and corroding underground infrastructure. The Consortium was approached in 2023 by the Folly Beach community leaders for assistance in understanding future risks and impacts related to sea level rise and flooding and to update their previous sea level rise adaptation plan published in 2017.

RESPONSE: The Consortium developed a tidal inundation and asset vulnerability assessment and mapping tool for the City of Folly Beach, provided technical assistance to the city in interpreting and applying sea level rise prediction data into their sea level rise adaptation plan, co-led community engagement events to collect public input into the planning process, including a sea level rise planning charrette and a tabling event.

RESULTS: The city's 2023 Sea Level Rise Adaptation Plan update – “Folly 2050: Planning for Water” – was published in partnership with Elko Coastal Consulting as a 40-page report in January 2024. Major recommendations include conducting a septic vulnerability assessment, more public outreach on flooding impacts, encouraging the use of impervious surfaces, considering the “2050 king tide” elevation in future building codes, and using public spaces for demonstration projects.

PARTNERS: City of Folly Beach, Elko Coastal Consulting

Town of Pawley's Island Utilizes S.C. Sea Grant Consortium and College of Charleston Resources to Obtain State Funding for Coastal Adaptation Efforts

Landon Knapp and Duncan Williamson, S.C. Sea Grant Consortium and College of Charleston; Norm Levine, College of Charleston; Nicole Elko, Elko Coastal Consulting

Associated Goals: Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: A/E-1d

RECAP: The S.C. Sea Grant Consortium partnered with the College of Charleston to provide geographic information system mapping resources to coastal communities by having student projects focus on real-world issues communicated by communities and collaborators, and the analysis for the Town of Pawleys Island was used to justify \$250,000 in state funding for coastal adaptation efforts in the town.

RELEVANCE: Coastal communities of South Carolina require Geographic Information System (GIS) mapping and analyses to address increasing community and environmental hazards, but many lack the necessary technical and

financial resources. Pawleys Island is a small and low-lying barrier island already experiencing substantial impacts from flooding and sea level rise, persistent street flooding from tidal flooding and heavy rain, and corroding underground infrastructure.

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, a vulnerability assessment was conducted for the communities of Pawleys Island and Murrells Inlet.

RESULTS: The 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 to draft a [sea-level rise adaptation plan](#). In 2023, the town received a \$250,000 earmark in the state budget to start implementing that plan.

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

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

Amanda Guthrie, 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

Associated Goal: Widespread community understanding of the risks associated with living, working, and doing business along the South Carolina coast encourages public and private decision-makers to create and adopt policies, plans, and ordinances to reduce risks, manage weather and climate events, and speed recovery.

Project Number: A/E-1d

RECAP: Due in part to heat-health assessment activities by the S.C. Sea Grant Consortium and partners, the mayor of the City of Charleston designated a heat awareness week in April 2023.

RELEVANCE: In the U.S., heat kills more people than any weather-related hazard. Due to climate change, hotter days and nights will create 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 a growing need to increase awareness of and reduce heat health impacts in the short and long term.

RESPONSE: The Consortium 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: The Consortium and partners hosted a two-day tabletop exercise to review how Charleston could address extreme heat scenarios. The Consortium, The Citadel, and Charleston County then collaborated to evaluate how road treatment affected heat islands. This collaboration led to a Community Engaged Internship focused on measuring heat and collating community resources. Lastly, the Consortium and partners helped the city develop a Heat Proclamation to designate a heat awareness week in April 2023.

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

SUSTAINABLE FISHERIES AND AQUACULTURE

ACCOMPLISHMENTS

S.C. Sea Grant Consortium Develops Mapping Application for Gullah Geechee Seafood Trail Website

Matt Gorstein, S.C. Sea Grant Consortium; Shu-Mei Huang and Landon Knapp, S.C. Sea Grant Consortium and College of Charleston; 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

Associated Goal: A healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and sustainably.

Project Number: A/E-1a

RECAP: The S.C. Sea Grant Consortium worked with the Gullah Geechee Chamber of Commerce to develop a mapping application for the Gullah Geechee Seafood Trail website.

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 Gullah Geechee Chamber of Commerce, an organization currently working to promote businesses owned by Gullah Geechee community members in South Carolina and enhance economic opportunity for the 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 2023, the Consortium continued to support the chamber by developing a mapping application for use on the [Gullah Geechee Seafood Trail website](#). 24 businesses are currently listed on the map – ranging from restaurants and seafood markets to cultural experiences.

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

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

Associated Goals: Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities; A healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and sustainably.

Project Number: R/A-38

RECAP: Working with local breweries in the Charleston area, Consortium-funded researchers examined the utility of spent grains as a nutrition source for red drum, an important mariculture species, and determined it is viable for aquaculture feed in quantities up to 25% of the overall feed formulation.

RELEVANCE: Determining cost-effective feed for 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-plus months of samples from each of the partner breweries and analyzed these samples for proximate (protein, lipid, ash, fiber) composition, amino acid profile, fatty acid profile, and NMR-based metabolite profiles. 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 utilize this material from multiple breweries without significantly changing the nutritional profile.

RESULTS: Given the minimal differences between spent grain from multiple breweries over time, researchers are encouraged that grain from different breweries can be combined without concern over quality as viable aquaculture feed.

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 and Partners Develop Proposal to Collect Data to Inform Resubmergence Policy

Sarah Pedigo and Matthew Gorstein, S.C. Sea Grant Consortium; Peter Kingsley-Smith, Gary Sundin and Lauren Faulk, S.C. Department of Natural Resources; Mike Marshall, South Carolina Department of Health and Environmental Control; Matthew Nowlin, College of Charleston

Associated Goals: A healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and sustainably.

Project Number: A/E-1c

RECAP: The S.C. Sea Grant Consortium in partnership with South Carolina Department of Natural Resources researchers, South Carolina Department of Health and Environmental Control shellfish sanitation managers, and

College of Charleston social scientists were awarded a \$360,000 grant through Southern Sustainable Agriculture Research and Education to collect Vibrio data on mariculture farms in South Carolina to inform resubmergence aquaculture policy and to evaluate the aquaculture policy change process.

RELEVANCE: Oyster growers must strike a balance between maximizing production efficiency and providing a safe, sustainable product. The two-week resubmergence requirement South Carolina 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 will allow local conditions data collection, document interagency communications, and develop policy recommendations to maximize sustainability and efficiency for the oyster mariculture industry in South Carolina.

RESPONSE: The Consortium responded to a need identified by the oyster mariculture industry by establishing a project team and being awarded funds 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 on-farm research to gather data.

RESULTS: The Consortium and project partners are planning lab testing of samples from three mariculture farms in South Carolina in summers of 2024 and 2025.

Partners: S.C. Department of Natural Resources, S.C. Shellfish Growers Association, South Carolina Department of Health and Environmental Control, College of Charleston

S.C. Sea Grant Consortium Partners with Clemson University on a Working Group to Explore the Feasibility of Offshore Aquaculture

Sarah Pedigo and Matthew Gorstein, S.C. Sea Grant Consortium; Dr. Charles Santerre, Clemson's College of Agriculture, Forestry, and Life Sciences

Associated Goals: Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities.

Project Number: A/E-1c

RECAP: The S.C. Sea Grant Consortium in partnership with a Clemson University researcher established a multi-institutional working group in early 2023 to explore the feasibility of offshore aquaculture off the coast of South Carolina, starting with a white paper by Clemson to share background information on offshore aquaculture status and trends.

RELEVANCE: Aquaculture Opportunity Areas have been sited in several regions of the country, though not the South Atlantic. It isn't well understood whether this region is amenable to these practices. A multitude of challenges go into establishment of offshore aquaculture, and there is a need for quality information products to guide optimal decision-making that balances marine resource health with economic growth potential and food production.

RESPONSE: The Consortium facilitated a series of three virtual working group meetings held October 2023, December 2023, and January 2024 with expert presentations from those who have been involved with offshore aquaculture in federal waters, question and answer sessions, and dialogue amongst South Carolina marine resource research and development stakeholders.

RESULTS: The Consortium provided a platform to share information with multiple institutions and gather their

feedback and overall perspective on offshore aquaculture. The feedback will be consolidated into a roadmap which indicates knowns, unknowns, interests, and institution capacity to explore further.

Partners: Clemson University College of Agriculture, Forestry, and Life Sciences

S.C. Sea Grant, Clemson University and Florida Sea Grant Offer Risk Management Information to Shellfish Growers

Sarah Pedigo, S.C. Sea Grant Consortium; Steve Richards, Clemson University Extension; Leslie Sturmer, University of Florida Institute of Food and Agriculture Sciences Extension and Florida Sea Grant

Associated Goals: A healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and sustainably.

Project Number: A/E-1c

RECAP: The S.C. Sea Grant Consortium in partnership with Clemson University Extension Faculty and Florida Sea Grant were awarded a grant from the U.S. Department of Agriculture 2023 Risk Management Education Partnerships Program to help shellfish growers identify production and legal liability risks to their farms and prepare risk management plans.

RELEVANCE: Shellfish farmers are confronted with countless decisions incorporating various levels of risk throughout a production season. Growers can more proactively protect against production and natural disaster risks by following protocol for production records and by choosing appropriate assistance policies for their operations.

RESPONSE: Workshops will be held in both South Carolina and Florida in summer 2024 to help growers assess how their farms are prepared to handle disaster; identify production, market, and legal liability risks; understand what crop assistance and disaster assistance programs are available to protect their operations from these risks; and be presented with resources and tools to improve risk management.

RESULTS: Three workshops will be hosted along the coast of South Carolina in summer 2024. Dedicated resource webpages will host resources for growers.

Partners: Clemson University, University of Florida Institute of Food and Agriculture Sciences Extension and Florida Sea Grant

S.C. Sea Grant Consortium Develops Training Program for Next Generation of Commercial Fishers and Mariculture Growers

Angela Treptow, Jocelyn Juliano, Matt Gorstein, Sarah Pedigo, S.C. Sea Grant Consortium; Steve Richards, Clemson University

Associated Goals: Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities.

Project Number: R/WD32-1

RECAP: In response to a declining commercial fisheries workforce, the S.C. Sea Grant Consortium developed a commercial seafood apprenticeship program to be hosted in the major southeast fisheries hub of McClellanville.

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: Building off of two previously funded projects, a community-engaged needs assessment and a feasibility blueprint for a training center in McClellanville, S.C., the Consortium, along with Clemson and seafood industry partners, created a month-long apprenticeship program focused on workforce training in commercial fishing and shellfish mariculture.

RESULTS: The Consortium and partners created a curriculum for a month-long workforce training program with expertise from 31 instructors and industry experts. The S.C. Commercial Seafood Apprenticeship Program will cover seamanship and navigation, boat and gear operation and maintenance, along with on-the-job training in shrimping, crabbing, oystering, and shellfish mariculture. Apprentices will be provided with free housing during the program and a \$1,000 stipend. The first cohort will complete the program in May 2024.

PARTNERS: Clemson University, Town of McClellanville, McClellanville Community Foundation, McClellanville Watermen's Association

S.C. Sea Grant Consortium Creates Seafood Direct Marketing Toolkit Based On Consumer Preference Surveys

Matt Gorstein, Jocelyn Juliano, Sarah Pedigo, Duncan Williamson, and Crystal Narayana, S.C. Sea Grant Consortium; Pravin Nath, Scott Swain, Danny Weathers, Michael Giebelhausen, Clemson University

Associated Goals: A healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and sustainably.

Project Number: A/E-1c

RECAP: Working from results of a previous Clemson University survey of consumer preferences and perceptions of direct marketing of seafood products, the S.C. Sea Grant Consortium created a seafood direct marketing toolkit for use by commercial seafood industry producers interested in direct-to-consumer sales.

RELEVANCE: The COVID-19 pandemic, along with other market shifts, 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 commercial seafood producers through creative strategies.

RESPONSE: Based on the previously funded survey results, Consortium specialists created fact sheets and a heat map application to help producers understand seafood consumer preferences and markets to target or avoid when considering the best methods for selling shellfish products.

RESULTS: The new mapping application may be used by shellfish producers to examine and compare relative consumer preferences for directly purchasing oysters, clams, crabs, and shrimp in zip codes across South Carolina,

North Carolina, and Georgia. Fact sheets explore consumer preferences by species as well as how they most often purchase seafood (in-person, online, by phone), where they consume seafood (restaurants, at home, special events), and in what quantities.

PARTNER: Clemson University

S.C. Sea Grant 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

Associated Goals: Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities.

Project Number: P/RCF-1

RECAP: With a second allocation of funds from Congress, 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 and Bayesian hierarchical modeling of remotely operated vehicle camera-trap and habitat data.

RELEVANCE: Red snapper, *Lutjanus campechanus*, is an ecologically and economically significant reef fish in U.S. Atlantic waters from North Carolina through 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: 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 as well as estimate and analyze the sample sizes needed to estimate the number of discards in the U.S. Atlantic red snapper fishery, as this has a known substantial effect on the population.

RESULTS: In year two, the team took additional fin clip samples, conducted remotely operated vehicle and camera-trap surveys, and analyzed results to produce two manuscripts. An additional 3D telemetry effective sampling area experiment was conducted and analyzed. Genotype sequencing of fin clip samples was completed for all year one samples. A two-day workshop was held to strategize the next steps for simulation analyses for estimating the magnitude of discards in U.S. Atlantic red snapper recreational fishery.

PARTNERS: University of Florida, SC Department of Natural Resources

Regional Sea Grant Programs Partner to Support a Reef Fish Extension/ Communications Outreach Fellow

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

Associated Goals: Sustainable fisheries and aquaculture that balance the long-term ecological health of the

resource and the social, economic, and cultural needs of communities.

Project Number: A/E-1c

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 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 in the information and guidance needed to inform best fishing practices, and messaging and communications regarding stewardship goals needs consistency and a boots-on-the-ground approach.

RESPONSE: This fellowship extends the best available science and fishing practices directly to the fishermen. The Reef Fish Outreach and Communications Fellow engages with the fishing community by visiting bait/tackle shops and networking and presenting at fisheries events from North Carolina to the Florida Keys.

RESULTS: The Reef Fish Outreach and Communications Fellow, under the guidance of the South Atlantic Marine Fisheries Council in Charleston, participated in more than 60 presentations, seminars, and events ranging in 2023, speaking with stakeholders about best fishing practices, citizen science, and South Atlantic federal fisheries regulations. Additionally, the fellow coordinated a three-part online seminar series focused on reef fish surveys throughout the South Atlantic and three offshore media trips focused on documenting best fishing practices.

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. Sea Grant Consortium Documents Perceptions of Commercial Shrimpers for Lowcountry Shrimp Collaborative Research Project

Robert Dunn, North Inlet-Winyah Bay NERR & University of South Carolina; Maeve Snyder, North Inlet-Winyah Bay NERR & 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

Associated Goals: Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities.

Project Number: A/E-1c

RECAP: S.C. Sea Grant Consortium researchers have explored the importance of different estuarine habitat types and variable environmental conditions on the shrimp population for the future management of a multi-million-dollar fishery.

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 low country 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 interviews to gain their perceptions of changes in environmental conditions and shrimp abundance.

RESULTS: In the second and third years of the project, field work, experiments and data analyses were conducted, a manuscript for the historical System Wide Monitoring Program data was prepared, and semi-structured interview results from commercial shrimper stakeholders were summarized for a StoryMap final product.

PARTNERS: North Inlet-Winyah Bay NERR, University of South Carolina, SC 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

IMPACTS

South Carolina Commercial Fisheries Infrastructure Needs Assessment Developed by S.C. Sea Grant Consortium Used to Inform Grant Program

Matt Gorstein and Jocelyn Juliano, S.C. Sea Grant Consortium; Steve Richards, Clemson University; Amy MacKown, S.C. Seafood Alliance; Kathryn Rowe, College of Charleston

Associated Goal: Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities.

Project Number: A/E-1c

RECAP: The S.C. Sea Grant Consortium 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, and information from this report was used by the S.C. Department of Agriculture in developing its [Growing Agribusiness Fund](#).

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 Consortium helped the industry assess the economic needs of working waterfront infrastructure (e.g. repairs, upgrades) required to remain viable food providers.

RESPONSE: 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.

RESULTS: The estimate of \$5.3 million was communicated to the S.C. Department of Agriculture and used in developing its Growing Agribusiness Fund. Seafood businesses (wild harvest and aquaculture producers and dealers) were eligible and encouraged to apply. The South Carolina General Assembly appropriated \$40 million

to launch the initiative, which will help existing businesses engaged in the processing, packaging, manufacturing, distribution, storage, and transportation of agricultural products, in turn providing more markets for agricultural producers.

PARTNERS: South Carolina Seafood Alliance, Clemson University

S.C. Sea Grant-Funded Study Results Used to Optimize Hatchery Strategies for Spotted Seatrout After Cold Winter Events

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

Associated Goal: Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities

Project Number: R/CF-24

RECAP: The S.C. Sea Grant Consortium funded a new modeling effort by S.C. Department of Natural Resources to determine the optimal hatchery production protocols to maximize genetic diversity of stocked fish as a response to severe winter conditions and population vulnerability.

RELEVANCE: Spotted seatrout populations are vulnerable to catastrophic mortality events associated with cold-water temperatures. Sustained or repeated events can greatly reduce populations. In such situations, stock enhancement is an important fisheries management tool. Understanding how hatchery management decisions can help mitigate the genetic impacts of stocking is critical to evaluate the potential long-term success of a stock enhancement program.

RESPONSE: The development of the model and preliminary management option recommendations are ready for implementation under a variety of future spotted seatrout recovery scenarios that allow population recovery while maintaining the health and adaptability of wild population reductions.

RESULTS: The S.C. Department of Natural Resources' stock enhancement program uses project information to optimize their hatchery management of broodstock to maximize genetic diversity of juvenile spotted seatrout produced. The resulting tool and preliminary recommendations will be useful to SCDNR in decision-making during future cold winter events. The developed model can be applied to other species recovery plans as well.

PARTNER: The College of Charleston

Cobia Sex-Identification Tool Developed by S.C. Sea Grant Researchers Incorporated into Stock Enhancement Programs

Tanya Darden, Matt Walker, Lengxob 'Lenny' Yong: S.C. Department of Natural Resources

Associated Goal: Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities.

Project Number: R/CF-25

RECAP: S.C. Sea Grant-funded researchers developed a non-lethal tool that can be used to assess critical life history information for cobia in S.C. and is directly applicable to stock assessments and management decisions to help ensure the long-term sustainability of the cobia fishery.

RELEVANCE: Sex ratios of fish populations are a key parameter for stock assessments and essential to understand fisheries management impacts. Cobia is a species of concern in South Carolina due to past heavy fishing pressure and is currently the target of restoration efforts. For species such as cobia that do not exhibit external sexual dimorphism, lethal dissection of gonads has been required for sex identification. A non-lethal method to determine Cobia sex would enhance management decisions.

RESPONSE: A non-lethal tool was developed to assess critical life history information for cobia in S.C. and can be directly applicable to stock assessments and management decisions. The new tool is also valuable to hatchery managers for optimizing broodstock sex ratios for genetic diversity and production. The genome-wide DNA sequence data for cobia generated during this project can be used for other investigations.

RESULTS: This project developed a new non-lethal genetic tool for sex identification in cobia. The tool has been incorporated into S.C. Department of Natural Resources stock enhancement program for restoration work with our genetically-unique inshore population that spawns in Port Royal Sound. It is also being used to generate new sex data for the upcoming stock assessment as well as an ongoing project investigating spawning patterns of Gulf of Mexico cobia.

PARTNERS: Other southeastern state fisheries agencies, NOAA port agents, and other southeastern U.S. universities donated genetic samples.

S.C Sea Grant Consortium Helps Shellfish Grower Establish Operation, Increasing Diversity in State Mariculture Industry

Sarah Pedigo, S.C. Sea Grant Consortium

Associated Goals: Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities.

Project Number: A/E-1c

RECAP: The S.C. Sea Grant Consortium provided technical assistance to support the integration of mariculture into a diverse South Carolina seafood business, in which the owner had previously relied on harvesting wild shellfish resources.

RELEVANCE: In South Carolina, there is a lack of diversity in the mariculture industry for reasons that may include inaccessibility to resources, lack of training opportunities, or high capital start-up costs. Underrepresented communities have relied on use of natural resources for subsistence, commercial, or cultural use and often have strong ecological knowledge. Reducing barriers to entry would enhance their ability to maintain their lifestyle and provide greater economic opportunities through extending mariculture practices.

RESPONSE: The Consortium assisted a prospective grower in receiving two grants to start its operation, including a U.S. Department of Agriculture Resilient Food Infrastructure award and a The Nature Conservancy Supporting Oyster Aquaculture Restoration award. In addition, the Consortium provided technical assistance to the grower to transfer oyster grow-out process knowledge.

RESULTS: In 2023, the new grower stocked and deployed oysters onto its operation and is preparing to carry out objectives of grants awarded to further establish its operation.

Partners: Gullah Man Oyster Co., LLC

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

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

Associated Goals: Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities.

Project Number: A/E-1c

RECAP: The S.C. Sea Grant 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 in South Carolina.

RELEVANCE: The toolkit provides information to aid industry entrants in navigating complexities of establishing an operation and lessens uncertainties of pursuing shellfish aquaculture in South Carolina.

RESPONSE: The Consortium consolidated informational materials into an aquaculture toolkit webpage and offered technical assistance to prospective industry entrants. The toolkit includes 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), and an oyster farm budget tool. A new addition to the toolkit is a GIS-based map application which consolidates all available lease siting information in SC.

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. In the past year through direct consults, four prospective industry entrants and one current industry member have used the business planning tool, and one used the permitting guide to submit a permit application.

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

Associated Goals: Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities.

Project Number: A/E-1c

RECAP: In partnership with the University of South Carolina Department of Geography, the S.C. Sea Grant Consortium developed and released a geographic information systems-based mariculture site mapping tool to aid in selecting appropriate locations for shellfish mariculture leases in South Carolina.

RELEVANCE: Siting a mariculture lease in South Carolina requires meeting standards from multiple permitting agencies. To this point, information has been available for regulatory parameters but has been hosted on multiple different web locations. This tool brings together all information available from permitting agencies and provides additional information for lease siting with additional economic, environmental, and social factors in mind. The tool also provides an instructional guide to work in accordance with agencies when selecting a lease site.

RESPONSE: The Consortium partnered with University of South Carolina Department of Geography to develop the GIS tool with iterative feedback from permitting agencies and the shellfish farming industry to incorporate recommended information and spatial layers that would lead to a useful and effective tool.

RESULTS: The GIS-based siting tool was released in January 2024 as part of the Consortium’s Aquaculture Toolkit and has been used by at least one prospective grower to submit a mariculture application for review.

Partners: University of South Carolina, College of Charleston

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

Imani Black, Minorities in Aquaculture (MIA); Sarah Pedigo, S.C. Sea Grant Consortium

Associated Goals: Sustainable fisheries and aquaculture that balance the long-term ecological health of the resource and the social, economic, and cultural needs of communities.

Project Number: A/E-1c

RECAP: The S.C. Sea Grant Consortium partnered with Minorities in Aquaculture in summer 2023 to offer hands-on aquaculture training to three university women of color through internships on South Carolina oyster farms in a project that aims to bridge the gap between women and sustainable seafood by providing support for women of color in high school, college, and beyond.

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 learn basic skills in aquaculture, gain access to the industry, and expand potential career opportunities in marine science and the seafood sector.

RESPONSE: The Consortium established a partnership with Minorities in Aquaculture, a 501c3, to carry out the MIA internship in 2022. 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. The specialists facilitated connections of interns to farm sites in the summer of 2023.

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 2023. Three undergraduate students from Consortium member institutions, conducted a full range of aquaculture activities throughout the internship, resulting in workforce training that equipped them to enter and support the industry.

PARTNERS: Minorities In Aquaculture

Consortium Facilitated Information Exchange Leads to Aquaculture Industry Connection to Accessible Seed Source

Sarah Pedigo and Matthew Gorstein, S.C. Sea Grant Consortium; Ben Dyar and Henry Davega, S.C. Department of Natural Resources

Associated Goals: A healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and sustainably.

Project Number: A/E-1c

RECAP: The S.C. Sea Grant Consortium facilitated an aquaculture information exchange in December 2022 between the mariculture industry and South Carolina Department of Natural Resources, offering an opportunity to share needs and solutions on topics such as seed access.

RELEVANCE: Mariculture industry members noted difficulties and inefficiencies with logistics and protocols concerning seed importation into South Carolina. Ability to access seed readily is a limiting factor for industry progression in the state, due to limited in-state hatchery capacity and difficulty in importing seed from out-of-state facilities.

RESPONSE: Difficulties with acquiring seed for operations was a topic expressed at the information exchange in late 2022. Members of the SCDNR were able to share alternative options for accessing in-state sources of seed for the industry versus necessitating imports for acquiring seed.

RESULTS: A pathway to increase access to seed within the state was identified, and at least three growers who attended the meeting are now acquiring seed from a reliable source. These industry members acted on information they obtained at this meeting to enhance their access to seed.

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

S.C. Sea Grant Consortium and Partner Offer Commercial Fishing Vessel Safety Training to Industry Members

Jocelyn Juliano, S.C. Sea Grant Consortium

Associated Goals: A healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and sustainably.

Project Number: A/E-1c

RECAP: In an effort to educate and train commercial fishermen on safety at sea, the S.C. Sea Grant Consortium co-organized two Alaska Marine Safety and Education Association (AMSEA) Commercial Fishing Vessel Drill Conductor Training classes in Beaufort and McClellanville, SC.

RELEVANCE: Commercial fishing is the most dangerous profession in the world, but with proper safety training, accidents and disasters can be prevented in many cases. Fishermen are required by law to complete monthly safety drills for their vessels and crew.

RESPONSE: The Consortium co-organized two AMSEA Commercial Fishing Vessel Drill Conductor trainings in major commercial fisheries hubs, Beaufort and McClellanville, SC. Attendees gained life-saving knowledge on safety at sea,

emergency, and disaster preparedness training.

RESULT: Six industry members received their USCG-certified AMSEA Commercial Fishing Vessel Drill Conductor Course certificate and are better prepared to practice safety at sea and respond to emergencies.

PARTNERS: Alaska Marine Safety and Education Association

SCIENTIFIC LITERACY AND WORKFORCE DEVELOPMENT

ACCOMPLISHMENTS

S.C. Sea Grant Consortium Designs and Edits 55 Communications 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 55 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: 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. 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: S.C. Sea Grant Consortium's Communications and Education Team assisted with the development of 55 products to support administration, extension, communications, and education programs.

RESULTS: Programs supported include From Seeds to Shoreline, Beach Sweep/River Sweep, the Clean Marina Program, the Blue Carbon Symposium, and the Wetlands of the Upper Estuary Conference, 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 Website Continues to Expand in Content and Access

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

RECAP: The S.C. Sea Grant Consortium added 35 news articles and 54 content pages to the website (www.scseagrant.org), a source of science-based information for decision-makers and the public. **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 was 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: In FY22-23, the website received 174,026 page views, a 36.9% increase from FY22-23.

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

Susan Ferris Hill, S.C. Sea Grant Consortium

RECAP: Eight issues of *CoastalScience@Work* e-newsletters were produced and delivered to an average of 1,087 individual subscribers. The e-newsletters contained program updates for the Consortium's partners and constituents.

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

RESPONSE: The Communications and Education Services staff produce and deliver *CoastalScience@Work*, the Consortium's e-newsletter, to an average of 1,087 individual subscribers through the platform Constant Contact. Email lists include the Board of Directors and alternates; Program Advisory Board; Extension and Education advisory committees; research and finance liaisons; National Sea Grant Office; member institution public information officers; S.C. African American Heritage Commission members; S.C. General Assembly members; U.S. Congressional staff; Consortium staff; and the general public.

RESULTS: Eight issues of *CoastalScience@Work* e-newsletters were produced and delivered to an average of 1,087 individual subscribers. The average open rate was 46.1% (a small increase from FY22-23) and the average click-through rate was 3.75%, both of which are higher than the average industry rates for educational content.

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

Susannah Sheldon, Susan Lovelace, Amanda Guthrie, Brooke Saari, Sarah Pedigo, Jocelyn Juliano, Matt Gorstein, S.C. Sea Grant Consortium

Associated Goals: Coastal and ocean education programs foster the development of a diverse scientifically trained workforce

Project Number: M/PM-3

RECAP: The S.C. Sea Grant Consortium completed the second round of the Community Engaged Internship 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 and 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 Community Engaged Internship Program in South Carolina to provide opportunities for undergraduate students from marginalized and underserved communities to conduct summer community-based projects that focus on environmental and resilience needs as aligned with the Consortium's strategic plan.

RESULTS: Three undergraduate summer interns worked on three projects in 2023. One from the University of South Carolina collected and analyzed urban heat data emanating from different building materials and land cover

types; one from Benedict College identified regional examples of incorporating climate resilience into local laws and ordinances; and one from University of South Carolina developed communications materials for the Trawl to Trash project, including a video tutorial on bag making and a website.

Partners: USC, Benedict College

S.C. Sea Grant Consortium and Partners Kick Off Gullah/Geechee CREATE Project

Matt Gorstein, S.C. Sea Grant Consortium; Queen Quet, Gullah/Geechee Sea Islands Coalition; Marilyn Hemingway, Gullah Geechee Chamber of Commerce; Zenobia Harper, Gullah Preservation Society

Associated Goals: Improve public understanding about the coastal and marine environment and related community issues

Project Number: R/MD23-2

RECAP: The S.C. Sea Grant Consortium and partners received \$300,000 through the National Sea Grant Office's marine debris community action coalition competition for *Gullah/Geechee CREATE: Coastal Debris Removal Engaging Artists through Environmental Cleanups*, a project focused on collecting and removing marine debris from the coastal environment and upcycling the collected material into artwork.

RELEVANCE: The Gullah/Geechee are a culture and community of descendants of enslaved Africans and indigenous Americans who share common language, foodways, food preparation skills, spiritual connection, art, and music. These communities are deeply embedded in the cultural history of South Carolina, and have a rich history of fishing, harvesting, and preparing marine resources, highlighting a longstanding connection to marine resources, as well as a vulnerability to marine debris in waterways and marine food chains.

RESPONSE: Because the project is led by community-based organizations and engages local artists, the team is building coalitions and partnerships to identify and actively address marine debris prevention and removal at the community level. The team plans to host art and education showcases in 2025 and 2026.

RESULTS: Two clean up events were hosted on St. Helena Island in October of 2023. 43 volunteers removed 64 bags of marine debris from Ball Park Road, and 30 volunteers removed 12 bags of marine debris from the Penn Center property. An interest survey was disseminated to artists – 41 artists filled out the survey, 17 registered for an information session, and 10 attended an information session. 6 artists are currently working on pieces.

PARTNERS: Gullah/Geechee Sea Islands Coalition, Gullah Geechee Chamber of Commerce, Gullah Preservation Society, James Island Arts and Cultural Center

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

Susan Lovelace, Amanda Guthrie, S.C. Sea Grant Consortium; Merrie Koester, University of South Carolina Center for Science Education and The Citadel James B. Near Center for Climate Studies; Scott Curtis, The Citadel James B. Near Center for Climate Studies

Associated Goals: Coastal and ocean K-12 education programs foster scientific literacy, stewardship, and exposure to science-based careers in both formal and informal settings.

Project Number: R/ED-3

RECAP: The Consortium was awarded nearly \$160,000 for a two-year grant through the NOAA National Sea Grant College Program and the NOAA Disaster Preparedness Program to expand and document 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, minority communities are at greater risk in disaster situations, while community-based organizations that serve and represent these minority communities are not linked well with disaster loss reduction and preparedness efforts.

RESPONSE: A S.C. Sea Grant Consortium researcher is expanding upon the Kids Teaching Flood Resilience program (www.kidsteachingfloodresilience.com) developed in response to a key challenge in the City of Charleston's 2015 Sea Level Rise Strategy Plan. A two-year grant was secured in 2023 to expand and create an educational program for youth educators to teach about hurricanes and improve science literacy and hurricane resilience.

RESULTS: The project team has created resources, such as classroom activities and education videos, for youth educators to use in their programs. A team of teachers has been involved in the testing of the materials and have provided feedback on the implementation and use of the materials.

PARTNERS: University of South Carolina Center for Science Education, The Citadel James B. Near Center for Climate Studies

S.C. Sea Grant Consortium's *Coastal Heritage* Wins Notable State Document Award

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

Associated Goals: Improve public understanding about the coastal and marine environment and related community issues.

Project Number: C/IS-1

RECAP: The fall 2023 issue of *Coastal Heritage*, "Where the Wild Places Are: Captivating Carolina Bays," won a 2023 Notable State Document award from the South Carolina State Library.

RELEVANCE: Recognition by librarians and state agency employees of the State of South Carolina is one metric by which success is measured. Acknowledgement that publications are relevant, interesting, well-researched, and provide significant information to the public confirms the Consortium's public service role is successful.

RESPONSE: The Consortium regularly submits publications to various award competitions. The primary contributors to *Coastal Heritage* are staff in the communications, extension, education, and administration departments, as well as university and federal agency partners.

RESULTS: The fall 2023 issue of S.C. Sea Grant Consortium's flagship magazine, *Coastal Heritage*, "Where the Wild Places Are: Captivating Carolina Bays," won a 2023 Notable State Document award from the South Carolina State Library. The magazine was one of 12 publications selected for the award, and judging criteria was based on design, writing style, and breadth of information.

S.C. Sea Grant Co-Edits Special Issue of Oceanography Focused on National Sea Grant Programs

Brita Jessen, S.C. Sea Grant Consortium

RECAP: S.C. Sea Grant Consortium co-edited a special feature issue of the journal *Oceanography* that highlights Sea Grant programs and priorities across the nation with a special feature on S.C. Sea Grant staff and an article on the Blue Carbon Law Symposium.

RELEVANCE: Sea Grant programs play a unique role by integrating place-based research, extension, education, and workforce development. The role of local Sea Grant programs has expanded over five decades and not all audiences know of the breadth and scope of impact across stakeholders and the research community. The journal *Oceanography* is freely accessible and well-regarded across academic communities on an international platform and provides an opportunity to highlight Sea Grant to new audiences.

RESPONSE: Consortium staff member Jessen provided a leadership role on the editorial team for the *Oceanography* special issue by convening monthly meetings; hosting informational webinars; recruiting and editing articles for a section of resilience articles; submitting an article on blue carbon; and writing Career Profiles featuring Sea Grant employees.

S.C. Sea Grant Consortium Educator Wins 2023 S.C. Environmental Awareness Award

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

Associated Goals: Coastal and ocean K-12 education programs foster scientific literacy, stewardship, and exposure to science-based careers in both formal and informal settings. Also, coastal and ocean education programs foster the development of a diverse scientifically trained workforce.

RECAP: The S.C. Sea Grant Consortium's marine education specialist E.V. Bell wins the 2023 S.C. Environmental Awareness Award.

RELEVANCE: The S.C. Environmental Awareness Award, established by S.C. General Assembly in 1992, recognizes outstanding contributions made toward the protection, conservation, and improvement of the state's natural resources. Nominations are submitted annually by the public and reviewed by members of the awards committee. Members include representatives from the S.C. Forestry Commission, S.C. Department of Health and Environmental Control, S.C. Department of Natural Resources, and the Consortium.

RESPONSE: After the award's committee receives the nominations, they are independently reviewed and ranked based on several criteria, including excellence in innovation, leadership, and positive impacts on the state's natural environment and/or resources.

RESULTS: The 2023 S.C. Environmental Awareness Award was given to the Consortium's marine education specialist E.V. Bell for her role in the developing and leading marine education programming, specifically the From Seeds to Shoreline® youth salt marsh program and the Palmetto Environmental Education Certification.

Educator Wins STEM Innovation Partnership Award for Participation in S.C. Sea Grant Consortium's Youth Salt Marsh Program

E.V. Bell, S.C. Sea Grant Consortium; Jennifer Brown, S.C. Governor's School for Science and Mathematics

Associated Goals: Coastal and ocean K-12 education programs foster scientific literacy, stewardship, and exposure to science-based careers in both formal and informal settings. Also, coastal and ocean education programs foster the development of a diverse scientifically trained workforce.

Project Number: E/ME-1

RECAP: Dr. Jennifer Brown of the S.C. Governor's School for Science and Mathematics won the National Consortium of Secondary STEM Schools Innovative Partnership Award based on participation in the S.C. Sea Grant Consortium's From Seeds to Shoreline (S2S) Program.

RELEVANCE: The From Seeds to Shoreline® program is the state's only youth-focused salt marsh restoration program and is coordinated by the Consortium in partnership with the S.C. Department of Natural Resources and Clemson University. Participating students learn about the importance of this ecosystem through cultivating *Spartina alterniflora* at their schools and transplanting young seedlings to areas of degraded or eroded marsh along the coastline.

RESPONSE: The Governor's School for Science and Mathematics (GSSM) is a year-round school that provides high school students with immersive experiences in science and math. GSSM has participated in the S2S program for more than four years and recently was nominated and became a finalist for the National Consortium of Secondary STEM Schools (NCSSS) Innovative Partnership Award based on their involvement in this program.

RESULTS: In 2023, the NCSSS awarded Dr. Jennifer Brown at the GSSM with the Innovative Partnership Award for her leadership and involvement in the Consortium's S2S program.

Partner: S.C. Governor's School for Science and Mathematics

Education Associations Partner to Leverage Capacity and Funding to Provide Outreach Opportunities

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

Associated Goals: Coastal and ocean K-12 education programs foster scientific literacy, stewardship, and exposure to science-based careers in both formal and informal settings. Also, coastal and ocean education programs foster the development of a diverse scientifically trained workforce.

Project Number: E/ME-1

RECAP: The Environmental Education Association of South Carolina and the S.C. Marine Educators Association partner to leverage resources for three outreach programs and opportunities.

RELEVANCE: The Environmental Education Association of South Carolina (EEASC) and the S.C. Marine Educators Association (SCMEA) provide educators with resources and opportunities to learn about our natural environment. The S.C. Sea Grant Consortium's marine education specialist is a member of SCMEA and serves on the EEASC Board

of Directors. Because SCMEA and EEASC market to the same target audience, participants often must choose between the two based on limited resources, time, and other factors.

RESPONSE: SCMEA and EEASC partnered to jointly host meetups open to members of either organization as well as non-members. Each meetup was jointly funded and co-coordinated by both organizations, and during each event, both organizations highlighted their specific membership benefits and opportunities.

RESULTS: In 2023, three joint EEASC-SCMEA meetups were hosted for approximately 44 attendees: “Seining, Seashells, and Sharks Teeth,” “Shell-abrading the Green Sea Turtle,” and “Marvelous Migrating Monarchs.” The majority of attendees were members of either EEASC or SCMEA and resulted in an increase in membership of both organizations from those non- members attending. Plans are underway to continue the joint meetups in 2024.

PARTNERS: Environmental Education Association of South Carolina, South Carolina Marine Educators Association

S.C. Sea Grant Consortium Secures \$20,000 for Ocean Science Career Project

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

Associated Goals: Coastal and ocean K-12 education programs foster scientific literacy, stewardship, and exposure to science-based careers in both formal and informal settings. Also, coastal and ocean education programs foster the development of a diverse scientifically trained workforce.

RECAP: The S.C. Sea Grant Consortium secured \$20,000 in grant funds from the National Oceanic and Atmospheric Administration and the National Marine Sanctuary Foundation to develop ocean career outreach and program materials for underserved populations.

RELEVANCE: A 2021 study by the National Sciences Foundation found only 8.8% of graduate students in the ocean sciences identify as part of a racial minority population. Barriers impeding underserved populations to pursue a career in the ocean sciences are complex, but reasons include financial limitations, lack of access to resources related to career opportunities, and a culture of exclusion. Exposing youth to career paths in the ocean sciences can increase diversity within this field.

RESPONSE: The Consortium submitted a proposal to the National Marine Sanctuary Foundation and NOAA to fund an Ocean Odyssey Coastliner Program to build a network to share about career opportunities, create four toolkits for hands-on learning to explore ocean sciences and careers, and provide teacher support at six Title 1 schools with predominantly minority populations. This proposal was submitted with the S.C. Department of Employment and Workforce, Horry-Georgetown Technical College, and Patriots Point Naval and Maritime Museum.

RESULTS: The National Marine Sanctuary Foundation and NOAA awarded the Consortium \$20,000 to create the Ocean Odyssey Coastliner program that would foster a network of ocean science professionals and educators, support immersive collaborations with six Title 1 schools with predominantly minority populations, and create educator toolkits that emphasized career paths through hands-on learning.

PARTNERS: S.C. Department of Employment and Workforce, Horry-Georgetown Technical College, Patriots Point Naval and Maritime Museum

S.C. Sea Grant Consortium Continues to Organize Diversity Staff Trainings

Associated Goals: Coastal and ocean education programs foster the development of a diverse scientifically trained workforce.

RECAP: The S.C. Sea Grant Consortium provided three staff trainings on topics related to incorporating diversity, equity, and inclusion 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 staff were diversity training opportunities for personal and professional growth. Using this feedback, four diversity staff trainings were scheduled: February 2023 (International African American Museum), March 2023 (Accessibility and Inclusivity), and December 2023 (Indigenous Peoples – self-guided).

RESULTS: During 2023, three diversity, equity, and inclusion trainings were held for Consortium staff, during which more than 75% of staff attended.

S.C. Sea Grant Consortium Continues Salt Marsh Education and Recreational Fishing Program with Local Title 1 School

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

Associated Goals: Coastal and ocean K-12 education programs foster scientific literacy, stewardship, and exposure to science-based careers in both formal and informal settings. Also, coastal and ocean education programs foster the development of a diverse scientifically trained workforce.

Project Number: E/ME-1

RECAP: The S.C. Sea Grant Consortium's From Seeds to Shoreline® program serves as a foundational component in a two-year education initiative at Edith L. Frierson Elementary School—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 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: 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 Elementary School on Wadmalaw Island. The project launched in fall of 2022 with partners leading a variety of classroom salt marsh education

activities approximately every other week. Through the From Seeds To Shoreline program, the students planted *Spartina alterniflora* seedlings at a campus-located greenhouse and participated in a restoration day within their community.

RESULTS: Since the launch of the program in fall of 2022, 150 students have participated in salt marsh education and recreational fishing programming, growing *S. alterniflora* on their school grounds, and restoring local salt marsh by planting *S. alterniflora* and placing modified abandoned fishing gear for oyster habitat. Assessment data from 2022-23 program showed an increase in knowledge about the salt marsh, including evidence that students have developed a personal connection to the salt marsh due to this program.

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

Associated Goals: Coastal and ocean K-12 education programs foster scientific literacy, stewardship, and exposure to science-based careers in both formal and informal settings. Also, coastal and ocean education programs foster the development of a diverse scientifically trained workforce.

RECAP: Nine issues of the *The Lettered Olive* education e-newsletter were produced and delivered to 1,130 individual stakeholders with an average open rate of 42% and click-through rate of 4.7%.

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 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* to 1,130 individuals. 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: Nine issues of *The Lettered Olive* education e-newsletter were produced and delivered during FY23-24. The average open rate was 42%, an increase from 37% from the previous reporting year. The click rate was 4.7%, which was nearly double the industry average of 2%.

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

Associated Goals: Coastal and ocean K-12 education programs foster scientific literacy, stewardship, and exposure to science-based careers in both formal and informal settings. Also, coastal and ocean education programs foster the development of a diverse scientifically trained workforce.

RECAP: The S.C. Sea Grant 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-four Knauss S.C. fellows have been selected since 1984, and 20 S.C. coastal management fellows have been placed since 1997. The Consortium and S.C. Space Grant Consortium 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 support undergraduate students.

RESULTS: In 2023, the Consortium supported 32 undergraduates, 18 master's-level students, and 13 Ph.D. students in conjunction with Consortium-funded research, internships, and fellowships. Thirty-six were new to Sea Grant support and 24 received continued support. Three of the graduate students were Consortium interns. Two Sea Grant-nominated students were selected for the Knauss fellowship and another for the Sullivan award. Student support has improved student and early professional ocean and coastal literacy, while helping secure employment.

Partners: Member institutions, MIA, SC Space Grant Consortium, Benedict College

IMPACTS

S.C. Sea Grant-Funded Program Develops New Career Education and Employment Opportunities

Julie Binz, Jessica Kinsella, S.C. Department of Natural Resources/ACE Basin National Estuarine Research Reserve

Associated Goals: Coastal and ocean K-12 education programs foster scientific literacy, stewardship, and exposure to science-based careers in both formal and informal settings.

Project Number: R/ED-2

RECAP: S.C. Sea Grant Consortium-funded researchers worked to enhance the participation and career opportunities of ACE Basin students in Title I schools through internship opportunities, teacher training sessions, career expos, and student engagement in marine science.

RELEVANCE: This project's primary goal was to facilitate viable conservation-based career paths for underserved students in the ACE Basin region of South Carolina by strengthening the relationship between the ACE Basin Reserve and local Title I schools and providing in-depth long-term engagement in marine science education activities.

RESPONSE: The S.C. Sea Grant Consortium funded the following opportunities: estuary education programs for over 800 middle school students; a marine biology career exposition for over 5,000 middle school students; a Career Explorers club for 20 high school students; a Master's research project on personal identity in the context of environmental career choices; and summer internships including workforce training for 10 high school students.

RESULTS: This project created 10 internships with the S.C. Department of Natural Resources (SCDNR); one intern is now fully employed at SCDNR. This project also supported an engagement specialist who is a bilingual educator.

SCDNR expanded its recruitment process as a result of this internship: job postings are now extended when possible, and the job posting link is widely distributed to local colleges and on social media to recruit to a wider, more inclusive audience.

PARTNERS: S.C. Aquarium; Gullah Geechee National Heritage Corridor; Sea Islands Heritage Academy; S.C. Chamber of Commerce

S.C. Sea Grant Consortium’s Environmental Education Certification Program Endorsed by S.C. State Department of Education

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

Associated Goals: Coastal and ocean K-12 education programs foster scientific literacy, stewardship, and exposure to science-based careers in both formal and informal settings. Also, coastal and ocean education programs foster the development of a diverse scientifically trained workforce.

Project Number: E/ME-1

RECAP: The Palmetto Environmental Education Certification program receives official approval from the S.C. State Department of Education as an endorsed local professional development provider.

RELEVANCE: The S.C. Sea Grant Consortium provided leadership in the development of the Palmetto Environmental Education Certification program (PEEC). Launched in 2018, this two-year program requires attendance at four workshops, completion of eight online modules and 90 hours of electives, and a final project. Both formal and nonformal educators are eligible for the certification and receive training on best practices, materials and resources for their place of employment, and guidance on the creation of a project.

RESPONSE: Formal educators must complete 120 hours of renewal credits through extracurricular professional development every five years to maintain their teaching license. In 2023, the Consortium applied to the S.C. Department of Education for PEEC to become an official “Endorsed Local Provider” for 120 renewal credits.

RESULTS: In 2023, the S.C. State Department of Education approved the PEEC as an “Endorsed Local Provider” for 120 renewal credits – the amount required for a formal educator to receive every five years to maintain licensure. Therefore, completing the PEEC course in two years satisfies one five-year cycle of renewal credit requirements.

PARTNERS: Environmental Education Association of South Carolina, S.C. Department of Education