

SCIENTIFIC LITERACY AND WORKFORCE DEVELOPMENT

IMPACTS

S.C. Sea Grant Consortium's Climate Change Workshop Information Incorporated into Local School Curricula

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

Relevance: South Carolina's coastline is vulnerable to an array of natural hazards, including hurricanes, earthquakes, and drought. Among these hazards, hurricanes and coastal storms tend to be the most common and visible due to potential widespread damage resulting from flooding and storm surge. Rising sea levels exacerbate the impacts of coastal storms. South Carolina's coastline has experienced a one-foot rise in sea level over the past 100 years, with future predictions estimating an accelerated rise. Even without a coastal storm, tidal and nuisance flooding resulting from events such as king tides or normal rainfall can hamper travel along roadways and can impact residences and businesses. Two recent examples – the October 2015 rainfall event and Hurricane Matthew in 2016 – underscore the need to continue providing science-based information to the public to aid in awareness, understanding, and decision-making for coastal residents for their protection and safety. With the rapidly increasing population along the S.C. coast, many residents and visitors do not understand the vulnerability of our coastline as a result of rising sea level. In particular, there is a need for educators and students who reside within coastal counties to have access to and understand the variety of scientific tools and literature available for understanding how weather and a changing climate are impacting their community. By incorporating tools, such as those developed by the National Oceanic and Atmospheric Administration, into the science curriculum, educators and students will have access to the most up-to-date information available regarding climate change and how communities are – and should – be adapting to meet these challenges.

Response: Though research, outreach, and educational programs, the S.C. Sea Grant Consortium aims to provide science-based information that highlights how our coastal environment is changing with regards to weather and climate and the possible risks communities face. In 2016, the Consortium was the recipient of a \$5,000 grant from the National Oceanic and Atmospheric Administration (NOAA) Climate Stewards Education Project (CSEP). The NOAA CSEP mission “provides formal and informal educators working with elementary through university age students with sustained professional development, collaborative tools, and support to build a climate-literate public actively engaged in climate stewardship.” To achieve this goal, NOAA CSEP funds up to six organizations in the United States to host multi-day educator trainings on climate-related topics specific to their region, and the S.C. Sea Grant Consortium was the only organization in the Southeast to receive funds for a Climate Stewards Workshop in 2016. The Consortium partnered with the South Carolina Aquarium and the National Park Service (Fort Sumter) to host a two-day workshop for 18 educators, entitled “Rising Tides and Changing Times,” that focused on the past, present, and future impacts of sea level rise. Based on an external evaluation conducted at the end of the workshop by the Technology for Learning Consortium, participants rated themselves significantly more knowledgeable in all content areas of the workshop with 90% of the participants confident in using what they learned in their places of employment. Specifically, an estimated 1,400 students and members of the public would be reached using the materials and information used during the “Rising Tides and Changing Times” workshop.

COASTAL SCIENCE SERVING SOUTH CAROLINA

Results: Two Charleston County schools, Ashley Hall and Charleston Development Academy, adopted information from the “Rising Tides and Changing Times” teacher workshop into their curricula.

1. Ashley Hall incorporated information (e.g. climate change graphs), tools (e.g. NOAA Sea Level Rise Viewer), and activities (e.g. “Climate Amazing Race”) presented during the workshop into Marine Science and AP Biology 1 courses.
2. The Charleston Development Academy incorporated information from the workshop into project-based learning efforts to address climate change using science-technology-engineering-art-math (STEAM).

Recap: Information and resources from S.C. Sea Grant Consortium’s “Rising Tides and Changing Times” educator workshop were adopted into the curricula at two local schools: Ashley Hall and Charleston Development Academy.

S.C. Sea Grant Consortium Aids in the Removal of 25.5 Tons of Marine Debris in the Charleston Harbor Watershed

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

Relevance: The presence of derelict vessels within South Carolina’s coastal waterways is a chronic problem and causes potential negative impacts on coastal ecosystems and navigational safety. Specifically, derelict vessels can cause damage to salt marsh habitat recognized as essential fish habitat by the South Atlantic Fishery Management Council. Reasons for vessel abandonment range from natural hazards (e.g., hurricanes) to the costs of upkeep and maintenance. Jurisdiction over derelict vessels in South Carolina is a collaborative effort among federal and state agencies, but despite this approach, derelict vessels remain a common occurrence within South Carolina’s coastal waterways. There are in excess of 150 derelict vessels along the coast.

Response: The S.C. Sea Grant Consortium (Consortium), in partnership with SCDHEC, received funding from the National Oceanic and Atmospheric Administration Marine Debris Program for the project “Using Community-Based Initiatives for Identification and Removal of Derelict Vessels and Other Marine Debris in Charleston County, South Carolina.” The project addressed the following objectives: 1) Removal of derelict vessels within the Charleston Harbor Watershed and 2) Prevention of marine debris in the Charleston Harbor Watershed through county-wide trainings and disposal opportunities.

Results: The project resulted in a cumulative 103.5 tons of marine debris being removed from the Charleston Harbor Watershed in the following manner with 25.5 tons removed during this reporting period:

1. A total of two derelict vessels were removed from the Charleston Harbor Watershed for a total of 23 tons removed.
2. A 3-day Clean Marine Event hosted in May 2016 provided an opportunity for Charleston County residents to dispose of unwanted fishing and boating gear. Nine locations staffed by volunteers were established across the county for residents to drop off their unwanted items. During the Clean Marine Event, residents were given the opportunity to dispose of their unwanted boat or trailer at the Bees Ferry Landfill for free. In total, 2.5 tons of fishing and boating gear was collected and recycled or disposed of properly.

Recap: S.C. Sea Grant Consortium was critical to the removal of harmful marine debris, including two derelict vessels and unwanted fishing and boating gear from Charleston County waterways for a total of 25.5 tons.

S.C. Sea Grant Consortium's Beach Sweep/River Sweep Litter Cleanup Saves Taxpayers \$209,873 in 2016

Susan Ferris-Hill, S.C. Sea Grant Consortium

Relevance: South Carolina has 2,876 miles of tidal shoreline, 504,450 acres of salt marsh, 165 linear miles of beaches, and more than 40 barrier islands. Natural resources account for approximately \$30 billion in annual economic output for the state (S.C. Dept. of Natural Resources' Economic Impact Report, 2009). And according to the S.C. Dept. of Parks, Recreation, and Tourism, tourism spending reached a record \$30 billion in 2016. Clean beaches, marshes, and waterways are critical to support commercial and recreational boating and fishing, wildlife viewing, tourism, and other industries. A litter-free environment also contributes positively to quality of life.

Response: The S.C. Sea Grant Consortium initiated the annual Beach Sweep litter cleanup program in 1988. In 1989, Hurricane Hugo devastated coastal and inland areas. To increase the effectiveness of the cleanup, the Consortium partnered with S.C. Dept. of Natural Resources in 1990 to extend the program statewide; the cleanup was then renamed Beach Sweep/River Sweep. Through the use of volunteers and private sector funds, the cleanup contributes to the economic, environmental, and societal well-being of the state. By participating in Beach Sweep/River Sweep, the public is more informed about natural resource issues, such as litter's detrimental effects on the landscape and wildlife, and people are empowered to take action and become environmental stewards.

Results: In 2016, 4,127 volunteers statewide collected over 24 tons of litter, covered 1,029 miles of South Carolina's beaches, marshes, and waterways, and recycled as much debris as possible. There were 110 coastal site captains at 135 cleanup locations in seven coastal counties, from Waties Island to Daufuskie Island. The dollar value of Beach Sweep/River Sweep volunteers' time is \$209,873 (Independent Sector, 2016). The number of volunteer hours was 8,694. Volunteers gained an increased awareness of the fragility of natural resources, the importance of keeping them litter-free, and contributed time to improve their communities and natural areas.

Re-cap: Beach Sweep/River Sweep has economic, environmental, and societal benefits. In 2016, 4,127 volunteers statewide collected over 24 tons of litter, covered 1,029 miles of South Carolina's beaches, marshes, and waterways. There were 110 coastal site captains at 135 cleanup locations in seven coastal counties. The dollar value of volunteers' time equals \$209,873. The number of volunteer hours was 8,694. The state's natural resources are cleaner, safer, and more beautiful for all to enjoy.

S.C. Sea Grant Consortium Website Continues to be Significant Source of Science-Based Information

Susan Ferris-Hill, S.C. Sea Grant Consortium

Relevance: Decision-makers and the public should be informed about coastal resource issues, and the S.C. Sea Grant Consortium website continues to be a significant source of information. The website also gives the users a better understanding of Consortium organization, as well as funded research, education, and outreach programs.

Response: CIS staff maintains the Consortium's website, (www.scseagrant.org), holds monthly web meetings with staff, and ensures the content is updated regularly with new information. CIS monitors website usage on a monthly basis with the web statistics software Sawmill version 8. The website received 1,505,837 hits, 276,632 unique visits, and 986,636 downloads during the reporting period.

COASTAL SCIENCE SERVING SOUTH CAROLINA

Results: The website received 1,505,837 hits, 276,632 unique visits, and 986,636 downloads during the reporting period. The top 10 downloads, and the number of times each was downloaded, were:

- *Low Impact Development in Coastal South Carolina: A Planning and Design Guide* – 25,770
- *2014 International Conference on Shellfish Restoration program* – 19,730
- *Of Sand and Sea: Teachings From the Southeastern Shoreline, Chapter 2* – 12,832
- *Chemical and Biological Contamination of Stormwater Detention Pond Sediments in Coastal South Carolina* – 10,063
- *Community Associations and Stormwater Management: A Coastal South Carolina Perspective* – 9,289
- *Sea Level Rise Adaptation Report: Beaufort County, South Carolina (full report)* – 8,268
- *South Carolina Coastal Wetland Impoundments* – 6,804
- *Coastal Waterfront Access Challenges & Opportunities for South Carolina Marine Fisheries Stakeholders* – 3,685
- *Tidal Creek Habitats: Sentinels of Coastal Health* – 3,683
- *Handbook of Relative Acute Toxicity Values for Crayfish* – 3,003

Re-cap: The S.C. Sea Grant Consortium website is a source of science-based information for decision-makers and the public to help them make wise choices regarding natural resource conservation and sustainability. The website also provides users with information about Consortium organization and processes. The website received 1,505,837 hits, 276,632 unique visits, and 986,636 downloads during the reporting period.

ACCOMPLISHMENTS

Marine Debris Removal Project Wins Community Pride Award

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

The S.C. Sea Grant Consortium, in partnership with the S.C. Department of Health and Environmental Control, received funding in 2014 from the National Oceanic and Atmospheric Administration Marine Debris Program for the project “Using Community-Based Initiatives for Identification and Removal of Derelict Vessels and Other Marine Debris in Charleston County, South Carolina”. The objectives of this project were removal of marine debris from the Charleston Harbor Watershed and engagement of Charleston County residents. By 2016, 103.5 tons of marine debris has been removed. In 2016, Charleston Community Pride awarded its Captain Pride Award to S.C. Department of Health and Environmental Control and S.C. Sea Grant Consortium for their work to remove abandoned vessels from Charleston Harbor and for the overall marine debris grant project. The Captain Pride Award is given each year to 10 individuals, businesses, governments, or civic organizations that have undertaken tasks that have significantly improved the environment.

S.C. Sea Grant Consortium Plans Launch of First Environmental Education Certification Program in South Carolina

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

The S.C. Sea Grant Consortium (Consortium) initiated efforts to develop South Carolina’s first environmental education certification program after a statewide survey and focus groups supported the need for this type of professional training. Approximately 120 educators completed the survey, stating the following as benefits for a certification program in the state:

- Improved skills (90%)

COASTAL SCIENCE SERVING SOUTH CAROLINA

- Networking with others in the field (84%)
- Enhanced status as a certified professional environmental educator (79%)
- Greater understanding of environmental issues (75%)
- Advanced learning (72%)
- Increased professionalism in your business (83%)
- Standard criteria for job applicants (57%)
- Marketing advantage from hiring certified professional environmental educators (43%)

Since then, the Consortium, in partnership with 14 formal and informal educators, developed the **Palmetto Environmental Education Certification (PEEC)** program with the vision of advancing professional environmental education in South Carolina and fostering a professional environmental education network to promote environmental literacy in South Carolina. The framework for PEEC is a two-year process involving four workshops, six online modules, electives, and a culminating capstone project. The pilot for PEEC is set for August 2017, with the official launch of the PEEC program scheduled for Fall 2018.

S.C. Sea Grant Consortium Produces Salt Marsh-Tidal Creek Ecosystem Educational Resources as Part of the “From Seeds to Shoreline” Program

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

In 2014, the S.C. Sea Grant Consortium, in partnership with the S.C. Department of Natural Resources, received a \$78,564 award from the U.S. Environmental Protection Agency to expand the From Seeds to Shoreline® (S2S) program throughout the Southeast and to create new resources that supplemented the educational context of the program. The S2S program is South Carolina’s only salt marsh restoration program designed to engage K-12 students in the cultivation and transplantation of *Spartina alterniflora*, the dominant plant of southeastern salt marshes. Four new publications were developed, including *Guide to the Salt Marshes and Tidal Creeks of the Southeastern United States*, a *Spartina alterniflora* poster, a *Salt Marsh Activity Book*, and a mobile responsive website for the guide:

www.saltmarshguide.org. Since production, 500 *Spartina* posters and 1,677 *Guide to the Salt Marshes and Tidal Creeks of the Southeastern United States* have been distributed to various formal and informal educators throughout the Southeast. The mobile version of the guide was used by 1,087 users for a total of 3,431 page views (77.9% were returning users) between December 2016 and January 2017. The *Salt Marsh Activity Book* began its distribution in February of 2017.

S.C. Sea Grant Consortium’s Guide to the Salt Marshes and Tidal Creeks of the Southeastern United States Adopted as part of a South Carolina Certification Program

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

In 2014, the S.C. Sea Grant Consortium, in partnership with the S.C. Department of Natural Resources, received a \$78,564 award from the U.S. Environmental Protection Agency to expand the From Seeds to Shoreline® program throughout the Southeast and to create new resources that supplemented the educational context of the program. The S2S is South Carolina’s only salt marsh restoration program designed to engage K-12 students in the cultivation and transplantation of *Spartina alterniflora*, the dominant plant of southeastern salt marshes. The Lowcountry Institute, located on Spring Island, S.C., coordinates the Lowcountry Master Naturalist Program, an intensive 12-week program that engages adult volunteers in learning about the different regions, ecosystems, and natural processes throughout South Carolina (<http://www.lowcountryinstitute.org/educational-outreach/master-naturalist-program>). As part of the program, high-quality resources such as field guides and ecology references are provided

to educators to be used by students in preparation for class. The coordinators of the Lowcountry Master Naturalist program adopted *Guide to the Salt Marshes and Tidal Creeks of the Southeastern United States* in December 2016 as one of the official resources used for their Lowcountry Master Naturalist class.

S.C. Sea Grant Consortium Collaborates on Development and Distribution of Southeast Region's First Microplastics Poster

Susan Ferris-Hill, E.V. Bell, and Susannah Sheldon, S.C. Sea Grant Consortium; John Weinstein, The Citadel; and Peter van den Hurk and Charles Rice, Clemson University

The S.C. Sea Grant Consortium marine educator, research manager, and communications director assisted with the development of the Southeast's first microplastics-related poster, *Microplastics in Estuaries*, in partnership with The Citadel and Clemson University. The poster extends information based on microplastics research conducted by The Citadel and Clemson scientists in an educational format that is easily understood by the general public. The information on the poster includes: definition of microplastics, impacts on the environment and wildlife, and stewardship approaches to help mitigate the amount of microplastics in estuaries. Two thousand four hundred copies of the poster were printed, and 900 posters have been distributed to-date to be displayed and used by schools, outreach organizations which address marine debris and pollution-related topics, and a variety of conference venues, including the South Carolina Aquarium's international conference on *Breaking Down Plastics*.

NOAA Climate Stewards Funding Supports S.C. Sea Grant Consortium Sea Level Rise Workshop **E.V. Bell, S.C. Sea Grant Consortium**

In 2016, the S.C. Sea Grant Consortium (Consortium) was the recipient of a \$5,000 grant from the National Oceanic and Atmospheric Administration (NOAA) Climate Stewards Education Project (CSEP). The NOAA CSEP mission "provides formal and informal educators working with elementary through university age students with sustained professional development, collaborative tools, and support to build a climate-literate public actively engaged in climate stewardship." To achieve this goal, the NOAA CSEP funds up to six organizations in the United States to host multi-day educator trainings on climate-related topics specific to their region, and the S.C. Sea Grant Consortium was the only organization in the Southeast to receive funds for a Climate Stewards Workshop in 2016. The Consortium partnered with the South Carolina Aquarium and the National Park Service (Fort Sumter) to host a two-day workshop for 18 educators, entitled "Rising Tides and Changing Times," that focused on the past, present, and future impacts of sea level rise. Based on an external evaluation conducted by the Technology for Learning Consortium, participants rated themselves significantly more knowledgeable in all content areas of the workshop, with 90% of the participants confident in using what they learned in their places of employment. Overall, an estimated 1,400 students and members of the public will be reached using the materials and information used during the "Rising Tides and Changing Times" workshop.

18 Young Scientists Envision S.C. Sea Grant Consortium's Future in Focus Groups **Susan Lovelace, S.C. Sea Grant Consortium**

The S.C. Sea Grant Consortium, as part of its FY2015-2016 visioning process, conducted focus groups to engage users in thinking about the Consortium's education, communication, extension, and research priorities for the future. Eighteen graduate-level students from four different universities discussed the need for adaptable and resilient coastal living, continuing need for education, both for residents and

COASTAL SCIENCE SERVING SOUTH CAROLINA

decision-makers, and vigilance in protecting coastal and ocean waters from emerging contaminants such as microplastics and pharmaceuticals. The sessions provided an opportunity for participants to consider the challenges and opportunities South Carolina will face over the next 25-30 years. Two focus group sessions were held at two different schools and included students from the University of South Carolina, The Citadel, the Medical University of South Carolina, and the College of Charleston. The input from each session was helpful in structuring the Consortium's 2018-2021 strategic plan.

S.C. Sea Grant Consortium fosters student support through internships, fellowships, and research Opportunities

Susannah Sheldon and M. Richard (Rick) DeVoe, S.C. Sea Grant Consortium

Supporting undergraduate and graduate students and early career professionals leads to an informed, engaged, and well-trained workforce. The S.C. Sea Grant Consortium is involved in several initiatives that support education and professional development for these individuals. Forty-six Knauss fellows have been selected from South Carolina since 1984, and 17 Coastal Management fellows from South Carolina have been placed with various state agencies nationally since 1997. In addition, Sea Grant partners with the S.C. Space Grant Consortium annually to support the Kathryn D. Sullivan Earth and Marine Science Fellowship, designed to increase the number of highly trained earth and marine scientists and to enable graduate students to conduct NASA- and NOAA-related Earth/marine science research. In 2015, S.C. Sea Grant supported 19 undergraduates, 37 master's-level students, and nine Ph.D. students in conjunction with Consortium-funded research, projects, and fellowships. Of these, 31 were new to Sea Grant support and 34 were continuing to receive support. Ten of the graduate students were Sea Grant extension and administration interns for the Consortium. One Sea Grant-nominated student was selected for the Knauss fellowship, two for the Coastal Management fellowship, and one for the Sullivan award. Sea Grant student support has improved ocean and coastal literacy among university students and early professionals and encouraged their success in securing coastal and marine-related employment.

S.C. Sea Grant provided 12 articles, generating more than 14,400 views on the National Sea Grant website's 50th Anniversary Section

Susan Ferris-Hill, S.C. Sea Grant Consortium

To celebrate the 50th anniversary of NOAA Sea Grant, state Sea Grant programs were asked to provide stories for the national website on monthly themes. The S.C. Sea Grant Consortium contributed 12 stories – more than any other program – that drew more than 14,400 views on the national website. Communications staff wrote two of the 12 and guided Education, Extension, and Program staff through the writing process for the other 10. Communications staff edited each of the articles, helped find photographs to illustrate them, and wrote captions for the photographs. Those stories featured former Knauss fellows (1,258 views), the emerging Charleston Resilience Network (3,799 views), Blueways-Greenways publications and app (1,535 views), the S.C. Coastal Water Monitoring Network web portal (1,702 views), graduate student support (835 views), the From Seeds to Shoreline® program (672 views), new oyster mariculture opportunities (661 views), microplastics research translated to an after-school program (1,318 views), the popular low-impact development guide (866 views), marine debris and litter cleanup programs (463 views), the working waterfront study group project (489 views), and the application of oyster shell cellular research in anti-biofouling paints (814 views).

S.C. Sea Grant Consortium Executive Director inducted into The Citadel's Academy of Science and Mathematics

M. Richard (Rick) DeVoe, S.C. Sea Grant Consortium

S.C. Sea Grant Consortium Executive Director M. Richard “Rick” DeVoe was inducted into The Citadel’s Academy of Science and Mathematics in a March 17, 2016 ceremony at the Francis Marion Hotel in Charleston. The academy induction recognizes alumni and non-alumni who play major roles in research and educational accomplishments of The Citadel’s School of Science and Mathematics. DeVoe was honored for his work at the Consortium, which supports research and outreach through eight member institutions, including The Citadel, and the agency’s staff. DeVoe has been the Consortium’s executive director since 1997. The Consortium has provided more than \$225,000 in competitive grants and development funds to The Citadel for coastal research, education, and undergraduate training. The grants have allowed the school’s faculty members to study toxicology, rice field impoundments, and microplastics in the environment. The Consortium also has provided startup funds and assisted faculty in establishing the networks and partnerships that fuel careers. In addition, the Consortium recently announced its support for the new Citadel Undergraduate Research Experience. DeVoe was inducted into the academy in the non-alumnus category. He was joined in the 2016 class by faculty inductee Dena P. Garner, an associate professor of exercise science and associate director of the Honors College, as well as alumni inductees Dr. William H. Bowers, an orthopedic surgeon who recently joined the faculty at the Medical University of South Carolina, and Dr. J. Patrick Johnson, a neurosurgeon from Dixon, California.

S.C. Sea Grant Consortium’s Coastal Heritage Magazine Wins Three Prestigious Awards

Susan Ferris-Hill, Joey Holleman, and Patty Snow, S.C. Sea Grant Consortium

Communications professionals from around the U.S. acknowledged *Coastal Heritage* magazine in national awards competitions. The *Coastal Heritage* team was recognized with three prestigious awards during FY16-17. *Coastal Heritage* won Second Place in the Magazine category from the National Association of Government Communicators Blue Pencil and Gold Screen Awards. The Association for Communication Excellence bestowed a Bronze Award for Publishing in the Critique and Awards competition. Awards for Publications Excellence selected *Coastal Heritage* for an Award of Excellence.