



S.C. SEA GRANT CONSORTIUM
Coastal Science Serving South Carolina



2019 Site Review Visit

2014-17 Program Briefing Book



August 6-8, 2019, Charleston, South Carolina

THE CHANGING FACE OF SOUTH CAROLINA

South Carolina's coast is one of the state's most valuable assets, featuring 2,876 miles of tidal shoreline, 165 linear miles of beaches, over 504,000 acres of salt marsh (20% of the East Coast's total), 500,000 acres of tidal bottomlands, five major estuarine systems encompassing 68.2 square miles, 40 barrier and sea islands, and 10,000 square miles of continental shelf. The coast can be divided into three regions: (1) The "Grand Strand," an area which contains few barrier islands and riverine systems, and includes Horry and Georgetown counties, (2) The Berkeley-Charleston-Dorchester county region, which includes the Charleston peninsula and outlying barrier and sea islands, and is a region of rapid economic growth and change, and (3) The "Lowcountry," which includes Colleton, Beaufort, and Jasper counties, the majority of the state's barrier and sea islands, and vibrant tourism and retirement communities and amenities.

This complex natural network of coastal uplands, near-shore islands, riverine watersheds and waterways, beaches, and wetlands supports a wide range of ecosystem types and coastal and marine species. It also serves as the resource foundation for the needs of our ever-growing and diversifying coastal population, increasing numbers of national and international visitors, a burgeoning marine transportation and shipping complex anchored by the Port of Charleston, a multi-billion dollar and diverse recreation and tourism industry, stable commercial and recreational fishing businesses, an explosion in manufacturing industries fueled by the arrival of Boeing, Daimler, and Volvo (just in the Charleston region), and the concomitant increase in residential and commercial development.

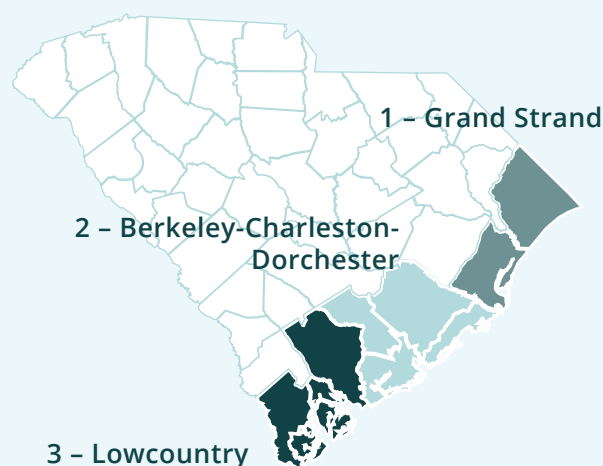
People are increasingly drawn to the South Carolina coast and enjoy the pleasant climate and overall high quality of life while taking advantage of opportunities the state's natural and cultural resources provide. More than 28% of the state's 5.02 million residents live in the eight coastal counties¹. From 1970 to 2010, the coastal county population of South Carolina increased by 127%, third highest among the 31 coastal and Great Lakes states nationwide². At the current rate of growth, the coastal population is expected to reach 2 million people by the year 2032¹. In addition, more than 20 million tourists visit coastal South Carolina each year. Indeed, during this decade, Charleston has been identified multiple times by Condé Nast Traveler as the number one tourist destination in the United States, and in 2015, number one in the world.

Population growth, rapid development, and increasing tourism are, however, placing greater pressure on the state's natural resources and coastal infrastructure, especially at the ever-widening margins of our urbanized areas. The arrival of major manufacturing industries to the Charleston tri-county area has exacerbated the rate of growth, which may affect high quality natural resources, resilient infrastructure,

and social welfare and well-being of the South Carolina coast and its people. Where we put people and how we accommodate their needs for critical infrastructure, transportation, jobs, and quality of life are questions facing South Carolina decision-makers along the coast and inland.

The southeastern United States coast is the last region of the country where the natural-resource base is relatively unharmed and unthreatened, and where anthropogenic impacts have been relatively minor. But this is rapidly changing as the state and the region have indeed been discovered. Back in 2010, the Charleston Metro Chamber of Commerce included growth management as one of its top issues and legislative priorities. Recent and rapid patterns of growth are resulting in changes in land use and an increased demand on both land and water resources. Pollution, erosion, shoreline change, sea-level rise, nuisance flooding, resource consumption, and hastily planned developments are

Coastal South Carolina



beginning to leave their marks.

The economy of coastal South Carolina is dramatically changing. Although it represents a decreasing portion of the state's economy, the commercial fishing industry (fish, oysters, clams, shrimp, and crabs) remains an important component of our local waterfronts, coastal economies, and ways of life. The state's commercial fisheries generates \$42 million annually in total economic contributions to the state economy and provides 840 jobs³; there are some 1,650 commercial saltwater and wholesale seafood dealer licenses⁴. South Carolina's shellfish aquaculture industry consists of established clam growers and new oyster farmers, a sector that doubled its number of businesses last year. Recreational fishing and boating make an even larger contribution to the state's economy. According to S.C. Department of Natural Resources, the annual impact of marine recreational fishing in the state exceeds \$590 million⁵. SCDNR sold 230,497

licenses to marine recreational fishers in the 2017 fiscal year, increasing the total number of individual saltwater licenses sold to 3,423,893 since the state began issuing them in 1992⁶. In addition, tourism is now a \$21.2 billion industry⁷, with tourism in the eight coastal counties accounting for approximately 40% of that total and supporting more than 99,000 jobs³. Three of the eight coastal counties led all of South Carolina's 46 counties in domestic travel expenditures in 2017⁸.

The Port of Charleston is one of the busiest and fastest growing container ports on the East and Gulf coasts, and in 2017 ranked eighth in the nation for dollar value of international shipments, with cargo valued at approximately \$70 billion^{9,10}. The South Carolina State Ports Authority (SPA) served 1,765 vessels and had total operating revenues of \$233 million in the 2017 fiscal year¹¹. The SPA also supports 187,206 jobs across the state, providing an economic impact of \$53 billion annually¹². The Port of Charleston is currently in the "race" with other southeastern U.S. ports to deepen its channels to accommodate the larger Panamax ships that will increasingly make up the maritime fleet. Indeed, in December 2016, the U.S. Congress authorized the Charleston Harbor deepening project to 52 feet, which will be the deepest port in the southeastern U.S. upon completion.

As in other coastal states from Texas to Maine, chronic and episodic hazards are impacting homes, businesses, critical infrastructure, culture, and natural resources throughout our coastal, estuarine, and riverine regions, and are exacerbated by the ever-increasing rate of sea-level rise. The winds, surges, and floods associated with frequent episodic hazard events, such as hurricanes, tropical storms, and nor'easters, and longer-term phenomena related to climate change, including sea-level rise and extreme tides, will continue to threaten highly developed and exposed portions of our coast. Historically, major tropical storms have struck the South Carolina coast every seven-to-eight years; over the last four years, South Carolina has been impacted by four hurricanes. Many long-range climate forecasters claim we are now entering a cycle of more severe coastal storms. More recently, severe "rain bombs" have resulted in extensive damage and some deaths in South Carolina (the

October 2015 flood and then rain associated with Hurricane Matthew in October 2016); such events are occurring more frequently throughout the U.S. And the mayor of Charleston, in his 2018 State of the City address, identified flooding as his number one priority. Increased vulnerability of humans, business and industry, and our natural resources to these natural hazards makes learning to understand, prepare for, and adapt to these risks a societal imperative.

The issues and opportunities South Carolina is facing are not unique to this state. State boundaries are political boundaries; however, rivers, watersheds, and the movement of water and all that it contains and transports are not restricted to individual states. Current issues include oil and gas exploration, nearshore/offshore wind energy production, and sand and gravel mining. Of particular importance is the generation of information on the nature and extent of these resources, as well as the impacts both from and to ongoing human activity, which will require state and region-wide planning in the ocean off the southeastern U.S.

As South Carolina continues to grow in population, industry, and tourism, there is an ever-growing need to provide venues for scientific literacy along the K-Gray spectrum and facilitate opportunities in workforce development. Job opportunities, especially in South Carolina, increasingly rely on a workforce skilled in STEM (Science-Technology-Engineering-Math) disciplines. To meet this challenge, it is imperative that students (K-12), teachers, undergraduates, and graduates have robust and meaningful STEM experiences to be competitive in the job market. Scientific literacy provides a basis for sound decision-making among South Carolina's population, specifically in balancing economic prosperity with natural resource conservation, responding to natural disasters (e.g., hurricanes), and preparing for significant changes in our natural, societal, and technological future. A scientifically literate population positions our state to achieve economic prosperity, enhance stewardship of our coastal resources, and raise the quality of life for all of our citizens.

Accommodating the various needs of those who use and enjoy coastal and marine resources presents an enormous challenge. The S.C. Sea Grant Consortium is committed to optimizing the balance among the economic, social, and

Sources:

¹U.S. Census Bureau (2018). *ACS Demographic and Housing Estimates: 2013-2017 American Community Survey 5-Year Estimates*.

²Crossett, K., et al. (2013). *National coastal population report, population trends from 1970 to 2020*. NOAA State of the Coast Report Series, U.S. Dept. of Commerce.

³Willis, D.B., and Straka, T.J. (2016). *The Economic Contribution of Natural Resources to South Carolina's Economy*. Clemson University and S.C. Dept. of Natural Resources.

⁴Hiltz, Eric (2018). Personal Communication. S.C. Dept. of Natural Resources.

⁵S.C. Ocean Planning Work Group (2012). *South Carolina Ocean Report: A Foundation for Improved Management and Planning in South Carolina*.

⁶S.C. Department of Natural Resources (2018). *FY 2017 Saltwater Recreational Fishing License Report*. Marine Resources Division, S.C. Dept. of Natural Resources.

⁷U.S. Travel Association (2018a). *The Economic Contribution of Tourism in South Carolina: 2016 Tourism Satellite Account Results*. S.C. Dept. of Parks, Recreation, and Tourism.

⁸U.S. Travel Association (2018b). *Economic Impact of Travel on South Carolina Counties 2017*. S.C. Dept. of Parks, Recreation, and Tourism.

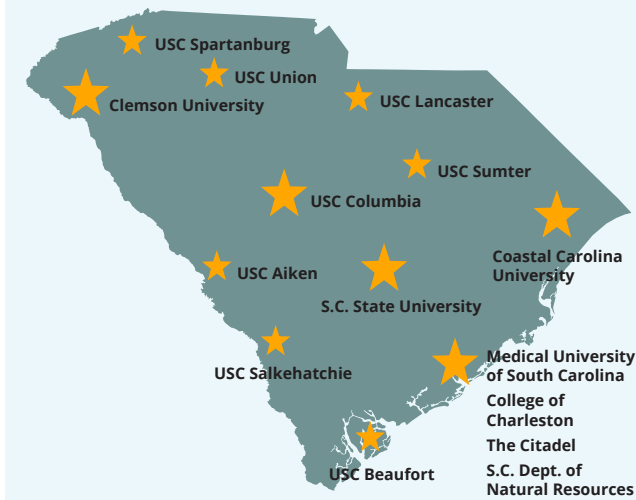
⁹S.C. Ports Authority (2018a). *Top Ten U.S. Seaport Districts in Dollar Value of Goods Handled Calendar Year 2017*.

¹⁰U.S. Census Bureau Trade Data Branch report FT920, Tables 1 and 4 "Exports" are FAS value of U.S. exports of domestic and foreign merchandise by district of export.

¹¹S.C. Ports Authority (2018b). *Statistics*.

¹²Von Nessen, J. (2015). *The Economic Impact of the South Carolina Ports Authority: A Statewide and Regional Analysis*. Darla Moore School of Business, University of South Carolina.

Member Institutions



environmental potential of the state's coastal and marine resources through the support of integrated research, education, extension, training, and communication programs. It does so by engaging the talents and expertise found at South Carolina's leading university and research institutions to increase our knowledge about the natural, cultural, and social environments of South Carolina and the region, and employing the skills and efforts of its program and outreach staff to package and disseminate this knowledge to the many communities and constituencies we serve.

PROGRAM ORGANIZATION AND MANAGEMENT

Mission and Mandate

The S.C. Sea Grant Consortium (Consortium) is an independent, university-based state agency—unique among the nation's 33 Sea Grant programs—whose mission is to generate and provide science-based information to enhance the practical use and conservation of coastal and marine resources to foster a sustainable economy and environment for the state of South Carolina and its citizens.

Sea Grant started in South Carolina in 1972 under the auspices of what is now the S.C. Department of Natural Resources.

In 1978, recognizing the needs and opportunities embodied by the state's vast array of ocean and coastal resources, the S.C. General Assembly formally united the state's university-based marine programs through the creation of the S.C. Sea Grant Consortium (Code of South Carolina, Section 48-45-10:100).

The Consortium's legislative mandate sets out three main tenets

upon which the agency operates:

1. "To provide a mechanism for the development and management of the Sea Grant Program for the State of South Carolina and adjacent regions which share a common environment and resource heritage."
2. "To support, improve, and share research, education, training, and advisory services in fields related to ocean and coastal resources."
3. "To encourage and follow a regional approach to solving problems or meeting needs relating to ocean and coastal resources in cooperation with appropriate institutions, programs, and persons in the region."

The Consortium received its Sea Grant College designation by U.S. Secretary of Commerce Malcolm Baldrige in 1986.

Organizational Framework

As a legislatively-based South Carolina state agency (of 75 total statewide), the Consortium has the management and administrative framework which allows it to be flexible, strategic, responsive, and independent but accountable in its activities. Its office is headquartered in Charleston, S.C.

The Consortium develops and supports a balanced and integrated research, education, extension, and communications program for South Carolina that seeks to provide future economic opportunities, improve the social well-being of its citizens, and ensure the wise use and development of marine and coastal natural resources. Charter member institutions of the Consortium are The Citadel, Clemson University, College of Charleston, Medical University of South Carolina, South Carolina State University, S.C. Department of Natural Resources, and the University of South Carolina. Coastal Carolina University joined the Consortium as a member in 1996; state legislation and Board policy allow for the Consortium to add additional institutions based on prescribed criteria and institutional expressions of interest.

Program Management

Board of Directors

Activities of the Consortium are governed by authorizing

Current Members of the Board of Directors

Harris Pastides, Ph.D. (Chair)	<i>President, University of South Carolina</i>
Col. Alvin A. Taylor (Past-Chair)	<i>Director, S.C. Department of Natural Resources</i>
James E. Clark	<i>President, South Carolina State University</i>
James P. Clements, Ph.D.	<i>President, Clemson University</i>
David J. Cole, M.D., FACS	<i>President, Medical University of South Carolina</i>
David A. DeCenzo, Ph.D.	<i>President, Coastal Carolina University</i>
Stephen C. Osborne, M.B.A.	<i>Interim President, College of Charleston</i>
Gen. Glenn M. Walters	<i>President, The Citadel</i>

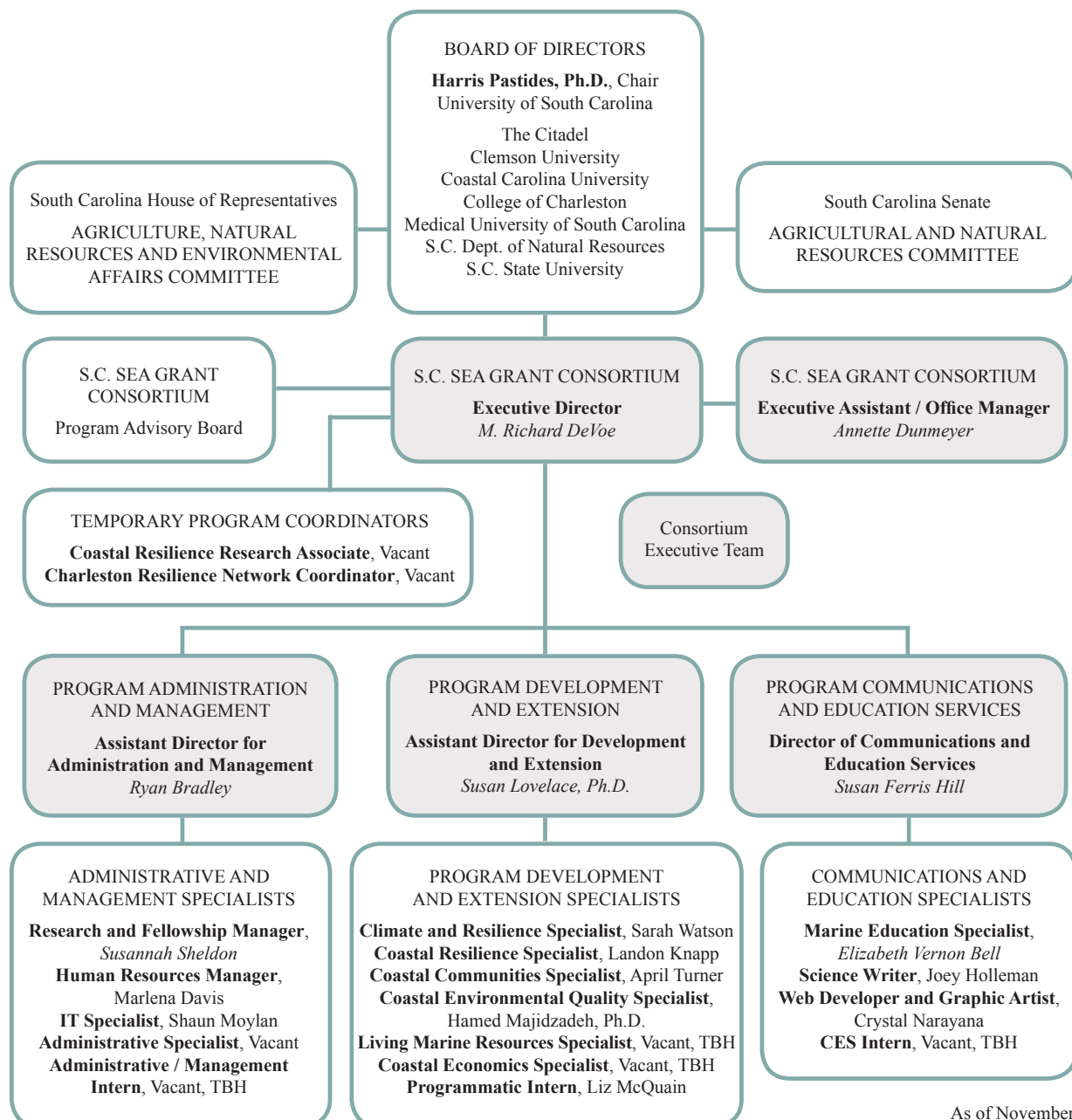
committees of the S.C. General Assembly and a Board of Directors to which the Executive Director reports. The Board includes the chief executive officers of the Consortium's eight member institutions. The Board meets annually to review Consortium program policies and procedures, and provides a direct line of communication between the Consortium Executive Director and the higher administrative levels of its member institutions. Each Consortium Board Member has designated a Board Alternate whom can act on his or her behalf. Board Members and Board Alternates are invited and participate in Board activities. Board roles and

responsibilities are identified in its By-Laws.

Consortium Institutional Liaisons

Institutional liaisons provide a direct administrative link between the Consortium and each of its member institutions. There are two designated liaisons for each Consortium member institution: one from the sponsored program office to address program development and proposal preparation matters and one from the budget office to foster communication about post-award grants and contracts. The Consortium's *External Procedures Handbook: A Faculty and*

Administrative Organizational Chart



As of November 30, 2018

Institutional Guide for Consortium Proposals and Projects provides documentation on the administrative processes the Consortium employs in managing its extramural programs, and it is made available to faculty and staff at the Consortium's member institutions. The Consortium staff are now in the process of updating the *External Procedures Handbook* to incorporate changes and updates to the agency's policies and procedures based on changes at the state and federal levels.

Executive Director

The legislation creating the S.C. Sea Grant Consortium also established the position of Executive Director. The Executive Director is responsible for managing the Sea Grant program for South Carolina, including development and implementation of Sea Grant proposals, oversight of the proposal solicitation and review process, communication with the National Sea Grant College Program office, management and oversight of all Sea Grant projects and programs, and management of fiscal resources. The Consortium is also expected to seek funding from a variety of non-state sources, which represents a significant percentage (~80%) of total Consortium support.

Consortium Staff

Consortium staff positions consist of 14 full-time FTEs and several temporary grant employees. Over the last two years, the Consortium has hired staff to fill its coastal climate, web, information technology, and human resources positions, and has been able to generate enough support to add three new program specialist positions for coastal environmental quality, coastal resilience, and coastal economics. This additional capacity will help the Consortium address the ever-increasing demands for its programs and services from its constituencies.

The organizational chart on page 4 identifies the Consortium's staffing as of November 30, 2018, with the exception of our Knauss fellows, who are technically Consortium employees, and identifies our "Core Group" senior management team (*in italics*).

Program Advisory Mechanisms

Program Advisory Board

The Consortium receives guidance and input from its Program Advisory Board (PAB). Prospective PAB members are invited by the Chair of the Consortium Board of Directors, and the PAB consists of representatives from a mix of academic, agency, business, and public interest organizations from South Carolina and adjacent coastal states.

The PAB was established in 2005 based on recommendations from our 2004 National Sea Grant Program Assessment. The purposes of the Consortium PAB are to:

1. Provide the Consortium with a broad perspective on South Carolina's critical coastal and marine resource issues, needs, and opportunities.
2. Review and evaluate input received from Consortium stakeholders for use in revising and focusing the agency's strategic and implementation plans.
3. Offer strategic guidance and advice to the Consortium as it develops and implements research, education, and outreach programs and projects.
4. Advise the Consortium Executive Director regarding emerging trends in coastal and marine resource policy and management.
5. Identify potential opportunities for funding support, new partnerships, and innovative ways of "doing business."

The PAB meets at least annually to provide support and guidance to the Consortium on a wide range of topics, including strategic planning, programmatic focus, and innovative funding strategies. Current PAB members are:

Federal Agencies

- Michael Allen, Community Partnership Specialist (retired), U.S. National Park Service
- Sherri Fields, Director, NOAA National Centers for Coastal Ocean Science Charleston Lab
- Jeffrey Payne, Ph.D., Director, Office for Coastal Management, NOAA National Ocean Service
- Gregg Waugh, Director, South Atlantic Fishery Management Council

State/Local Government

- Robert Boyles, Deputy Director, SCDNR-Marine Resources Division
- Rutledge B. Leland, Mayor, McClellanville, S.C.
- Elizabeth B. von Kolnitz, Chief, SCDHEC-Ocean and Coastal Resource Management

Academic/Research Institutions

- Clark Alexander, Ph.D., Director, Skidaway Institute of Oceanography
- Jeffrey S. Allen, Ph.D., Director, S.C. Water Resources Center
- James Arrington, Ph.D., Administrator (retired), South Carolina State University
- Elizabeth Colbert-Busch, Director, Corporate Development and Community Engagement, Clemson University
- Paul T. Gayes, Ph.D., Executive Director, Burroughs and Chapin Center for Marine and Wetland Studies, Coastal Carolina University
- Fred Holland, Ph.D., Director (retired), Hollings Marine Laboratory
- Jay Pinckney, Ph.D., Director, Belle W. Baruch Institute, University of South Carolina
- Paul A. Sandifer, Ph.D., Director, Center for Coastal Environmental and Human Health, College of Charleston
- Deborah J. Stirling, J.D., Burroughs and Chapin Center for

Marine and Wetland Studies, Coastal Carolina University

Business/Private Sector/Public Interest

- Laura Cantral, J.D., Executive Director, S.C. Coastal Conservation League
- Anne D. Cope, Ph.D., P.E., Senior Vice President, Research and Chief Engineer, Institute for Business and Home Safety
- Jannie Harriot, Executive Director, S.C. African American Heritage Foundation
- Debra Hernandez, P.E., Executive Director, SE Coastal Ocean Observing Regional Association
- Heather Hodges, J.D., Executive Director, Gullah-Geechee Cultural Heritage Corridor Commission
- John L. Knott, Jr., Founder and President, CityCraft Ventures, LLC
- Chris Mack, M.B.A., P.E., P.M.P., Coastal Services Program Manager, AECOM
- Kevin Mills, President and CEO, South Carolina Aquarium
- Lundie Spence, Ph.D., Director (retired), Center for Ocean Sciences Education Excellence-SE
- Tim Todd, Executive Director, Discover Upcountry Carolina Association

Program Specialist Advisory Committees

In addition, each Consortium Program Specialist convenes an Extension Advisory Committee to help direct their activities; more information is presented under the Stakeholder Engagement section.

Significant Institutional Policies

The State of South Carolina and the Consortium Board of Directors have developed the following key policies which strengthen the nature and efficiency of the Sea Grant College Program in South Carolina and contribute to its ability to field an innovative and cost-effective program:

1. The State of South Carolina continues to demonstrate its commitment to Sea Grant in the state through an annual appropriation of state funds.
2. Since its inception in 1980, the Consortium Board of Directors maintains a policy that waives overhead costs on Sea Grant projects; instead, overhead costs can be used by PIs to offset the matching requirements of the program.
3. Any institution which has “active comprehensive research, education, and extension programs in the area of coastal and marine resources use and conservation” may seek membership in the Consortium by submitting its credentials to the Board for review in accordance with criteria and procedures established by the Board.
4. The S.C. Sea Grant Consortium itself charges no overhead on Sea Grant projects; therefore, 100% of each Sea Grant dollar for Sea Grant projects goes to support programmatic efforts.
5. On September 1-2, 2015, the Consortium was evaluated

by a five-member National Sea Grant College Program (NSGCP) Site Visit Team, which assessed the agency’s program and organizational structure, stakeholder engagement, and collaborative activities. The final report of the NSGCP Site Visit noted that several of the Board alternates have or are currently serving as principal investigators on Sea Grant-funded projects, which was deemed a conflict of interest. The Consortium Board of Directors and Executive Director agreed, and on April 15, 2016, the Consortium Board of Directors approved a policy which states “Effective May 1, 2016, no sitting member of the Consortium Board of Directors or his/her designated Board Alternate shall be eligible to compete for or receive Sea Grant Consortium funding.”

Recruiting Talent

Strategic Planning

The S.C. Sea Grant Consortium’s mission is to generate and provide science-based information to enhance the practical use and conservation of coastal and marine resources to foster a sustainable economy and environment for the state of South Carolina and its citizens. The agency achieves its mission by partnering with scientists from the state’s leading research institutions and a diversity of coastal stakeholders, serving as a broker of funding, facilitating dialogue among coastal interests, and providing science-based information to resource managers, policymakers, business and industry, and the public. The Consortium’s 2014-17 Strategic Plan, *The Changing Face of Coastal South Carolina: Enhancing Understanding – Informing Decision-Making*, is available at www.scseagrant.org/pdf_files/SCSGC-Strat-Plan-2014-2017.pdf. This strategic plan was approved by both the Consortium’s Board of Directors and the National Sea Grant Office.

The goal of the Consortium’s 2014-2017 Strategic Plan was to “optimize the ability of S.C. Sea Grant Consortium’s research, education, and outreach programs to address the coastal resource needs of South Carolina.” The Consortium’s plan served as a guide and filter for the activities that the S.C. Sea Grant Consortium undertook during this time, but its goals and objectives are expected to be relevant for a number of years to come. Nevertheless, the strategies the Consortium utilizes to achieve these goals and objectives are re-evaluated during every subsequent revision of the plan. New strategies are included as current strategies are addressed and new issues arise. We assess the outcomes and performance measures on two-year cycles.

The Consortium consistently seeks involvement and input from its constituencies to help shape priorities and programs. This ensures that our activities are responsive to the needs of the Consortium’s stakeholders and allows us to determine:

1. Priority needs in South Carolina pertaining to coastal and ocean resources use and conservation;
2. Current activities in South Carolina that are underway to

address these needs;

3. Priority needs that are not being adequately addressed by current activities; and
4. Most importantly, specific potential actions the Consortium can take to address unmet needs.

In addition to the ongoing strategic planning process, the Consortium utilizes other means to enhance its ability to identify constituent groups and their needs. This is accomplished through interaction with members of the Consortium's Board of Directors, Program Advisory Board, Consortium member institutional liaisons, Sea Grant Extension Program specialists and each of their Advisory Committees, and Communications and Information Services staff.

The Consortium's Plan of Action section is divided into Programmatic and Management components. The Programmatic component includes the Consortium's goals, objectives, and strategies for research, education, and outreach activities for five areas: the Coastal and Ocean Landscape; Sustainable Coastal Development and Economy; Sustainable Fisheries and Aquaculture; Hazard Resilience in Coastal Communities; and Scientific Literacy and Workforce Development. The Consortium's Management component includes process-based activities which dictate how the Consortium supports its mission in three areas: Planning, Program Management, and Overall Performance; Connecting with Users; and Human Resources. The outcomes, performance measures, and targets for the next four years are included within each component. These are used to report on the success of our actions. Although our programs are in continual formative assessment, we gather data to formally assess our program during annual reporting cycles.

Request for Proposals Development

The Consortium's 2014-17 Strategic Plan served as the foundation for the development of detailed priorities included in our Request for Proposals (RFP) (www.sceagrants.org/16-18-rfp.pdf). For each two-year Omnibus cycle, the Consortium requests proposals that address the strategic goals identified by the Consortium and priorities of the National Sea Grant College Program Office as they

relate to issues that face South Carolina, the region, and the nation. In preparation for the announcement, the Consortium staff develop an initial list of priorities for comment by resource managers and extension advisory committees. We strive to ensure that the priorities are specific, relevant, and timely. The RFP includes a list of the priorities, as well as instructions for submitting a concept letter and full proposal. A concept letter submission and review process is employed by the Consortium to identify investigators whose conceptual ideas appear to address national and state needs and Consortium strategic goals.

Review Process

Concept Letter Review Panels, consisting of eight-to-ten state and federal resource agency scientists and managers as well as Sea Grant management and outreach staff, are convened to review all concept letters and select those that merit further development into full proposals. The review process generally results in about 20-25 concept letters being deemed meritorious, and full proposals are solicited. All full proposals are distributed to qualified professionals from academia, government, and industry throughout the United States for technical and conceptual review; we seek to secure at least three written peer reviews per proposal. It is Consortium policy to select technical peer reviewers from outside the state of South Carolina, however, at times comments on proposals also are solicited from agency and user representatives within the state. All prospective reviewers are made aware of and subject to the Consortium's Conflict of Interest Policy for peer and panel reviews, which reflects national policy. We average four-to-five written external peer reviews per proposal, typically receiving more than 100 for the 20-25 proposals being considered. All comments received from the Proposal Review Panel and peer reviewers are organized and filed at the Consortium office, blind copies of which are provided to the Principal Investigators.

Additionally, Full Proposal Technical Review Panels consisting of seven-to-ten members, are convened at the Consortium office in late August to review and evaluate all full proposals. Panelists are selected based on the programmatic make-up of the proposals; thus, representation on the panel changes from biennium to biennium. In general, our panelists include natural and social scientists and outreach professionals with federal and academic backgrounds. In addition, the Consortium's NSGO program monitor at the time, Mr. Christopher Hayes, attended and observed the process.

Results of FY2014-17 RFP Process

Concept Letters and Proposals

Based on these reviews and the priority

Project Selection – Core Funds

	FY14-16	FY16-18	TOTAL
Concept Letters	57	48	105
Full Proposals Solicited	21	21	42
Full Proposals Funded	8	8	16
% Successful Full Proposals	40%	45%	43%
Continuing Projects	0	0	0
New Projects	8	8	16

Recruitment of PIs* and Institutions

	FY14-16	FY16-18
Cont./New PIs (Concept)	54:20	41:47
Cont./New PIs (Proposal)	23:5	23:17
Cont./New PIs (Funded)	14:1	11:11
Institutions (Concepts)	8	18
Institutions (Full Props)	7	9
Institutions (Funded)	3	7

* Cont./New PIs and Institutions reflect lead PIs, co-PIs, and associate PIs.

needs identified in the Consortium Request for Proposals, research and outreach proposals are selected for inclusion in each biennial cycle for the Consortium's Sea Grant Program Plan. The table on page 7 provides metrics on the Consortium's proposal solicitation, review, and selection process.

Recruitment of Principal Investigators and Institutions

The Consortium undertakes a wide range of activities to recruit new PIs. The Consortium maintains continuous contact, including notifications of RFP announcements, with its Institutional Liaison officers, who work in the sponsored programs office of each member institution. Consortium staff maintain and update a faculty and staff database to whom

all announcements are directly distributed via e-mail, and they present at a range of venues about upcoming omnibus RFP and other funding opportunities. The table to the left illustrates the number of PIs who have responded to the Consortium's Sea Grant RFP and the number of institutions they represent.

Success in National Competitions

In addition to our quadrennial Sea Grant College Program proposal, the Consortium submitted 32 proposals to the National Sea Grant Office from fiscal year 2014-15 through fiscal year 2017-18. From those opportunities, the Consortium was awarded more than \$769,000 in supplemental funding for 18 different projects spanning this past four-year period of performance; a success rate of just under 60%.

Consortium Funding – Sources and Trends

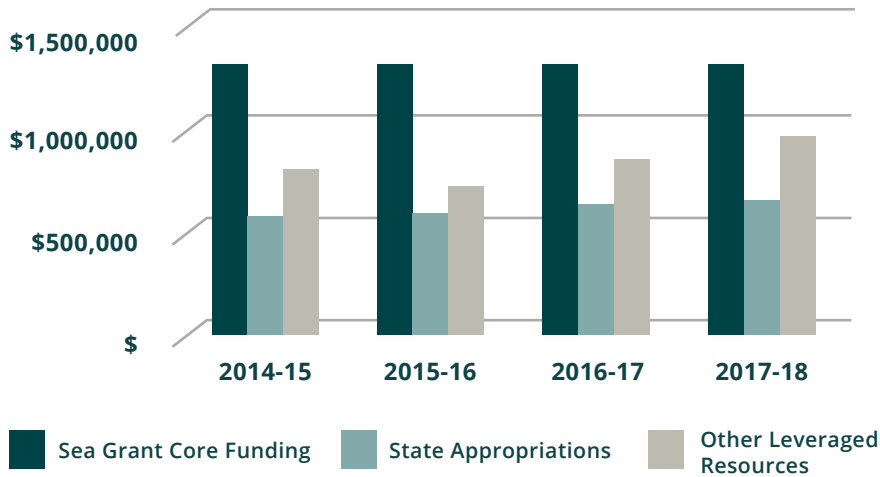
The Consortium budget consists of funding from three primary sources: the state of South Carolina, through its annual state appropriations process; the NOAA National Sea Grant College Program core; and from competitive state, Sea Grant, and other federal and non-federal funding opportunities. Approximately 77.8% of the Consortium's funding originates from non-state-appropriated grants and awards for which it competes. The remaining 22.2% of funding is secured through an annual state appropriations process. The Consortium has increased its annual resources over the past four years by approximately 23% despite a series of gubernatorial vetoes and continued state-imposed fiscal tightening experiences in the previous quadrennial

National Strategic Initiative Proposals (Submitted : Awarded)

NSI Title	2014-15	2015-16	2016-17	2017-18	TOTALS
NSGO Knauss Fellowships	4:2	2:1	6:2	5:2	17:7
NSGO NSI: Resilience Research (Minibus)*	1:1	N/A	1:1	N/A	2:2
NSGO NSI: 2015 Conferences/Workshops Competition	N/A	2:2	N/A	N/A	2:2
NSGO NSI: 2016 Aquaculture Conferences/Workshops	N/A	N/A	2:2	N/A	2:2
NSGO NSI: Resilience Fellowship	N/A	N/A	1:1	N/A	1:1
NSGO NSI: OCM Coastal Community Resilience*	N/A	N/A	1:1	N/A	1:1
NSGO Initiatives (other): Historic Flood Emergency Response	N/A	N/A	1:1	N/A	1:1
NSGO NSI: Regional Integration	N/A	N/A	N/A	1:1	1:1
NSGO NSI: Network Visioning	N/A	N/A	N/A	1:1	1:1
NSGO NSI: Marine Aquaculture	N/A	N/A	N/A	4:1	4:1
ANNUAL TOTALS:	5:3	4:3	12:8	11:5	32:19

*Successful proposals for NSGO NSI: OCM Coastal Community Resilience and NSGO NSI: Resilience Research (2016-17) funded a single project.

Consortium Budget Trends by Fiscal Year



Annual Funding

Fiscal Year	Total
2014-15	\$2,685,636
2015-16	\$2,660,502
2016-17	\$2,851,167
2017-18	\$2,983,075

*Figures do not include institutional cost shares.

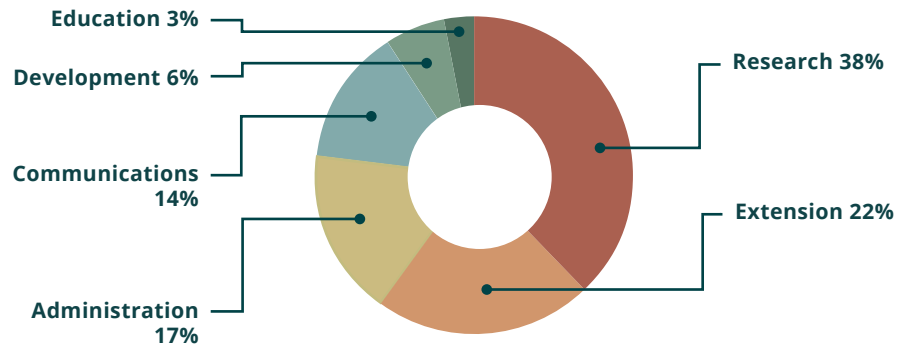
**Other funds include support by non-core Sea Grant, federal, state, and private sources.

budget period. Budget trends covering the four-year period from fiscal year 2014-15 through fiscal year 2017-18 are detailed in the table above.

Distribution of Consortium Sea Grant Dollars

The Consortium's federal Sea Grant support has been relatively flat since fiscal year 2001. The distribution of Consortium funding (both Sea Grant and matching funds) among program elements is illustrated in the table below. Collectively over the past two and current biennial funding cycles (fiscal year

Distribution of Core Sea Grant Funds



Distribution of Core Federal and Matching Funds (\$) Among Program Elements

	FY14-15	FY15-16	FY16-17	FY17-18
Total Core Sea Grant	\$1,329,670	\$1,329,670	\$1,329,670	\$1,329,670
Total Match	\$696,911	\$655,044	\$653,640	\$655,052
Research (core + match)	\$743,229	\$770,792	\$750,000	\$750,000
Extension (core + match)*	\$403,435	\$438,386	\$446,539	\$447,906
Education (core + match)	\$9,668	\$84,024	\$86,354	\$86,646
Communications and Information (core + match)	\$279,102	\$279,983	\$287,502	\$288,410
Program Development (core + match)	\$264,013	\$83,313	\$76,571	\$74,307
Program Administration (core + match)	\$327,134	\$328,216	\$336,344	\$337,453

*Includes Coastal Development (A/CG-1) and Climate Supplement (A/CC-5) programs.

Distribution of Sea Grant Funding

Sea Grant College Program funding received by the Consortium spanning the past four-year period of performance:

Source of Funds	FY14-15	FY15-16	FY16-17	FY17-18
Core Sea Grant College Program	\$1,329,670	\$1,329,670	\$1,329,670	\$1,329,670
NSGO Knauss Fellowships	\$113,000	\$56,500	\$113,000	\$116,500
NSGO NSI: Resilience Research (Minibus)	\$26,551	\$26,551	\$26,551	\$26,551
NSGO NSI: 2015 Conferences/Workshops Competition	\$0	\$32,998	\$0	\$0
NSGO NSI: 2016 Aquaculture Conferences/Workshops	\$0	\$0	\$13,920	\$0
NSGO NSI: Resilience Fellowship	\$0	\$0	\$20,000	\$0
NSGO NSI: OCM Coastal Community Resilience	\$0	\$0	\$12,500	\$12,500
NSGO Initiatives (other): Historic Flood Emergency Response	\$0	\$0	\$50,000	\$0
NSGO NSI: Regional Integration	\$0	\$0	\$0	\$50,000
NSGO NSI: Network Visioning	\$0	\$0	\$0	\$30,000
NSGO NSI: Marine Aquaculture	\$0	\$0	\$0	\$42,250
FISCAL YEAR TOTALS:	\$1,469,221	\$1,445,719	\$1,565,011	\$1,607,471

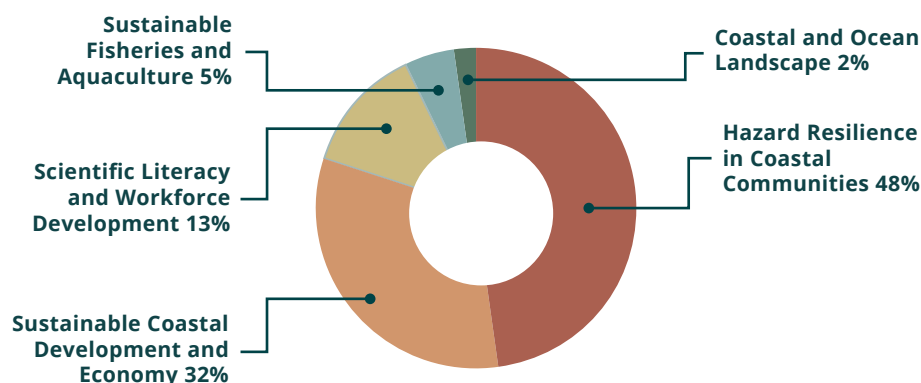
2014-15 through fiscal year 2017-18), the Consortium has allocated funds (core plus match) according to the following percentages: Research – 37.8%; Extension – 21.8%; Education – 3.3%; Communications – 14.2%; Program Development – 6.2%; and Administration – 16.7%.

Consortium Leveraged Funds

During the past four years, the Consortium has continued to effectively secure non-state resources in support of its strategic programmatic areas which are organized into research, education, and outreach activities. Due to the pressures brought on the agency from the gubernatorial vetoes and significant staff turnover experienced during the previous quadrennial period, the Consortium realized the importance of initiating new connections through additional

outside partnerships and resource possibilities. From fiscal year 2014-15 through fiscal year 2017-18, the Consortium secured non-state and non-Sea Grant resources totaling \$3.357 million. The Bureau of Ocean Energy Management (BOEM), U.S. Geological Survey (USGS), and National Academies of Sciences (NAS) through the Gulf Research Program represent new sources of support for Consortium efforts during this past quadrennial period. For example, the work in coordination with BOEM yielded \$750,000 as an initial investment to study offshore landscapes for wind energy development, and additional opportunities for future research in these areas continues to increase as renewable clean energy research gathers momentum. Our partnership with USGS initiated the signing of a five-year Memorandum of Understanding with the anticipation of future research

Leveraged Funds by Program Area



opportunities after the completion of the initial research grants awarded. In addition to entering a long-term partnership with USGS, the Consortium also signed an extension, through September 2020, of its Memorandum of Agreement with the NOAA Hollings Marine Laboratory to continue to foster graduate student scholarship and workforce development, and re-established a formal working relationship with the USGS Coastal and Marine Geology Program to support university-based research and resource studies on nearshore and offshore coastal processes. We expect this trend to continue as the Consortium actively pursues extramural funding for new projects relating to offshore energy development, community resilience efforts, stormwater management, and other state, regional, and national strategic initiatives.

STAKEHOLDER ENGAGEMENT

Engaging Stakeholders

The S.C. Sea Grant Consortium's stakeholders can be divided into two categories: institutional and external. The Consortium's institutional constituencies consist of the faculty, staff, and students of the agency's eight member institutions. Externally, the Consortium is charged with serving the needs of an extremely diverse group of organizations, institutions, and individuals representing universities; federal, state, and local natural resource and economic development agencies; business and industry; state and local governments; community groups; non-governmental organizations; K-12 educational institutions; and the general public. The Consortium utilizes formal and informal methods to assess the needs of its institutional and external customers, including its strategic planning process; active participation in meetings, conferences, and workshops; direct stakeholder contacts; and service on a large number of planning, professional, and organizational committees. In the section "Recruiting Talent," we describe how we engage stakeholders in the development of our strategic planning, priority-setting, and request for proposals, and in our proposal review process.

The Consortium's Program Advisory Board (PAB), described under Program Organization and Management, provides input on the priorities of the agency. In addition, the PAB often reiterates the importance for the Consortium to develop a plan for the whole of the Consortium and all its programs to serve the needs of South Carolina constituents, while being consistent with the NOAA National Sea Grant College Program.

The Consortium's Sea Grant Extension Program involves users in its program planning and evaluation process in the areas of Living Marine Resources, Coastal Communities, Coastal Climate and Resilience, and Coastal Environmental Quality. Consortium Program Specialists live and work in our coastal communities and interact daily with their program constituents. This informal daily interaction

creates a relationship of trust between the specialists and the communities they serve, and provides the specialist with a deep knowledge of the issues and concerns among members of the user community in addition to an awareness of their vision for the future.

Another informal mechanism by which program specialists gain a knowledge and understanding of stakeholder interests and concerns is through participation on a variety of program-related, community-based committees and task forces. These focused, topical interactions bring the specialists into regular contact with state agency representatives, local government staff, community interest groups, the business community, and individual citizens to better learn how the Consortium can offer support through research, communications, and education. In addition, each program specialist is guided by a formal advisory committee including local and state government agency representatives, business owners, and representatives of community organizations. The information, advice, and guidance received through these informal and formal means are then incorporated into the formal Consortium strategic planning process.

The Consortium's Communications and Information Services (CIS) program supports the agency's mission by identifying users of coastal and marine resource information, assessing their needs, and providing them with information to address problems, enhance opportunities, and increase their understanding of coastal issues and human impacts upon the coastal and marine environment. CIS sets its objectives in accordance with the agency's strategic plan, and builds visibility and support for Consortium programs and activities. In support of Consortium goals, CIS employs various tactics to communicate with the public and targeted audiences. These include regular publications (e.g., the quarterly magazine *Coastal Heritage* and the agency's "impacts" e-newsletter *CoastalScience@Work*), topical publications (e.g., technical reports and brochures), media relations (e.g., press releases and feature stories), and the agency's main website (www.scseagrant.org), as well as topic-specific sites such as the S.C. Task Group on Harmful Algae (www.scseagrant.org/hab), Beach Sweep/River Sweep (www.scseagrant.org/content/?cid=49), and the International Conference on Shellfish Restoration (www.scseagrant.org/icsr). CIS developed and maintains the Consortium's Facebook page (www.facebook.com/scseagrant), Twitter feed (www.twitter.com/scseagrant), and Beach Sweep/River Sweep Facebook page (www.facebook.com/BeachSweepRiverSweep). CIS also organizes and spearheads special events, including the annual, statewide Beach Sweep/River Sweep litter cleanup in partnership with the S.C. Department of Natural Resources and the biennial International Conference on Shellfish Restoration. In addition, CIS manages the Consortium's booth at various festivals and conferences.

Key Partnerships and Stakeholder Relationships

Partnerships are an integral component of how the Consortium conducts its work; indeed, one of the Consortium's Operational Principles is that the value of working with partners and stakeholders from all sectors is critical to our success. It is increasingly a fact of life that neither Sea Grant nor its partners individually have the resources to implement effective programs for the ever-increasing complex needs of stakeholders. So having partners' support and involving them in program development and implementation is a necessity. Thus, the Consortium actively engages in collaborative programming with state and federal government agencies, universities, community-based non-governmental organizations, local and regional governments, businesses, and a variety of industry user groups. The Consortium has worked diligently to enhance its statewide and regional research and outreach program efforts through large-scale grant funding and small-scale partnership efforts; the following reflect a sampling of these activities.

Stormwater Pond Research and Management

Collaborative: Developing and transferring knowledge to assure pond efficiency now and in the future

In 2014, the Consortium initiated an effort to gather scientists and resource managers from across the state to discuss issues related to stormwater pond development and management and to coordinate research and outreach efforts related to their construction, management, and maintenance. The S.C. Stormwater Pond Research and Management Collaborative was established to further investigate and address the challenges associated with stormwater ponds in our coastal areas, and to learn about the numbers and impacts of stormwater ponds in the coastal landscape. Researchers from seven Consortium member institutions are completing work on a pond inventory, a state-of-the-science report, and an outreach strategy for stakeholder engagement and information sharing. The Collaborative is guided and advised by a Stormwater Pond Advisory Council, consisting of local stormwater managers, consultants, stormwater pond practitioners, realtors, government officials, scientists, and outreach specialists. Recurring funding was secured from the state of South Carolina to help support the Consortium's Coastal Environmental Quality Program Specialist position. See the related section on the Collaborative under Program Performance for information about the mission and activities of the program.

South Carolina Working Waterfronts: Preserving the waterfront needs of fishers and the public as the coastal population changes

After hearing from coastal communities that they were struggling to maintain and/or evolve their traditional working waterfronts, the Consortium and researchers from Clemson University and College of Charleston spoke with stakeholders from Murrells Inlet, Georgetown, McClellanville, Mount Pleasant, and Port Royal. In group meetings and individual interviews conducted during 2015 and 2016, researchers asked about the future of traditional working waterfronts and gathered information that helped identify needs, challenges, and opportunities for each community. The results of this research were presented at Community Forums designed to facilitate discussion and help prioritize issues. See the section on Working Waterfronts in Program Performance for additional information.

Our Coastal Future Forum: Using deliberative discussion to engage residents in the decision-making process

Our Coastal Future Forum, initiated in 2016 with a Gulf Research Program Exploratory grant, allowed coastal residents to have thoughtful, issue-driven discussions with each other, researchers, and decision-makers in a neutral setting. Currently focused on environmental health, biodiversity, living marine resources, and energy and mineral resources—all within the context of a changing climate—participants were provided the opportunity to learn the science behind the issues together and to actively engage in formulating solutions to problems. More information about the Forum can be accessed at www.scseagrants.org/Content/?cid=937.

S.C. Coastal Information Network: Coordinating coastal community outreach activities in South Carolina

The South Carolina Coastal Information Network (SCCIN) was established by the Consortium in 2008 to encourage partnerships and collaborative efforts to enhance coordination of coastal community outreach efforts in South Carolina. The Network includes federal and state agencies, regional government agencies, universities, and private organizations seeking to coordinate and/or jointly deliver outreach programs while promoting sustainable use of natural resources along the coast. The Network includes representatives from the Consortium, NOAA Office for Coastal Management, NOAA Hollings Marine Laboratory, S.C. Department of Health and Environmental Control, S.C. Department of Natural Resources, ACE Basin National Estuarine Research Reserve, University of South Carolina Belle W. Baruch Institute, North Inlet-Winyah Bay National Estuarine Research Reserve, S.C. Department of Archives and History, S.C. Forestry Commission, Clemson University Cooperative Extension, Berkeley-Charleston-Dorchester Council of Governments, Lowcountry Council of Governments, Waccamaw Regional Council of Governments, S.C. Urban Land Institute, Charleston

Waterkeeper, and Ashley-Cooper and Coastal Waccamaw Stormwater Education Consortia. The purpose of the SCCIN is to enhance collaborative efforts in delivering outreach programs to coastal communities, avoid duplication of effort, minimize the number of meetings/workshops that community leaders and staff are asked to attend, leverage scarce resources, and therefore maximize program benefits and expected outcomes. The SCCIN was recognized as a Best Management Practice in the Consortium's 2015 Site Review Team Final Report. In 2016-2017 the SCCIN members worked together to develop a Flood Resources Guide for coastal communities, and the website continues to expand its resource offerings. The SCCIN website, redeveloped in 2017, can be accessed at www.sccoastalinfo.org.

Charleston Resilience Network: A federal, state, and local partnership dedicated to understanding climate impacts to critical infrastructure

The Charleston Resilience Network (CRN) (www.charlestonresilience.net) was formed in 2015 as a volunteer-based effort composed of public- and private-sector stakeholder organizations within the Charleston metropolitan area that have a collective interest in the resilience of communities, critical infrastructure, and socio-economic continuity to episodic natural disasters and chronic coastal environmental hazards. The CRN was created in part as the result of an invitation to present local potential climate change impacts and adaptation strategies underway at a Department of Homeland Security Office of Infrastructure Protection Climate Change Adaptation tabletop exercise in 2014. CRN is working to foster a unified resilience strategy and provide a forum to share information, educate stakeholders, and enhance long-term planning decisions that result in the implementation of effective hazard mitigation strategies and recovery efforts. Current steering committee partners include the Consortium, NOAA Office for Coastal Management, U.S. Department of Homeland Security, U.S. Army Corps of Engineers, S.C. Department of Environmental Control-Ocean and Coastal Resource Management, South Carolina Emergency Management Division, Berkeley-Charleston-Dorchester Council of Governments, City of Charleston, City of North Charleston, Charleston County, Charleston Commissioners of Public Works, College of Charleston, The Nature Conservancy (S.C.), South Carolina Aquarium, Charleston Metro Chamber of Commerce, and Wells Fargo. A localized volunteer-based grassroots alliance working to assess specific hazard vulnerabilities and build community-level resilience to flooding and other water-related hazard issues, the CRN has been successful in receiving grants to benefit the region. See the section on Charleston Resilience Network under Program Performance for additional information.

Oyster South: A coalition for the advancement of southern oyster mariculture

Oyster mariculture is gaining in popularity throughout the southern United States. In an effort to promote camaraderie and information sharing between beginning farmers throughout the region, Oyster South was born (www.oystersouth.com). Oyster South members include chefs, writers, researchers, farmers, wholesalers, educators, and extension agents. As a group the members are dedicated to the development of oyster mariculture in the South which will create jobs, maintain local traditions of working on the water, and provide ecosystem services to the region's coastal waters. The group also works together to formulate research questions and seek funding. Sea Grant aquaculturists in the South serve on the advisory board, ensuring the group is well-networked throughout the region. The second Oyster South Symposium was held in Charleston in early 2018, and the Consortium's Living Marine Resources Program Specialist served as point for the planning committee.

Offshore Mapping and Analysis for Offshore Wind Energy Development: BOEM support leads to initial resource assessment in South Carolina

Offshore wind resources in the U.S. Atlantic are abundant, stronger, and more consistent than land-based wind resources, and the wind resource found off the coasts of southern North Carolina and northern South Carolina show high potential. In 2014, officials from the Bureau of Ocean Energy Management (BOEM) Office of Renewable Energy Program contacted the S.C. Energy Office to begin discussions about providing funding to initiate a mapping and analysis program in the northern portion of the state's coastal ocean. The S.C. Energy Office asked the Consortium to work with its member institutions and others to coordinate the preparation and submission of a formal proposal to BOEM to begin this work. The Consortium was able to solicit and assemble a formal proposal, titled "Atlantic Offshore Wind Energy Development: Geophysical Mapping and Identification of Paleolandscapes and Historic Shipwrecks Offshore South Carolina," to BOEM within a 30-day period, which was funded in November 2014 for \$750,000. More than \$780,000 was provided as match. The overall objectives of the project were to: 1) Initiate a systematic geophysical survey of two areas offshore of South Carolina that have high probability of being initially developed for wind power generation; 2) Conduct detailed surveys to assess geoarchaeological potential of prehistoric habitation at select sites and to provide baseline information concerning the potential to identify prehistoric and relict landforms, historic shipwrecks and objects, and hazardous munitions and explosives of concern lying in the S.C. Outer Continental Shelf; and 3) Conduct a detailed geophysical survey connecting the proposed survey area and a similarly

extensive geophysical survey completed through a partnership with the USGS from 0-5 miles offshore. Partners in the project include the BOEM Office of Renewable Energy Program, S.C. Energy Office, Coastal Carolina University, University of South Carolina, College of Charleston, South Carolina Regulatory Task Force on Clean Coastal Energy, and the BOEM-South Carolina Offshore Renewable Energy Task Force. The project concluded in 2018 with the final report and data under final review by BOEM as of this writing.

COLLABORATIVE NETWORK/NOAA ACTIVITIES

The S.C. Sea Grant Consortium interacts routinely with NOAA and Sea Grant partners in program activities, research efforts, and outreach initiatives; the following are selected examples:

Governors' South Atlantic Alliance: A federal-state government partnership

The Consortium was actively involved with the formation and nurturing of the Governors' South Atlantic Alliance (www.southatlanticalliance.org), formally established on October 19, 2009 at an official ceremony in Charleston, S.C. involving the Governor's appointees from the four southeastern states, as well as representatives of the White House Council on Environmental Quality and three federal co-lead agencies. The Consortium formally participated as a member of the Executive Planning Team which supports regional alliance development, and served as team lead for the Working Waterfronts Technical Team. The Alliance has suspended operations with activities concluding in 2016.

Southeast Coastal Ocean Observing Regional Association: A NOAA IOOS Office partnership

The Consortium continues to play a leadership role in the Southeast Coastal Ocean Observing Regional Association (SECOORA) www.secoora.org, and was instrumental in its creation. In 2002, the Consortium was asked by university and ocean observing leaders in the region to direct the development and management of the region's ocean observations program. A Steering Committee of representatives from state government, academia, industry, and business was formed by the Consortium's Executive Director to guide growth of the organization. SECOORA officially began in 2003 through a grant award from the NOAA Coastal Services Center to the Consortium. From 2002-2010, the Consortium and SECOORA successfully competed for \$6 million in NOAA funding to support the organization's maturation, ocean observing assets, data generation and integration, stakeholder engagement, and administration. On March 17, 2010, SECOORA was spun off from the Consortium, becoming an independent, non-

profit corporation. SECOORA, one of 11 ocean observing regional associations established through the Integrated Ocean Observing System (IOOS) network, coordinates coastal ocean observing activities and facilitates dialogue among stakeholders in the southeastern U.S. SECOORA currently has an annual operating budget of about \$560,000, 40 dues-paying member organizations, a director and five staff, and a host of partner institutions. It is governed by a Board of Directors; the Consortium Executive Director was SECOORA's first Board chairman and currently serves on its Executive Committee.

Southeast Disaster Recovery Partnership: An IOOS, NOAA, and SE Sea Grant partnership

The Southeast Disaster Recovery Partnership (SDRP) provides training, resources, and relationships that coastal communities need to bounce back after a disaster. The Partnership connects disaster recovery practitioners from a variety of backgrounds, including emergency management, business, and natural resources. An outgrowth of the Governors' South Atlantic Alliance and now supported by the Southeast Coastal Ocean Observing Regional Association, SDRP partners conduct projects that build disaster recovery in North Carolina, South Carolina, Georgia, and Florida and provide a platform to engage public and private sector leaders to help our states and communities learn from one another. In 2017, the National Sea Grant College Program office provided funding under its Regional Integration initiative to support the five southeastern Sea Grant programs and the NOAA Southeast and Caribbean Regional Team to work with SDRP, the Southeastern Climate Community of Practice, and the Carolinas Integrated Sciences and Assessments program to develop a process that can be used to enhance coastal disaster resilience and recovery, particularly in the private sector, through public-private partnerships. The project, titled "Fostering Public-Private Partnerships in the Southeastern U.S. and Caribbean to Advance Resilience and Disaster Recovery," is reviewing, evaluating, and prioritizing effective public-private sector strategies for disaster recovery.

Southeast and Caribbean Climate Community of Practice: A Southeast regional partnership

The Southeast and Caribbean Climate Community of Practice (CoP) (www.seaccop.wordpress.com) brings together individuals from local, state, and federal governments, academia, non-profit organizations, and the private sector in the Southeast U.S. (N.C., S.C., GA, FL, P.R.) to apply climate science toward assessments of how coastal communities and ecosystems can adapt to the impacts of climate variability and change. The Consortium Coastal Climate and Resilience Program Specialist co-chaired the CoP steering committee and participated on the planning

committee for meetings in 2016 on Tybee Island, GA, and 2017 in Charleston, S.C., ensuring the CoP maintains momentum and reach into communities in the region. The CoP hosts webinar and other training opportunities for members. The CoP has expanded its membership to 251 members, a 63% increase since 2014.

Sea Grant Regional Resiliency Research Initiative: A Sea Grant and NOAA Office for Coastal Management Partnership

The Consortium joined with the Sea Grant College Programs of North Carolina, Georgia, and Florida in partnership with the NOAA Office for Coastal Management to co-fund a multi-year project in which a regional research team is doing hands-on work with a coastal rural community in each state (Nags Head, N.C.; Beaufort, S.C.; Liberty County, GA; and Monroe County, FL;). The aim is to use visualization tools and other approaches to help residents and decision-makers understand flooding risks and adaptation options. Because project communities have each been significantly affected by hurricanes or tropical storms over the two years of the project (due to hurricanes Matthew and Irma), some project modifications have been made to respond to community needs arising out of these events, particularly related to conducting traditional Vulnerability, Consequences, and Adaptation Planning Scenarios (VCAPS) assessments. Research results include a series of draft white papers that are currently being finalized related to the legal and policy issues that have arisen as these communities seek to address coastal hazard risks, as well as findings related to improving HAZUS assessments. Informal discussions are currently underway regarding the possibility of continuing this partnership effort in the Southeast region focusing on critical regional resilience needs.

From Seeds to Shoreline®: The Southeast region's first statewide salt marsh restoration program for K-12 educators and students

The Consortium's Marine Education Program Specialist developed, in partnership with the S.C. Department of Natural Resources and Clemson University Cooperative Extension, the first student-driven salt marsh restoration program in South Carolina. The program, From Seeds to Shoreline® (S2S), engages students in the collection and germination of *Spartina alterniflora* seeds and the cultivation and transplantation of seedlings to salt marsh locations along the coast. The three-pronged partnership has increased the capacity to meet the growing demands of the program and leverage resources. S2S has trained coastal and inland teachers and has expanded to the Georgia and North Carolina Sea Grant programs. The program also partners with S.C. Department of Natural Resources' S.C. Oyster Restoration and Enhancement Program to develop living shorelines. At

its core, S2S strives to teach K-12 students about the salt marsh ecosystem through a hands-on, stewardship restoration program. See the section on From Seeds to Shoreline® under Program Performance for additional information.

Collaborative Engagement

In addition, the Consortium is actively engaged with a number of NOAA institutions in planning, advisory, and information-sharing roles, such as:

Program Advisory/Strategic Planning

- The Directors of the NOAA Office for Coastal Management, NOAA Hollings Marine Laboratory, and NOAA National Centers for Coastal Ocean Science Charleston Lab are members of the Consortium's Program Advisory Board (PAB).
- The Director of the S.C. Department of Health and Environmental Control Office of Ocean and Coastal Resource Management is a member of the Consortium's PAB.
- The Director of the South Atlantic Fishery Management Council is a member of the Consortium's PAB.
- The NOAA Office for Coastal Management is represented in the Charleston Resilience Network.

Regional Initiatives

- The Consortium Director was a member of the Executive Planning Team for the Governors' South Atlantic Alliance (GSAA) (www.southatlanticalliance.org); NOAA was one of three lead federal agencies for the GSAA.
- The Consortium Director is Past-Chair and currently an Executive Committee member of the Southeast Coastal Ocean Observing Regional Association (SECOORA) (www.secoora.gov); the Consortium is a SECOORA institutional member.
- The Consortium is collaborating with the GA, N.C., and FL Sea Grant College Programs on a Regional Resiliency Research Competition, in partnership with the NOAA Office for Coastal Management.
- The Consortium participates in the NOAA Southeast and Caribbean Regional Collaboration Team; the Consortium Executive Director currently serves as the southeastern Sea Grant representative.
- The Carolinas Integrated Sciences and Assessments, a NOAA RISA program funded by the NOAA Climate Program Office, is located at the University of South Carolina and is a supporting partner in the Consortium's Coastal Climate and Resilience Program.
- The Consortium's Living Marine Resources Program Specialist and Education Specialist have participated in the NOAA Southeast Marine Debris Workshop due to their previous efforts to address abandoned and derelict vessels (ADV) and unwanted recreational fishing and boating gear.

State-Level Extension/Outreach Programs

- The Consortium created and coordinates the S.C. Coastal Information Network (www.sccoastalinfo.org) to enhance the coordination and collaboration among coastal outreach programs in South Carolina. Participating organizations include the S.C. Sea Grant Extension program, the NERRS Coastal Training Programs (NI/WB; ACE Basin), NOAA Center for Coastal Management, SCDHEC Office of Ocean and Coastal Resource Management, Clemson University Cooperative Extension, and three Councils of Governments (see full list above in Key Partnerships and Stakeholder Relationships section).
- The Consortium's Education Specialist partnered with NOAA's Planet Stewards (formerly Climate Stewards) program in 2016 to host a two-day professional development workshop in partnership with the South Carolina Aquarium and the National Park Service.

Student Training/Workforce Development

- The Consortium is a partner in the Ft. Johnson Seminar Series (www.cofc.edu/~grice/fjseminar.htm), which includes NOAA National Centers for Coastal Ocean Science Charleston Lab, National Institute of Standards and Technology, Grice Marine Laboratory of the College of Charleston, Marine Biomedicine and Environmental Sciences Program at Medical University of South Carolina, and S.C. Department of Natural Resources-Marine Resources Division.

National Sea Grant Initiatives

- The Consortium Executive Director served as a member of the Sea Grant Association's Aquaculture Working Group, which assembled a 10-year research and outreach investment strategy for Sea Grant programming.
- The Consortium's Living Marine Resources Program Specialist and Executive Director co-chaired the Sea Grant

Visioning effort to produce an Aquaculture Communications Plan.

- The Consortium's Coastal Communities Program Specialist co-chaired, with the GA Sea Grant Associate Director of Marine Extension, the Sea Grant Visioning effort to produce a 10-year Coastal Tourism Vision Plan.

PROGRAM PERFORMANCE

One of the desires of the S.C. Sea Grant Consortium is to be the "go-to" organization for information, support, and assistance on issues and opportunities related to the conservation, management, and wise use of the state's ocean and coastal resources. Our approach is to let our work speak for our success. The Consortium's significant involvement in a myriad of programs, projects, and activities related to our mission is only constrained by the limits placed on the program and its staff due to limited time, resources, and staff. Our many leadership roles in a variety of organizations, institutions, and programs are a reflection of both our desire to make a difference and the recognition by our partners who include us in collaborative efforts that we do, indeed, effect positive change. The examples of program activity found in this briefing book, in our PIER report, and during our February 5-7, 2019 Site Review Visit will provide the evidence of respect and accomplishment that we have achieved.

Leadership

The Consortium encourages staff to serve on planning, professional, and organizational committees in order to develop relationships and conduct cooperative projects with targeted stakeholder groups on the international, national, regional, state, and local levels. A list of selected leadership positions held by Consortium staff is provided below. Sea Grant-related leadership activities are highlighted in italics.

Consortium Leadership Roles

Rick DeVoe, Executive Director

<i>Member, NSGO Steering Committee, Assessing the Market and Non-Market Value and Economic Impacts of Coastal Engagement</i>	<i>2017 - present</i>
<i>Southeast Sea Grant Program Representative, NOAA Southeast and Caribbean Regional Team (SECART)</i>	<i>2017 - present</i>
<i>Member, Joint SGA/NSGO/NSAB Program Implementation and Evaluation Committee (PIE II)</i>	<i>2016 - 2017</i>
Member, Steering Committee, Charleston Resilience Network, Charleston, S.C.	2015 - present
Member, Advisory Committee, Boating Infrastructure Grant Program (U.S. Fish and Wildlife Service), S.C. Department of Natural Resources	2014 - present
Co-Chair, Board on Oceans, Atmosphere, and Climate, Association of Public and Land Grant Universities (APLU)	2013 - 2018
Member, Advisory Board, Graduate School, College of Charleston	2013 - present
Member (Ex-Officio), S.C. African American Heritage Commission	2013 - present
Member, Marine Biology Council, Graduate Program in Marine Biology, College of Charleston	2012 - 2018
Member, Advisory Committee, Carolinas Integrated Sciences and Assessments (CISA) Regional Climate RISA	2011 - present

Rick DeVoe, Executive Director (cont.)

Member, Gullah/Geechee Sea Island Coalition Think Tank	2011 - present
Member, Advisory Board, Master of Public Administration Program, College of Charleston	2010 - 2014
Member, Regulatory Task Force for Coastal Clean Energy, S.C. Energy Office	2009 - present
Member, Board of Advisors, Burroughs and Chapin Center for Marine and Wetland Studies, Coastal Carolina University	2008 - present
Member, Executive Planning Team, Governors' South Atlantic Alliance	2008 - 2016
Member, Board of Directors, Southeast Coastal Ocean Observing Regional Association (SECOORA) (Vice Chair 2013-2018; Finance and Audit Committee 2012-present)	2007 - present
South Carolina Representative (voting) and Member, Public Policy Committee, Consortium for Ocean Leadership	2007 - 2016
<i>Member (and Chair 2003-2008), External Relations Committee, Sea Grant Association</i>	<i>2003 - present</i>
Moderator (Lead), National Ocean Science Bowl – S.C.-GA Region	1998 - 2018
Member, Board of Directors, LowCountry Institute/Spring Island Trust (Spring Island, S.C.)	1998 - present
Member, Advisory Board, S.C. Water Resources Center, Clemson University	1998 - present
Chair, South Carolina Task Group on Harmful Algae	1997 - 2018
Member, Advisory Committee, North Inlet-Winyah Bay National Estuarine Research Reserve	1994 - present

Susan Lovelace, Assistant Director for Development and Extension

<i>Planning Committee, South Atlantic Region Sea Grant Extension and Communicators Meeting</i>	<i>2017 - 2018</i>
<i>Member, Sea Grant Network Diversity, Equity, and Inclusion Community of Practice</i>	<i>2017 - present</i>
<i>Liaison, Sea Grant Extension Assembly to Extension Disaster Education Network (EDEN)</i>	<i>2016 - present</i>
External Member, Steering Committee, 2016 Social Coast Forum, NOAA Office for Coastal Management	2015 - 2016
Member, Scientific Committee and Site Consultant, International Symposium on Society and Resources Management	2014 - 2015
Invited Participant, Gulf Research Program, National Academies of Sciences – Health Opportunities Analysis Workshop	2014

Susannah Sheldon, Research and Fellowships Manager

Founding Board Member and National Liaison, Graduate Women in Science, Charleston Chapter	2018 - present
Member, Education Committee, 2019 Charleston STEM Festival Early Childhood	2018 - present
Officer, Board of Directors, Southeastern Estuarine Research Society	2017 - present
Member, Broadening Participation Council, Coastal and Estuarine Research Federation	2017 - present
Member, Leadership South Carolina Class of 2018	2017 - present
Member, Education Working Group, Citizen Science Association	2015 - 2016
Member, Steering Committee, 2nd Biennial TCS/RAE Summit	2014 - 2015
Officer, Board of Directors, The Coastal Society	2013 - 2015
Agency Representative, Selection Committee, S.C. Environmental Awareness Award	2011 - present
Agency Representative, Ft. Johnson Marine Science Seminar Committee	2011 - present

April Turner, Coastal Communities Program Specialist

<i>Team Co-Lead, National Sea Grant Tourism Visioning Team</i>	<i>2017 - present</i>
President, Executive Committee, S.C. Nature-Based Tourism Association	2016 - present
Member, Program Committee, South Carolina Clean Marina	2016 - present
Member, Advisory Board, Carolina Clear Program, Clemson University	2015 - 2017
Member, Clean and Resilient Marina Program Taskforce (Regional initiative stemming from GSAA Working Waterfronts Technical Team)	2015 - 2017
<i>Chair, Executive Committee, National Sea Grant Sustainable Coastal Community Development Network</i>	<i>2014 - 2017</i>
Team Lead, Working Waterfronts Technical Team, Governors' South Atlantic Alliance	2014 - 2016

April Turner, Coastal Communities Program Specialist (cont.)

<i>South Atlantic Regional Coordinator, National Sea Grant Sustainable Coastal Community Development Network</i>	2014 - 2016
Member, Steering Committee, Palmetto Environmental Education Certification for S.C.	2014 - 2017
Member, Outreach and Education Committee, National Working Waterfronts Network	2013 - present

Julie Davis, Living Marine Resources Program Specialist

<i>Team Co-Lead, National Sea Grant Aquaculture Communications Visioning Team</i>	2017 - 2018
<i>Southeast Aquaculture Representative, Sea Grant Fisheries Extension Network</i>	2015 - 2018
Member, Advisory Panel, East Coast Molluscan Health Management	2015 - 2018
Member, Hatchery Certification Committee, East Coast Molluscan Health Management	2015 - 2018
Officer, Committee Member, and Member at Large, National Shellfisheries Association	2015 - 2017
South Carolina Representative, Board of Directors, and Member, Strategic Planning Team, Vibrio Working Group, East Coast Shellfish Growers Association	2014 - 2018
Member, Student Award Review Panel, Oyster South Coalition for the Advancement of Southern Oyster Mariculture	2014 - 2018
Member, Advisory Board, Oyster South	2014 - 2018

Elizabeth Fly, Coastal Climate Program Specialist (2014-2017)

<i>Chair, Southeast and Caribbean Climate Community of Practice Steering Committee</i>	2014 - 2017
Member, Planning Committee, Carolinas Climate Resilience Conference	2014

Susan Ferris Hill, Director of Communications

Member, National Association of Government Communicators	2006 - present
Member, Association for Communication Excellence	2006 - present
Member, Steering Committee, and Chair of Communications Committee, International Conference on Shellfish Restoration	2006 - 2016
Agency Representative, Selection Committee, S.C. Environmental Awareness Award	2005 - 2017
Member, S.C. Task Group on Harmful Algae	2001 - present
Coastal Coordinator, Beach Sweep/River Sweep	2001 - present

Joey Holleman, Science Writer and Public Information Coordinator

Agency Representative, Selection Committee, S.C. Environmental Awareness Award	2017 - present
Member, Society for Technical Communication, Carolina Chapter	2016 - present
Member, University Research Magazine Association	2016 - present
Member, American Association for Advancement of Science	2016 - present

Elizabeth Vernon Bell, Marine Education Program Specialist

Member, Education and Outreach Committee, Southeast Coastal Ocean Observing Regional Association (SECOORA)	2018 - present
Mentor, DataStreme Ocean, Climate, and Atmosphere	2016 - present
Member, Board of Advisors, Career STEM Academy (Summerville High School)	2015 - present
Member, Logistics Committee, Charleston STEM Festival	2014 - present
Chair, Steering Committee, Palmetto Environmental Education Certification for S.C.	2014 - present
Member, Education Task Force, South Carolina Aquarium	2015
Member, Advisory Council, Charleston County Cooperative Extension, Clemson University	2013 - present

Productivity

As stated earlier in this document, the S.C. Sea Grant Consortium's Strategic Plan is written to encompass the needs, issues, and opportunities that have been expressed by its diverse stakeholder and constituent base. Thus, its goals and objectives are expected to be relevant for a number of years to come; it is not an implementation plan. The work that the Consortium – its staff, its faculty and students, its partners and collaborators, and its audiences – has conducted and the results it has produced reflects significant progress in meeting our strategic goals and objectives. While we are involved and engaged in a variety of issues and topics, we have committed significant time and energy to those that are described in the following pages. These topics will be further elaborated by our panelist discussions during the site visit.

Programmatic Area: Healthy Coastal Ecosystems

Vision: The ecological and economic value of coastal and ocean ecosystem functions are documented and resultant information and tools are delivered to state and local decision-makers, resource managers, and interested public.

Stormwater Ponds: Studying their growing importance

In 1999, a survey of the state's coastal watersheds spotted 8,100 ponds. In 2016, a Consortium-funded researcher used satellite maps to count 21,594 ponds in the coastal region. This proliferation of ponds has replumbed coastal watersheds, and the Consortium has responded with an array of research, outreach, and education efforts focused on stormwater ponds.

The Consortium in 2014 organized the South Carolina Stormwater Ponds Research and Management Collaborative, bringing together dozens of researchers, engineers, and municipal stormwater managers. The goals were to develop science-based strategies for the construction, use, and maintenance of stormwater ponds, and to satisfy the pond-information needs of communities, homeowners' associations (HOAs), businesses, and industries. The Consortium hired a program coordinator to lead the Collaborative, secured state appropriations and federal Sea Grant funds to prime the effort, and along with partners convened a pond management conference that drew 155 developers, pond managers, HOA representatives, and government officials.

The 2016 pond inventory by University of South Carolina researcher Erik Smith was foundational. The Consortium also funded research by Smith on the effectiveness of ponds at retaining runoff and removing pollutants and on how quickly ponds are filling with sediment. He found well-designed ponds retain runoff and effectively reduce sediment, phosphorus, and pathogens such as *E. coli* from flowing downstream, but they don't do a good job removing nitrogen.

Graduate students working with Smith determined sediment buildup in ponds studied in Georgetown and Horry

counties has been minimal – less than half a centimeter a year. At that rate, ponds can go much longer than the national guideline of 10-15 years between dredgings, which is especially important to pond owners hoping to avoid the expense.

Other pond efforts have focused on informing developers who incorporate ponds into their projects and property owners who have to manage ponds. To that end, Consortium-supported research in 2015 at Clemson University helped determine the best site and design for a stormwater wetland as part of the Murrells Inlet Watershed Plan and a new bioretention system for the city of Myrtle Beach. Consortium-funded researchers also in 2015 began compiling state-of-knowledge reports on effectiveness of pond designs, best approaches for pond management, proper ecosystem functions of ponds, and existing laws and regulations related to ponds. A comprehensive state-of-knowledge report will be published by early Spring 2019.

The Consortium worked alongside partners from Clemson University Cooperative Extension and the National Estuarine Research Reserves to organize pond conferences in Beaufort County (2015 and 2017) and Charleston County (2014 and 2016).

The Fall/Winter 2017-18 issue of the Consortium's Coastal Heritage magazine was designed as an introduction to the expansion of pond building in the region, the vast amount of pond research, and the importance of both to the general public. The article featured the Crowfield Plantation Homeowners Association, which began saving money for pond maintenance after officers attended the Charleston pond conference in 2014. Two other HOA managers called the Consortium, asking for copies of the magazine to help explain pond responsibilities to their boards.

Tidal Creeks: Determining the impacts of coastal development

Tidal creeks branch through South Carolina's eastern edges, like blood vessels to and from the heart of the coastal region. They provide essential ecosystem services, protecting us from flooding and erosion, providing a venue for recreation, and serving as nurseries and habitat for commercial and recreational fisheries. And as with arteries and veins in humans, it's imperative we keep tidal creeks healthy. Consortium-supported research checks in routinely on those creeks.

Researchers from Coastal Carolina University and University of South Carolina documented changes in important estuarine food webs in North Inlet associated with the warming climate. They found gobies are hatching in the water column later in the year than in the past, which may have consequences for their feeding patterns on oyster larvae. Changes in the interactions between these two ecologically important species could have ripple effects on estuarine food webs in South Carolina's tidal creeks, salt

marshes, and bays.

In Beaufort County, Consortium-funded research documented flashes of low salinity in tidal headwaters linked to high stormwater influx. A National Estuarine Research Reserve (NERR) Science Collaborative project, the research provided scientific data necessary to identify which portions of watersheds are most sensitive to stormwater runoff. Beaufort County incorporated the data into the 2016 update of its Stormwater Management Plan.

Another project in collaboration with the S.C. Department of Natural Resources (SCDNR) looked at the impacts of coastal development on tidal creek headwaters, using historical data going back to 1994 from 48 creeks. Population density and impervious surfaces had increased in most of those watersheds. One aspect of this study was to determine whether the use of best management practices (BMPs), including stormwater ponds, has a direct impact on tidal creek environmental quality. BMPs were determined to have not altered the delivery of nutrients to the creeks.

A separate study investigated the delivery of nutrients from groundwater into 14 tidal creeks. The samples were analyzed for a variety of nutrients, including nitrogen, ammonium, phosphorus, orthophosphate, and dissolved organic carbon. Initial analysis of individual creeks began to reveal trends. Among other things, the findings support the hypothesis that recirculation of saline creek water through salt marshes may present a far larger source of nitrogen to tidal creeks than fresh groundwater discharge from uplands, whether the uplands are developed or not.

All of the research is based on the assumption that maintaining the health of tidal creeks is incredibly important to our region. To help get that message across to a broad range of people, the Consortium partnered with SCDNR on the *Guide to the Salt Marshes and Tidal Creeks of the Southeastern United States*. The 104-page guide was funded by a U.S. Environmental Protection Agency grant.

The first section of the guide describes the physical, chemical, and biological environment of marshes and tidal creeks in easy-to-understand terms. The next 60 pages are designed as a field guide, with photos, identifying characteristics, range/habitat information, and fun facts on the dominant flora and fauna of the ecosystem.

Programmatic Area: Sustainable Fisheries and Aquaculture

Vision: Sustainable fisheries and aquaculture in the coastal region are compatible with changing demographics, business development, regulatory environments, and



Photo: Grace Beahm Alford

long-term conservation of natural and cultural resources.

Oyster Mariculture: Jump-starting an industry in South Carolina

The Consortium has worked for decades to foster development of aquaculture, including marine shrimp, hybrid striped bass, and hard clams. More recently, the focus has been on shellfish mariculture.

Single oyster production from wild harvest in South Carolina had dwindled early this century and alternative methods, such as farming oysters, were required if South Carolina was going to capitalize on restaurant market demand for premium

single oysters. The Consortium's Living Marine Resources Program Specialist provided technical assistance in 2014 to help two growers test the use of off-bottom cages. Single oysters with desirable shell shape and meat quality were grown to harvest within 14 months of being spawned.

When disease concerns in 2014 prompted a moratorium on oyster seed imported from outside the state, the Consortium worked with regulators to identify southern hatcheries that could meet the state's zero-tolerance policy on disease. Two South Carolina shellfish nurseries were permitted to import eyed larvae, and the Consortium provided technical expertise on remote setting of eyed larvae for single oyster production.

That kept the industry going in 2014, but more needed to be done to reduce reliance on out-of-state seed sources. The Consortium provided technical assistance to Lady's Island Oysters owner Frank Roberts to begin seed production at his facility in Beaufort County. First, South Carolina diploid oysters were spawned and raised in the hatchery. Then tetraploid sperm was imported from Louisiana broodstock and crossed with South Carolina diploid females to produce S.C. triploid oysters.

Triploids are spawnless, or non-producing, and have better meat quality in warmer months than diploids, which must expend energy in reproduction. Consortium-funded research by Peter Kingsley-Smith at the S.C. Department of Natural Resources (SCDNR) found that triploids grow slightly faster than diploids in South Carolina waters.

Boosted by the Consortium's efforts, the harvest of single oysters has become a viable business in the state. The number of growers has expanded from three in 2013 to 12 in 2017. In 2017, the first year in which oysters grown from Lady's Island seed reached maturity, the value of maricultured oysters harvested in the state doubled to \$272,440, according to SCDNR. Figures for 2018 weren't available when this report went to press, but growers expect the wholesale value of the harvest will top \$1 million.

The Consortium also worked in 2017 with scientists and specialists from the Southeast on a U.S. Department of Agriculture Southern Regional Aquaculture Center research project aimed at managing biofouling on the cages used in oyster mariculture. Also, Consortium staff created an inventory tracking tool for oyster growers, and helped put together the first Oyster South Symposium in Alabama to foster exchange of information among beginning oyster farmers.

In June 2017, Roberts joined experts from California, Maine, Michigan, and Mississippi in Washington, D.C., for a Capitol Hill briefing panel entitled “Aquaculture in the United States: Enhancing Growth of the Domestic Industry.”

“Sea Grant was the first place our industry looked for help,” Roberts said. “Now, three years later, thanks to science-based technologies and techniques learned from Sea Grant, we are realizing our long-term goals can be achieved.”

Programmatic Area: Resilient Communities and Economies

Vision: Coastal residents, communities, and businesses understand the risks and vulnerabilities associated with both chronic and episodic coastal hazards, and are prepared for and able to recover from these hazards with minimal disruption to social, economic, and natural systems.

Charleston Resilience Network: Working as one to address flooding

“In the next 100 years, there is nothing more pressing on the city of Charleston than sea-level rise and its impact.” Charleston Mayor John Tecklenburg made that declaration on June 15, 2017, at a flood resiliency knowledge exchange between officials from Charleston and the Tidewater region of Virginia. The event was organized by the Consortium and its partners in the Charleston Resilience Network (CRN) and drew about 60 attendees.

Starting in 2014, the Consortium laid the groundwork for the region’s acknowledgement of the critical importance of flood resilience work. The Consortium joined with the S.C. Department of Health and Environmental Control, College of Charleston, The Nature Conservancy, South Carolina Aquarium, utilities, and municipal and county governments in the region to form the CRN. In less than two years, on behalf of the CRN, the S.C. Sea Grant Consortium earned a contract through the Department of Homeland Security’s National Infrastructure Protection Plan Security

and Resilience Challenge and a Regional Coastal Resilience grant from NOAA.

Leveraging those funds, the CRN built awareness in the greater Charleston area regarding the vulnerability of the region’s critical infrastructure while enhancing the collective ability to support science-based decisions on infrastructure investments.

The need for the CRN quickly became clear in October 2015, when a rare set of atmospheric conditions funneled up to 26 inches of rain into the region over three days. In February 2016, the CRN partnered with the National Academies of Sciences to host a symposium on the 2015 flood and the resilience-related needs the disaster emphasized, and 50 people participated in the event.

Much of CRN’s early work involved bringing together individuals and groups who often had been working on resilience issues in separate silos. An event dubbed “Rendezvous for Resilience” kicked off the effort, bringing together 40 professionals with a range of expertise and responsibilities together in April 2017. New participants were involved with the monthly coffee hours that featured guest speakers at various locations throughout the greater Charleston region. A website, www.charlestonresilience.net, was established to share information on resilience events and research.

The Consortium in Spring 2017 worked with Enough Pie, a local non-profit dealing with gentrification challenges in the Upper Peninsula of Charleston, on a unique project to spread the word about resilience. “Awakening V: King Tide” included nine public artworks and 10 community events that featured local scientists and community leaders.

The NOAA grant generated data products which, on a parcel-level scale, provide a high-resolution presentation of flood vulnerabilities in the Charleston region. The data also identifies the capacity of critical infrastructure to absorb impacts of flooding events, both in the short term and long term. These products formed the basis for three neighborhood engagement expos with an average attendance of 50 people each designed to assist local stakeholders and organizations as they move from resiliency planning to implementation.

Butch Barfield, North Charleston’s Emergency Preparedness Coordinator, was excited about the multiple avenues of communication at the expo in his city. “The best part of this is neighbors coming out and talking with us,” Barfield said. “You need to embrace listening to establish trust.”

Flood Adaptation: Providing data to coastal communities

As nuisance tidal flooding increased



Photo: Grace Beahm Alford

remarkably in recent years, coastal communities turned to the Consortium for science-based data and expertise in planning adaptation strategies.

In 2014, the Consortium's Coastal Communities Program Specialist collaborated with the state's two National Estuarine Research Reserves (NERR) and the Center for Watershed Protection on *Low Impact Development in Coastal South Carolina: A Planning and Design Guide*. The 425-page document provides local decision-makers with stormwater engineering specifications, land-use planning resources, and site-design practices tailored to the conditions of the South Carolina coast. Funded in part by a NERR Science Collaborative grant, the guide routinely ranks as the most-downloaded document on the Consortium's website.

In 2015, the city of Beaufort and town of Port Royal formed a task force on sea-level rise and asked the Consortium for help. The task force identified eight areas of high vulnerability and worked with public works directors from the two municipalities to come up with measures to mitigate flood risk.

At the same time, the Consortium earned National Sea Grant funding for a sea-level rise adaptation project in Beaufort County. The Consortium's Coastal Climate Program Specialist provided the science-based data to help the county come up with 23 new adaptation strategies and assisted the county in two public workshops aimed at building public buy-in for sea-level rise recommendations. The results were published in the "Sea Level Rise Adaptation Report: Beaufort County, South Carolina," which was distributed to municipal staff and stakeholders in Beaufort County. The report can be accessed at www.scseagrant.org/pdf_files/Beaufort-Co-SLR-Adaptation-Report-Digital.pdf.

In 2015, the city of Folly Beach sought technical assistance from the Consortium to help update its Local Comprehensive Beach Management Plan for the first time in 24 years. A Consortium graduate assistant with GIS-mapping expertise provided beachfront monitoring and erosion data. As the town later updated its Comprehensive Plan, it inserted sea-level rise considerations for the first time based on Consortium-supplied data. And with Consortium guidance on improving documentation about open-space protection and repetitive-loss properties, the city improved from class 7 to a class 4 in the Federal Emergency Management Agency's Community Rating System, which led to a 30% discount in flood insurance premiums for its residents.

Along the northern coast, Consortium-supported research at Clemson University in 2014 led to design and siting criteria for an

engineered stormwater wetland system installed at Murrells Inlet. Georgetown County's stormwater department and the Waccamaw Regional Council of Governments partnered on the effort. The research also helped determine the site and design of a new bioretention system for the city of Myrtle Beach.

Consortium staff worked with the North Inlet-Winyah Bay NERR in 2015 to develop and implement a workshop designed to increase local decision-makers' knowledge of coastal vulnerabilities to sea-level rise.

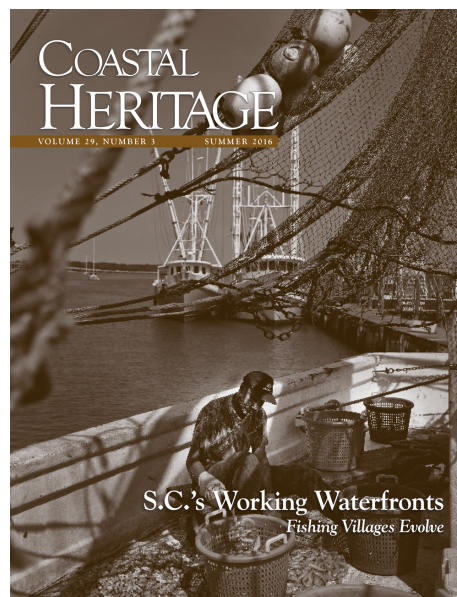
In response to the record-breaking October 2015 flooding in South Carolina, the Consortium, S.C. Coastal Information Network (SCCIN), and Extension Disaster Education Network compiled a "Flood Resources Guide." Supported by National Sea Grant funding, the online guide features more than 200 links to resources through the SCCIN website, www.sccoastalinfo.org. The information has been handy as coastal regions suffered flooding associated with tropical systems in 2016, 2017, and 2018.

Working Waterfronts: Helping plan their evolution

In 2015-16, the Consortium held workshops in five coastal communities especially impacted by working waterfront challenges – Murrells Inlet, Georgetown, McClellanville, Mount Pleasant, and Port Royal. Participants identified problems and priorities while developing a vision for the future of their working waterfront. Clemson University researchers led the workshops, which were funded through a Coastal Research and Extension Group mini-grant, which were considered a best management practice in the Consortium's 2015 site review visit.

On a parallel track, the Consortium recruited graduate students from the College of Charleston to survey municipal planners, commercial fishers, seafood wholesalers, and local residents to gather data about how each group thought working waterfronts have changed due to increasing population, land conversion, and sea-level rise. While some similarities arose, each of the communities faced specific challenges.

The information gleaned from the workshops and the interviews provided background for the summer 2016 issue of the Consortium's *Coastal Heritage* magazine, "S.C.'s Working Waterfronts: How Fishing Villages Evolve." The issue focused on working waterfronts, how they have changed over the past 100 years, and their struggles to maintain traditional uses. Not only was the information shared with the magazine's 5,000 subscribers, but *The Georgetown Times* newspaper requested



and received permission to reprint the majority of the content four months later.

Early in 2017, the researchers and Consortium staff returned to each of the communities for forums in which they provided summaries of their findings. More than 150 people attended the forums, which also drew coverage from 17 newspapers and two television stations.

The research found a general opinion on what comprises a successful working waterfront: sustainable income opportunities, a balance of industrial and non-industrial uses, flexible fishery uses, community support, maintenance of water quality, and safe access to the water. The full project results were published on a webpage, www.scsseagrant.org/Content/?cid=946 and presented at the S.C. Seafood Summit in March 2017.

While each of the communities pledged to use the findings as they moved forward, the town of McClellanville took immediate action. Town officials, in conjunction with the Consortium and the East Cooper Land Trust (ECLT), earned a grant from the S.C. Municipal Association to determine options for maintaining the town's two commercial docks as their aging owners consider retirement.

The project team is working on a master plan for the town's working waterfront and has contracted with a firm to explore the option of cooperative ownership and operation of wholesale seafood operations at the docks. The ECLT is in discussions with the dock owners to put their property under conservation easements that would prevent their conversion to residential uses.

Mineral and Energy Resources: Gauging South Carolina's capacity

Consortium research in recent years has helped determine the capacity of the ocean off the South Carolina coast to provide sand for beach nourishment and wind for potential clean energy production.

South Carolina has adopted beach nourishment as the predominant strategy for addressing coastal erosion on beaches. As the demand for sand has grown so has concern about the sustainability of the process. Consortium-funded research in 2014 looked at infill rate and sediment composition in offshore borrow sites where sand has been harvested for nourishment projects.

Sediment analyses indicated the seabeds of most ebb tidal deltas are composed mainly of well-sorted sand, and dredging impacts are mainly on grain size and carbonate content. The site studied was restored to pre-dredging levels within six months after dredging. This work can help guide



Photo: Povl Petersen, Dreamstime

borrow-area siting for future beach nourishment projects.

Consortium researchers also monitored 16 miles of nourished beaches for annual reports that would determine if enough erosion had occurred to trigger the start of a new renourishment project. Based on 2014 monitoring, the U.S. Army Corps of Engineers initiated the process for nourishing those beaches in Horry County.

The composition of the seafloor also could be a crucial consideration in the location of future wind energy towers off the S.C. coast. An economic impact study performed by Clemson University in 2012 estimated a 1,000-megawatt offshore wind project would create 3,800 jobs and \$3.6 billion in economic

output. Recognizing that potential, the S.C. Energy Office in 2014 asked the Consortium for help in mapping a portion of the seafloor off North Myrtle Beach. This area, known as Long Bay, has been determined as one of the most likely sites for a future wind farm.

The project grew into a multi-institutional effort funded by the Bureau of Ocean Energy Management (BOEM) Office of Renewable Energy Program. Researchers from Coastal Carolina University, University of South Carolina, and College of Charleston not only mapped the geophysical attributes of the seafloor, but they also provided a survey of historic shipwrecks and hazardous unexploded ordnance in areas where wind energy facilities could be constructed.

Researchers used sonar, magnetometers, echosounders, and cameras to study an area 11-to-16 miles off North Myrtle Beach. They mapped a network of sediment-filled remnants of ancient river channels that could serve as routes for transmission cables as well as many hardbottom outcroppings that should be avoided.

They also mapped the shipwreck of the *USS General Sherman*, a 200-foot former blockade runner that survived the Civil War only to sink in a coastal storm in 1874.

The potential wind energy areas off South Carolina's coast are vast, and this survey only covered a small geographic area. The Consortium's research, however, will provide a general understanding of the geophysical and archaeological characteristics of the seafloor off the state's northern coast.

Programmatic Area: Environmental Literacy and Workforce Development

Vision: A scientifically literate public, at both youth and adult levels, understands the value and vulnerability of coastal and marine resources, makes wise decisions

regarding these resources, and supports the development of a well-trained and diverse workforce in coastal- and marine-related careers.

From Seeds to Shoreline®: Engaging educators and students in natural resource stewardship

The From Seeds to Shoreline® (S2S) salt marsh restoration program, which began in 2011, grew tremendously from 2014-17, much like the *Spartina alterniflora* seedlings at the heart of the K-12 education effort.

The program is designed to engage students in germinating *Spartina* seeds in the fall, growing seedlings in greenhouses during the winter months, and transplanting them into marshes at the end of the school year. In 2014, the Consortium partnered with the S.C. Department of Natural Resources (SCDNR) to secure funding from the U.S. Environmental Protection Agency to expand the program throughout South Carolina and replicate the educational training model in North Carolina and Georgia, through Sea Grant programs in those states.

The grant also supported the development of a *Spartina alterniflora* poster, the 104-page *Guide to the Salt Marshes and Tidal Creeks of the Southeastern United States*, a salt marsh coloring book, and a website, www.saltmarshguide.org. The Lowcountry Master Naturalists program was impressed with the guide and included it in the group's required resource materials.

In all, the program features 15 partnering institutions, including universities and local, state, and federal agencies. For instance, the Consortium facilitated training in 2015 of education staff at eight informal science centers to expand the program. Education staff at the South Carolina Aquarium, four National Estuarine Research Reserves (NERRs), and the North Carolina and Georgia Sea Grant programs joined the effort during that period.

The Consortium also led three one-day workshops on S2S for K-12 teachers in the summer of 2014. Those helped boost the number of students participating in the program from 1,044 in 2013 to 1,800 in 2015. The expansion into North Carolina and Georgia added 625 students in the 2015-2016 school year.

As more trained personnel allowed expansion of the program to more schools, the need arose for a centralized greenhouse to grow seedlings for schools that had limited resources of their own. The Consortium worked with the Clemson University Carolina Clear Program and the Ashley-Cooper Stormwater Education Consortium in 2014 to purchase and construct a greenhouse at Clemson University Extension's "Education Shed"

on U.S. 17 near Charleston.

One goal of the program is to plant the seedlings in areas where marshes are in need of restoration. In 2015, a planting site profile and monitoring protocol was developed through a graduate student-focused project. The protocol is designed to allow students and teachers to monitor the success of transplanted seedlings and measure the footprint of restored salt marsh.

In 2016, the Consortium partnered with SCDNR and Florida Guana Tolomato NERR to win a Science Transfer grant to pilot a hydroponics method of cultivating *Spartina*, and it was tested by 10 teachers. Hydroponics would provide schools an option to the greenhouse method.

Those outside the program recognize the impact of S2S. In 2016, it was featured in an episode of S.C. Educational Television's *Making It Grow*. In 2017, it earned the Johnnie Dodds Education Award at the Community Pride of Charleston County award ceremony.

The Consortium applied for, and received, a trademark on From Seeds to Shoreline in 2016. In 2017, the South Carolina student participation had jumped to 4,340 led by 145 teachers in six coastal counties and two inland counties, for a total of 46 schools involved statewide. More information about the program and its products can be accessed at www.scseagrant.org/Content/?cid=921.

PROGRAM CHANGES RESULTING FROM PREVIOUS SITE REVIEW VISIT

The S.C. Sea Grant Consortium hosted its 2015 National Sea Grant Site Visit on September 1-2, 2015 in Charleston, S.C., and we received our final Site Visit report on November 2, 2015. We are pleased that the Site Visit Team (SVT) had only one recommendation for our program to address.

Recommendation #1: The membership of the Board of Directors and their alternates should not be eligible for Sea Grant funding.

SCSGC Response: The SCSGC Executive Director presented this recommendation to the chairman of the Consortium's Board of Directors, along with a draft policy document to directly address it, in early Spring 2016. A special meeting of the Consortium Board was held on April 15, 2016 to discuss the recommendation and the draft policy document to resolve it. By a unanimous vote, the Board adopted a written policy, effective May 1, 2016, which states in essence that "no sitting member of the Consortium Board of Directors or his/her designated Board Alternate shall be eligible to compete for or receive [S.C.] Sea Grant Consortium funding."



Photo: E.V. Bell