COASTAL SCIENCE SERVING SOUTH CAROLINA

SOUTH CAROLINA SEA GRANT CONSORTIUM

AUTHORITY – The South Carolina Sea Grant Consortium (Consortium; www.scseagrant.org) was created in 1978 through South Carolina Act No. 643. The Consortium was nationally certified as a Sea Grant College Program by the Secretary of the U.S. Department of Commerce in 1986.

MISSION – Generate and provide science-based information to enhance the practical use and conservation of coastal and marine resources that fosters a sustainable economy and environment for the State of South Carolina and its citizens.

ORGANIZATION – The Consortium is an independent university-based state agency which reports to the S.C. House of Representatives and the S.C. Senate. Consortium member institutions are Clemson University, Coastal Carolina University, College of Charleston, Medical University of South Carolina, S.C. Department of Natural Resources, South Carolina State University, The Citadel, and University of South Carolina. The Consortium Board of Directors consists of the Presidents of the Consortium's member institutions, to whom the Executive Director reports.

FORMAT OF THE CONSORTIUM'S PRP BRIEFING BOOK THIS YEAR – The Consortium's PRP briefing book provides testimonial statements which document the value of a select sample of the agency's collaborations, partnerships, and service to the citizens of the state and nation.

"The Consortium is one of the most fiscally accountable and reputable state agencies in…South Carolina, from its Executive Director, to its officers and staff, to its academic professionals. This organization has made meaningful changes in natural resource conservation…" – J. Yancey McGill, (D-Williamsburg County; 1989-2014), Chairman, Senate Finance Natural Resources Subcommittee, S.C. Senate, and Lt. Governor (2014-15), Columbia

"The S.C. Sea Grant Consortium provides a valuable, albeit behind the scenes service that helps South Carolina maintain a competitive advantage in both economic development and tourism" – J. Gary Simrill (R-York County; 1993-present), Chairman, House Ways and Means Economic Development and Natural Resources Subcommittee, S.C. House of Representatives, Columbia

"Today, 35 years after its creation, the Consortium is arguably one of the best Sea Grant programs in the country. It organizes and links the strengths of its numerous participating institutions statewide to address…challenges with nimbleness, transparency, integrity, and effectiveness" – Paul A. Sandifer, Ph.D., Research Associate (Professor), College of Charleston, and Former Senior Scientist, Science Advisor to the NOAA Administrator, and Chief Science Advisor for the NOAA National Ocean Service, and Director, S.C. Department of Natural Resources

"Higher education systems are undergoing dramatic shifts in funding allocation, missions and foci, and how faculties and staffs spend their time and intellectual effort. The consortial organization unique to S.C. Sea Grant provides them a buffer from these changing times…their entrepreneurial culture…will enable them to succeed where others will have faltered" – James G. Sanders, Ph.D., Director, Skidaway Institute of Oceanography, Savannah, GA

"Most of us in environmental agencies and academia turn to [the Consortium's] outstanding staff and communication networks…as the most effective way to translate complex scientific information into consumable and understandable information for the public and decision makers" – Geoff Scott, Ph.D., Chair and Clinical Professor, Department of Environmental Health Sciences, University of South Carolina, Columbia

The S.C. Sea Grant Consortium 2010-2015: A Time of Resilience and Rejuvenation

The last five years (2010-2015) have been a time of challenge, of survival, of transition, *of resilience,* for the Consortium. The agency was faced with a series of budget vetoes and significant staff turnover due to retirements and departures, resulting in the loss of over 135 years of experience. As a result, the Consortium had to institute a strategy of retreat in order to regroup and rebuild. Due to extremely strong support expressed by the Consortium's constituencies and its member institutions, the S.C. General Assembly overrode the vetoes in each of the four years they were issued. Indeed, the S.C. General Assembly's support of the Consortium resulted in a 68% increase in state recurring funds during this time. Since then, the Governor recommended level funding for the agency for FY14-15 and FY15-16, for which we are most grateful. We have also replaced outgoing staff with a cadre of new and energetic professionals who are adapting well. And this last year has been a time of rejuvenation, of renewed commitment, of promise, and of great potential. The agency has become a much stronger institution because of these experiences, and we have produced well. A 2013 study prepared by the Darla Moore School of Business of the University of South Carolina documented the Consortium's total economic impact of $8.9 million in South Carolina, and that for every 10 jobs created directly by the Consortium, an additional 11 jobs, on average, are created elsewhere in the state. But to ensure our viability in the future, we have initiated a visioning exercise to evaluate our standing in South Carolina and the region, in the context of significant changes occurring now in our institutions, technologies, socio-demographics, economics, and natural resources. The Consortium seeks to be well-positioned, organizationally and programmatically, to address emerging and unanticipated issues and needs of our stakeholders for the next 20-30 years.

"I planned to vote to sustain the veto…but I like to make sure of the facts before we do something like that. And so I went looking; and we can't do this. So I come to tell you that…we want and need the Sea Grant Consortium right where it is: An independent and yes, small, but vitally important agency administering the funds that make our coast and coastal ecosystem safe and able to support our tourists and coastal industries" – Kristopher Crawford, M.D., (R-Florence; 2007-2014) in a 2012 floor statement before the S.C. House of Representatives

"In spite of these [veto] *difficulties, Consortium leadership has sustained its programs, retained staff, and kept its credibility. Today, the Consortium team remains the state leader in supporting coastal research and the associated outreach and extension activities"* – A. Frederick Holland, Ph.D., Director (retired), NOAA Hollings Marine Laboratory, Charleston

"The Consortium not only benefits the state of South Carolina through preserving and enhancing coastal resources for businesses, visitors, and residents, but it also directly generates new economic activity through the external funding it brings to the state and its contributions to the employment and income base of South Carolina every year" – Joseph Von Nessen, Ph.D., Darla Moore School of Business, University of South Carolina, Columbia

"In short, the Consortium is highly resilient because it is diverse, broadly inclusive, intensely networked, well-trusted, and people in all walks of life know it delivers. It is woven into the very fabric of the state" – Paul A. Sandifer, Ph.D., (Professor), College of Charleston, and Former Senior Scientist, Science Advisor to the NOAA Administrator, Chief Science Advisor for the NOAA National Ocean Service, and Director, S.C. Department of Natural Resources

COASTAL SCIENCE SERVING SOUTH CAROLINA

Recognizing the Value of South Carolina's History and Culture through *Coastal Heritage*

Coastal Heritage, a free quarterly publication produced by the S.C. Sea Grant Consortium since 1982, brings readers timely information about South Carolina's rapidly developing coast. The S.C. coast has experienced sweeping changes since the end of the Civil War. *Coastal Heritage* addresses these challenges by offering readers an in-depth look into environmental, technological, historical, and cultural patterns of change along the S.C. coast and how they affect residents and visitors. Hard copies of *Coastal Heritage* are distributed nationally and internationally to 5,500 subscribers, 500 issues are distributed to additional targeted audiences, and each issue is available on the Consortium website. From 2010 to 2015, *Coastal Heritage* has won over 20 prestigious awards at the regional, national, and international levels.

"I commend you on the excellent job you did of distilling a complex subject into nine pages of accurate, understandable, and highly readable text. In my 40 years with Texas Sea Grant I can recall few articles…which explained a subject with the clarity, and detail, you provided in your article" – Russ Miget, Environmental Quality Specialist, Texas Sea Grant College Program (Spring/Summer 2013 "Climate Change and Extreme Weather.")

"Once again you have published a well-researched and fine article, "Carolina's Gold Coast." I enjoyed reading it and learned something" – James T. Morris, Director, Belle W. Baruch Institute for Marine and Coastal Sciences, University of South Carolina (Winter 2014 "Carolina's Gold Coast: The Culture of Rice and Slavery.")

Consortium Enables Volunteers in its Annual Beach Sweep River Sweep Event

Beach Sweep/River Sweep is South Carolina's largest, volunteer-driven litter cleanup. The Sweep, now in its 27th year, is organized by the S.C. Sea Grant Consortium (coastal counties) in partnership with the S.C. Department of Natural Resources (inland counties), and is held in conjunction with the Ocean Conservancy's International Coastal Cleanup. The cleanup is funded almost entirely by private cash and in-kind donations. From 2010-2014, 16,895 coastal volunteers cleared 71 tons of debris along 1,139 miles. Total value of coastal volunteers' time during this period was $604,580 (Independent Sector and U.S. Bureau of Labor Statistics).

"We've enjoyed our Beach Sweep/River Sweep partnership with S.C. Sea Grant these past 26 years. I think it's the public's enthusiastic participation in the Sweep that keeps Sea Grant and the DNR doing this year after year. The Sweep is a good tradition that we need to continue" – Bill Marshall, Environmental Program Manager, S.C. Department of Natural Resources, Columbia

"For 26 years the National Park Service at Fort Sumter National Monument has acted as site captains for S.C. Sea Grant's annual Beach Sweep on Sullivan's Island. One of the most compelling things about this event is the loyalty of our volunteers. Some groups have been volunteering every year for nearly as long as we have been doing the Sweep. We are also amazed every year by the results of Beach Sweep. We would be unable to pull off this kind of cleanup effort without the support and reputation of S.C. Sea Grant Consortium" – Olivia Williams, Interpretive Ranger, U.S. National Park Service, Sullivan's Island

Consortium Enhances Shellfish Aquaculture Industry in South Carolina

Shellfish aquaculture extension activities at the S.C. Sea Grant Consortium focus on enhancing decision-making for established, beginning, and prospective growers, using applied science-based information and putting tried-and-true technologies to work on South Carolina shellfish farms. Consortium staff work with resource managers, scientists, and growers locally, regionally, and nationally to generate the necessary knowledge for and to understand and remove barriers to responsible aquaculture production in South Carolina. For example, in response to a state moratorium on oyster seed from points north of South Carolina announced in April 2014, the Consortium worked with SCDNR shellfish managers and private growers to identify acceptable seed sources from points south and then provided technical training on remote setting techniques to the growers. This resulted in over three million seed, valued at over $60,000 sold in the state in 2014, meeting the needs of all existing growers and supporting the establishment of five new operations. Currently, in an effort to build capacity for an in-state oyster seed supply, hatchery and nursery technology training efforts are underway and nine new growers have received hands-on training. Farm visits foster technology transfer to new and beginning oyster farmers growing high-value single oysters using off-bottom methods. In 2014, this emerging industry doubled in size and growers are beginning to hone techniques they were first exposed to during Sea Grant-led demonstrations. And in consideration of new species, the Consortium, in partnership with Florida Sea Grant and SCDNR, distributed submerged soil kits to shellfish mariculture permit holders to determine the feasibility of culturing sunray venus clams in South Carolina. If the proper soil conditions exist, this would provide a high-value diversification opportunity for the state's shellfish aquaculture industry.

"We relied on the shellfish mariculture expertise within the S.C. Sea Grant Extension Program to educate our planning staff and County Council; this resulted in amendment of our Dock Ordinance to accommodate the waterfront access needs of our County's shellfish mariculture industry" – Tony Criscitello, Planning Director, Beaufort County

"Every time I talk to Sea Grant staff about my oysters I learn something new about how to improve production and start to feel warm and fuzzy about getting into this business" – Hank Tiller, beginning oyster farmer, McClellanville

"Sea Grant staff knowledge of seed availability in the region and hatchery and nursery production skills have been key in helping the industry remain viable despite significant regulatory hurdles and seed shortages" – Frank Roberts, President, Lady's Island Oysters, Seabrook

Consortium Supports Sustainable Seafood Efforts in South Carolina

The S.C. Sea Grant Consortium supports seafood programs which aim to ensure a safe and sustainable supply of domestic seafood and to assist producers with growing, harvesting, and marketing their products effectively and efficiently. Projects to ensure the availability of sustainable seafood include defining working waterfront needs of the commercial fisheries sector and solutions for long-term sustainability, working with shellfish growers to implement proactive husbandry practices to improve product quality and efficient harvest practices, fostering involvement of blue crab fishermen in climate adaptation related fisheries management decisions through creation of the "Crabbers Who Care" Research Network, and matching researchers with industry partners to examine virulence and magnification of *Vibrio parahaemolyticus* in oysters. To foster research and communications, the S.C. Sea Grant Consortium has organized and hosted the International Conference on Shellfish Restoration (ICSR) since 1996 to promote dialogue between private and public sector shellfish restoration practitioners. The Consortium also fosters partnerships between the tourism and seafood sectors to diversify cash flow in the fisheries and aquaculture sectors and provide an authentic guest experience for tourists. These efforts currently include an examination of the feasibility of a S.C. Seafood Trail through facilitation of initial organizational and strategic planning meetings.

Working Waterfronts Discussion Group, McClellanville, S.C.

"I consider South Carolina Sea Grant Consortium agents an important asset for my understanding of issues and interaction with many partners (local and state government agencies, educational resources and industry members) important to the success of my business, industry and the general public…Thank you, South Carolina Sea Grant" – Jerry Gault, Owner, Gault Seafood, Commercial Fisherman and Seafood Wholesaler, Beaufort, SC

"She [a student] had a transformative time at the conference (ICSR) and is attending SUNY Cobleskill in the fall to major in Aquaculture" – Peter Malinowski, Teacher and Aquaculture Program Director, Billion Oyster Project and New York Harbor School, New York City, NY

"Thank you for all your hard work and effort to bring great presentations to us. We learned so much" – Vonne Knight, Director of Ag Literacy Programs, Women of Farm Bureau Leadership Conference, S.C. Farm Bureau, Columbia

"In an era where globalization has dramatically impacted both fisheries and the fishing industry worldwide, partnering with the…Consortium on research projects has provided the opportunity for faculty, staff and graduate students to examine important coastal zone issues associated with recreation and tourism in S.C. We feel this collaboration has been fruitful to Clemson doctoral students, S.C. Sea Grant's coastal stakeholders, and the citizens of South Carolina. We look forward to future collaborations" – Bill Norman, Ph.D., Professor and Laurie Jodice, Ph.D., Research Associate, Department of Parks, Recreation and Tourism, Clemson University

PIER PRP Program Focus Area Report

South Carolina Sea Grant Consortium

Safe and Sustainable Seafood Supply

Program Focus Area: SUSTAINABLE FISHERIES AND AQUACULTURE

Program Goals

1. A sustainable supply of seafood that meets public demand at competitive prices.
2. A healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and efficiently.

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Impacts and Accomplishments toward Program Goals

1. **Program Goal: A sustainable supply of seafood that meets public demand at competitive prices.**
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   - 20951 - Consortium assists oyster industry with response to seed transport restrictions
   - 14110 - S.C. Sea Grant Extension and Partners Foster Improvements in Shellfish Aquaculture Production

   Accomplishment(s)
   - 21292 - Innovative Consortium Research Highlights Role of Gene Groups in Egg Quality and Embryo Development
   - 17721 - Policy Implications from Comparative Research on the Survival and Growth of Diploid and Triploid Single Eastern Oysters in South Carolina
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   - 15716 - First Evaluation of Genetically-Produced (â€œNaturally Matedâ€) Triploid Eastern Oysters (Crassostrea virginica) in Coastal Waters of South Carolina is Completed
   - 15715 - Value of Triploid Oysters Grown in South Carolina Demonstrated as a Commercial Product
   - 15713 - Trade Adjustment Assistance Training Benefits South Carolina Shrimp Fishermen

2. **Program Goal: A healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and efficiently.**
   Impact(s)
   - 20951 - Consortium assists oyster industry with response to seed transport restrictions
   - 16042 - S.C. Sea Grant Consortium Fostered Development of the Governors' South Atlantic Alliance

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   - 21281 - Consortium-Supported Research Indicates Interest in Establishment of a Cooperative SC Seafood Trail
   - 17739 - Novel Genetic Sequencing Pipeline Streamlines Efforts
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Full Text of Impacts and Accomplishments

21292 - Innovative Consortium Research Highlights Role of Gene Groups in Egg Quality and Embryo Development

RELEVANCE: The inability of eggs to produce viable embryos is considered a major limiting factor for development of global finfish aquaculture, and has remained intractable and of unknown cause(s) despite decades of attention by researchers around the world. Recent research has strongly implicated dysfunction of ovarian gene expression as a root cause of the problem. Patterns of ovarian gene expression associated with high and low egg quality could identify the specific physiological functions that are impaired and point the way toward changes in husbandry practices that can optimize egg quality.

RESPONSE: S.C. Sea Grant researchers at S.C. DNR, in a joint project with scientists at North Carolina Sea Grant, sought to discover patterns of ovarian gene expression associated with high and low egg quality in striped bass, a finfish used in aquaculture that has problems with arrested development in eggs, which identified specific physiological functions that were impaired, and lead to changes in husbandry practices that can optimize egg quality. Further, the Sea Grant researchers attempted to extend the analysis to wild caught individuals and evaluate the capacity of gene expression profiling as a tool for assessing the egg quality among age cohorts.

RESULTS: Results demonstrate that interactions among a small group of genes influence egg quality and viability, a key component of reproductive fitness in all vertebrates, including humans. These findings may help aquaculturists select fish that have the highest probability of producing large numbers of viable eggs. Additionally, fisheries managers may be able to better evaluate what percentage of females in the wild population is going to produce viable eggs and subsequently modify management strategies.

RECAP: S.C. Sea Grant research indicates that a small group of genes influence egg quality in target fisheries species, and therefore embryo development. Gene expression can accurately predict fertility in striped bass, which could lead to development of diagnostic kits for use in hatchery operations This has the potential to help aquaculturists select fish with the highest likelihood of producing viable eggs, with potential major impacts on finfish aquaculture worldwide. Back to Goals

21281 - Consortium-Supported Research Indicates Interest in Establishment of a Cooperative SC Seafood Trail

RELEVANCE: South Carolina offers unique experiences related to seafood harvest and production, maritime history and culture of fishing, marine fisheries ecology, and seafood culinary interests. South Carolina's coastal tourists are supportive of sustainability initiatives for local marine-resource dependent businesses. A seafood-themed drive trail could be an incubator for entrepreneurship and create more opportunities for marketing local seafood products through a unified brand image. While other theme-based trails exist in the region, there has been no assessment of the potential for a South Carolina seafood trail and related capacity for this type of business incubator.

RESPONSE: S.C. Sea Grant researchers from Clemson University conducted interviews in the Berkeley and Charleston county region to determine interest in and feasability of a seafood trail. Information on 106 businesses from a variety of sectors (including, but not limited to, ecotourism operators, seafood harvesters, festivals, museums/aquariums, and restaurants) was collected for preparation of a visualization tool to elucidate related activity clusters that may be suitable for inclusion in a South Carolina Seafood Trail.

RESULTS: Online surveys of these participants were performed, with a response rate of 20%. Critical issues facing the development and maintenance of a South Carolina Seafood Trail were leadership, funding, and membership criteria. Given the low survey response rate, a single workshop, as opposed to the initially proposed three, was scheduled to focus on developing a strategic plan for a South Carolina Seafood Trail.

RECAP: S.C. Sea Grant-funded research at Clemson University indicates broad stakeholder support for the establishment of a cooperative seafood tourism trail throughout coastal South Carolina, as long as use of local seafood and stakeholder-based leadership are ensured; the forthcoming workshop will address barriers and opportunities for moving forward to establish the trail. Back to Goals

21279 - Consortium Research Develops A Novel Tool to Enhance Fishery Management of Commercially-Important Finfish Species

RELEVANCE: Indices of fish egg production are essential for understanding recruitment and developing stock assessment models for species management. Traditional methods of enumerating and identifying planktonic fish eggs entail time-consuming microscopy. Furthermore, eggs of different species are often morphologically indistinguishable, leading to erroneous population assessments that can adversely affect management decisions.

RESPONSE: S.C. Sea Grant researchers at the University of South Carolina and the S.C. DNR-Marine Resources Research Institute proposed to address this problem by seeking to develop and validate a

rapid, cost-efficient, and novel molecular tool, sandwich hybridization assay (SHA), which facilitates species-specific fish egg identification and quantification; the economically important species, red drum was used as the target organism. During the effort to design the species-specific egg identification tool, specific rRNA regions of interest from the target species and eight closely related species were compared.

RESULTS: Researchers discovered that there was little interspecific genetic difference between the fish, so a species-specific capture probe could not be developed from that particular rRNA region. To overcome this, a more versatile genome was sequenced, and this revealed several regions that were distinct and therefore promising candidates for probe design. Additionally, researchers designed both new capture and signal probes for the sequenced genome region. Tissue and egg samples from fish species common to coastal SC waters were tested to confirm that the SHA is species-specific, which it was. IN addition, plankton tows confirmed that the probe only produces a positive signal during times when red drum eggs are present. A workshop was held in conjunction with the Southern Division of the American Fisheries Society meeting in 2014 to detail the assay itself, applications to fisheries, protocols for sampling and processing, and allow the participants to work through the process.

RECAP: S.C. Sea Grant-sponsored research at University of South Carolina and the S.C. DNR-MRRI led to development of a novel, cost-, and time-efficient genetic tool that will enable fishery scientists to rapidly quantify planktonic fish eggs of a given species. This tool is being transferred to the private sector for commercial production to enhance fishery management, and several end-users (fish and water quality researchers/managers) have already expressed interest in incorporating this tool within their programs. Back to Goals

20951 - Consortium assists oyster industry with response to seed transport restrictions
Relevance: Currently, nine growers are producing high value single oysters using off-bottom methods in South Carolina. Until recently, these growers relied on 2mm seed produced in Virginia hatcheries and imported into South Carolina for nursery and grow out. On April 1, 2014 the state of South Carolina placed a moratorium on import of oyster seed from all points north of South Carolina due to concern over disease transfer.

Response: The South Carolina Sea Grant Consortium's Living Marine Resources Extension Specialist worked with regulators to identify Southern United States hatcheries that could meet the state's zero tolerance policy on disease by providing eyed larvae for remote set in South Carolina. Two SC shellfish nurseries were permitted to import eyed larvae and the Consortium provided technical expertise on system set-up and skills needed for successful remote setting of eyed larvae for single oyster production.

Results: A total of 18 million eyed larvae were imported and introduced to set on microcultch, resulting in production of more than 3 million single oysters and seed sales exceeding $60,000. Setting techniques and shipping and disease testing coordination were honed at both Lady's Island Oysters and Island Fresh Seafood. The Consortium's efforts resulted in all established grower's seed needs being met. In addition, three new growers began production. Subsequent to these efforts, an industry member, SCDNR shellfish management, and the Consortium were invited to an East Coast Molluscan Shellfish Health Management workshop and continue to provide advisory services to the group as a whole.

RECAP: The South Carolina Sea Grant Consortium assists the oyster industry with overcoming a crisis in seed import restrictions resulting in all new and established grower's seed needs being met and resulting in state seed sales in excess of 3 million single oysters and $60,000 for the 2014 season.
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17739 - Novel Genetic Sequencing Pipeline Streamlines Efforts
RELEVANCE: The development of Next Generation Sequencing (NGS) has presented biologists with a vast new potential to examine the entire genome of non-model organisms with the goal of understanding adaptation and evolution of organisms. These tools are currently being applied to address such issues as reproductive failure in striped bass and will soon be replacing microarrays as the standard method of gene expression profiling. In addition, these data can be used to develop single nucleotide polymorphism panels, which are becoming the next generation of tools for studies in population genetics and evolution.

RESPONSE: While the potential to interrogate the genome in such depth and in non-model species for which little or no genomics information is available, the massive amounts of data and the short read lengths create problems for individual investigators, including basic storage and transfer of large quantities of data.

RESULTS: Sea Grant researchers successfully combined the strengths of the scientific workflow project, Galaxy, with traditional high performance computing resources and affordable cloud-based data storage that encourages collaboration. As a result, a NGS pipeline has been deployed. The system facilitates broad-based collaboration and distribution by building around the Google Drive cloud storage solution, where the processing of RNA sequences can be both shared and analyzed with a single upload and be reused for multiple purposes.

RECAP: RECAP: S.C. Sea Grant researchers at the College of Charleston have developed a streamlined

genetic analysis pipeline, allowing broader collaboration and distribution of large quantities of genomics data among current and potential investigators. Back to Goals

17729 - Novel Analytical Approaches Being Used to Develop Telomere-Based Aging Tools for Long-Lived Marine Fishes

RELEVANCE: Accurate monitoring of fish populations and proper management of fisheries is of utmost importance to fisheries managers as increased fishing pressure and human perturbation of habitats can cause fish populations to decline. Evaluation of fish population health is generally provided by periodic model-based stock assessments, of which age structure is one critical population parameter. Management of many long-lived marine fishes lack critical age structure parameters for all or a portion of their life stages and, therefore, future assessments and management will substantially benefit from the inclusion of information generated from a non-lethal, telomere-based aging tool.

RESPONSE: In light of recent publications indicating the failure of telomere-based aging tools for natural populations, and the likely high noise that was driving these conclusions, Sea Grant researchers conducted several experiments to maximize noise reduction in the estimation of telomere length from red drum and cobia field samples. They optimized protocols to overcome restriction digestion inhibition and to ensure repeatability of telomere length estimation. In addition, an evaluation of preservative and DNA isolation protocols was completed as they both result in some degree of DNA shearing and little is known about the influence of these factors on either the overall degree of impact or pattern of impact throughout the genome.

RESULTS: The researchers' comparison of telomere distribution among preservative/isolation protocols suggests similar distributions following isolation as well as after restriction digestion. No differences were observed in average telomere length based on preservative or isolation protocols, and these protocols were sampling approximately the same number of telomeres within each sample. Sea Grant researchers have made substantial progress in the development of the red drum standard curve for telomere-based aging. The resulting increased understanding of telomere loss patterns in natural populations has allowed researchers to test two novel analytical approaches for the development of telomere-based aging tools.

RECAP: Though researchers were unsuccessful in developing a telomere-based non-lethal tool for estimating age in these recreational fishes, substantial improvements in telomere laboratory techniques and data analysis have allowed application of these methodologies to the endangered Atlantic sturgeon. Initial results indicate that telomere shortening mechanisms may differ between teleost and non-teleost fishes. Back to Goals

17721 - Policy Implications from Comparative Research on the Survival and Growth of Diploid and Triploid Single Eastern Oysters in South Carolina

Relevance: Populations of the Eastern oyster, Crassostrea virginica, have declined along much of the mid-Atlantic coast of the US during the last century due to factors such as over-harvesting and habitat degradation. Despite this, South Carolina estuaries continue to provide excellent growing conditions for native oysters. Considerable economic potential exists for the production of locally-derived single oysters raised from hatchery seed. Maximizing this economic potential requires the optimization of grow-out techniques and the evaluation of potential merits of the use of triploids compared to diploids.

Response: The goal of this Sea Grant-funded project was to evaluate the performance of triploid Eastern oysters, which are thought to be advantageous in aquaculture due to their sterility, improved meat quality, and in many cases superior growth, as a candidate species for single oyster aquaculture in South Carolina.

Results: This project highlighted the need to re-visit the SCDNR policy which governs indigenous shellfish importation. Specifically, this recent research presented opportunities to consider scenarios not previously envisaged when the original policy document was written, at a time when importations were primarily associated with the movement of hard clam (Mercenaria spp.) seed and brood stock. Such variances from the original policy document included the use of polyploid animals, importations of eyed larvae and small seed (as opposed to the movement of brood stock animals), the efficacy of the hatchery certification process, advances in disease diagnostic techniques, discussions surrounding the need for an updated outlook on shellfish disease management at a regional scale, and the need to consider genetics as well as disease and hitch-hikers in terms of potential risks to South Carolina oyster populations from indigenous shellfish importations. A new demand for triploid oysters in South Carolina has resulted from this project. Two commercial shellfish growers involved in this project applied for applications to import their own triploid oysters for commercial grow-out in February 2013 and it is likely that in the future more commercial growers will want to import more triploid oysters due to their now proven high growth rates in South Carolina waters.

RECAP: Research on the survival and growth of diploid and triploid single Eastern Oysters in South Carolina is shedding new light on the state's existing policies regarding indigenous shellfish importations. Back to Goals

17616 - Managing Reproductive Behavior in Fisheries and on Fish Farms

RELEVANCE: Persistently poor egg quality is a major problem in finfish aquaculture and has remained intractable and of unknown cause(s) despite decades of attention by researchers around the world.

Recent research has strongly implicated dysfunction of ovarian gene expression as a root cause of the problem. Researchers hope to discover patterns of ovarian gene expression associated with high and low egg quality in striped bass which will identify the specific physiological functions that are impaired and point the way toward changes in husbandry practices that can optimize egg quality. In addition, they will extend the analysis to wild caught individuals and evaluate the capacity of gene expression profiling as a tool for assessing the egg quality.

RESPONSE: During the spring of 2012, researchers induced both domesticated and wild striped bass from the Roanoke River in N.C. to complete maturation and ovulation for hatchery evaluations of egg quality (fertility, embryo and larval development, etc.). The fish were subjected to ovarian biopsy prior to the experiment and a sample of their eggs was collected at spawning and subsequently preserved. In fall 2012, researchers collected biopsies from the vetted samples from the spring spawning activity to assess the subsequent development and maturation as required by the grant objectives.

RESULTS: Patterns of gene expression are being identified in order to detect "fingerprints" of gene expression genes that can predict egg quality and potential reproductive fitness of wild and farmed striped bass.
RECAP: The research is expected to result in a gene expression profiling tool to enhance the efficient production of hybrids for grow-out facilities and to inform fisheries management policies. Back to Goals

16042 - S.C. Sea Grant Consortium Fostered Development of the Governors' South Atlantic Alliance
RELEVANCE: Florida, Georgia, South Carolina and North Carolina share an extraordinarily rich array of ocean and coastal resources that provide enormous economic, environmental and social benefits for each state. These resources are increasingly in demand by a variety of users as the nation attempts to become more self-sufficient with the resources it consumes, e.g., fisheries, aquaculture, traditional and alternative energy, mineral resources, sand resources for nourishment, ports and navigation, etc. At the same time, these additional pressures can impact the very resources we wish to utilize, and can result in declining fishery resources, degraded coastal habitats, increased pollution, vulnerability to coastal hazards, multiple use conflicts, user "rights" issues, and threats to security and military operations, among other concerns. The connectivity of ocean resources and invisible political boundary lines require that states act to manage and maintain these resources within a regional framework that includes consideration for short-term (e.g., tsunamis; demographics) and long-term (e.g., sea level; temperature and ecosystem shifts) changes in the earth (and ocean) system.

RESPONSE: The Governor's South Atlantic Alliance (GSAA) was formally established by the Governors of FL, GS. S.C., and N.C. on October 19, 2009, with the mission of increasing regional collaboration among South Atlantic states, with federal agency partners and other stakeholders, and sustaining and enhancing the environmental (coastal/marine), natural resource, economic, public safety, social, and national defense missions of the respective states and the South Atlantic region. It serves as a conduit for collectively finding, acting on, and regionally implementing science-based actions to sustain coastal and ocean ecosystems. The S.C. Sea Grant Consortium is actively involved with the Governors' South Atlantic Alliance; the Consortium Executive Director (DeVoe) is a member of the GSAA Executive Planning Team's Leadership Group which is directing regional alliance activities on behalf of the alliance.

RESULTS: In Fall 2010, the Consortium was selected by the GSAA to temporarily serve as its administrative and fiscal agent, and the Consortium developed, maintains, and hosts the GSAA's Web site. In December 2010, the Consortium submitted, on behalf of the GSAA, two proposals to NOAA in response to its FFO for regional ocean partnership and coastal and ocean planning development, totalling over two years about $557,000 for alliance development and $3,099,000 for coastal and ocean planning related activities. In January 2012, the Consortium and the GSAA were informed by NOAA that one-year cooperative agreements of $270,000 for alliance development and $784,000 for coastal and ocean planning efforts were being awarded. The GSAA was one of only three regional partnerships in the nation to receive FY11 funding for coastal and ocean planning.

RECAP: Consortium engagement with the Governors' South Atlantic Alliance Executive Planning Team led to the agency being selected as fiscal administrator for GSAA and the receipt of over $1.3 miilion in competitive grant funding for GSAA programming and management. Back to Goals

15716 - First Evaluation of Genetically-Produced ("Naturally Mated") Triploid Eastern Oysters (Crassostrea virginica) in Coastal Waters of South Carolina is Completed
Triploid Eastern oysters (Crassostrea virginica), which possess an extra set of chromosomes, have been shown in other states to have superior growth performance compared to fertile, diploid oysters that have two sets of chromosomes in their adult cells. This growth advantage is conferred through their sterility and consequent greater investment of energy in tissue growth rather than reproduction. This higher growth rate, in addition to a more year-round marketable product, is of particular value and interest to the shellfish aquaculture industry. Two methods exist for producing triploid oysters; a less favorable chemical method, and a more effective and advantageous genetic method, producing "naturally mated" triploids. The genetic production of triploid C. virginica, however, is patented, proprietary, and dependent upon tetraploid parents that are currently not maintained within South Carolina, therefore presenting a barrier to their production and application by the industry here. In a scientific collaboration among the South Carolina Department of Natural Resources, the Virginia

Institute of Marine Science, and 4Cs Breeding Technologies Inc., researchers facilitated the production of naturally mated triploid C. virginica in Virginia and subsequent nursery and open water field grow-out at industry sites across the South Carolina coast from Murrells Inlet to the May River. At each of the 6 industry study sites, oysters of three distinct lines (two diploid lines and the triploid line) were grown side-by-side until at least one of the lines reached a marketable size, at which time all three lines were sampled for a final time. While extensive analyses of growth rates both in terms of oyster shell height and tissue weight are ongoing, analyses conducted thus far have revealed that, over equivalent time periods, the triploid oysters reached a larger size (shell height) than at least one of the two diploid lines at all sites investigated, but that the patterns of differences between the three lines varied between sites, highlighting the importance of site effects. Anecdotal observations during the course of the study suggested that the triploid oysters were more "cupped" than the diploid lines, and additional data collection is ongoing to collect both shell depth data and tissue weight data that may reveal further growth advantages of the triploid line over the diploid lines. This study has been extremely valuable in providing several commercial shellfish growers with their first opportunity to grow and monitor triploid oysters on their leases and also to assist the industry in making decisions regarding the merits of future investment in triploid shellfish aquaculture.

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15715 - Value of Triploid Oysters Grown in South Carolina Demonstrated as a Commercial Product

Sea Grant researchers have been evaluating the performance of triploid (three sets of chromosomes) Eastern oysters (Crassostrea virginica), which are thought to be advantageous in shellfish aquaculture as compared with diploids due to their sterility, improved meat quality, and superior growth. Current research is attempting to maximize the economic potential of producing triploid oysters raised in hatcheries, which requires the optimization of grow-out techniques as well as evaluation of the value of triploid oysters in South Carolina waters. The research components and collaborations utilized in this project have created opportunities to provide South Carolina shellfish growers access to "naturally mated" (as opposed to chemically produced) triploid native oysters that they previously did not have access to due to an unfamiliarity with the patents and proprietary agreements. There is considerable interest in the application of triploid oysters in South Carolina based on their documented growth rates in other states, and now as a result of this project, in South Carolina waters. Many of the commercial growers involved with this project consider the triploid oysters to be a superior product to the local diploid oysters. For example, one of the commercial growers who sells his oysters at a local farmer's market recently commented that the triploid oysters "stole the show" when compared to the local diploid oysters. Commercial growers who have successfully grown these triploids, implementing responsible husbandry to raise a high quality seafood product, are now interested in procuring more triploid oysters for future marketing. This may involve the acquisition of tetraploid brood stock to allow South Carolina to produce triploids independently of reliance upon collaboration with a project in Virginia. Project researchers are working with industry members to facilitate these discussions.

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15713 - Trade Adjustment Assistance Training Benefits South Carolina Shrimp Fishermen

The US shrimp fishery has been severely impacted by the import of foreign, farm-raised shrimp through decreasing shrimp value and profit. The US Department of Agriculture Trade Adjustment Assistance (TAA) program offers technical training and cash benefits to farmers and shrimpers who have been adversely affected by competition from imports. Shrimp fishermen, spouses, and crew members who qualify for TAA must complete 12 hours of coursework and create a long-term business plan in order to receive up to $12,000 each in cash benefits. The S.C. Sea Grant Consortium, along with Sea Grant programs from NC to TX, developed and delivered training for the TAA program on topics related to financial and estate planning, fuel efficiency, shrimp marketing opportunities, and overall business management. In South Carolina, a total of 21 workshops were delivered to 147 shrimp fishermen, spouses, and crew members. One hundred percent of participants have developed short-term business plans and, to date, 85% of participants have developed a long-term business plan, which had to be completed by 2013. Training provided the participants with the ability to assess the viability of their current fishing operation and determine what course of action to take with regard to the future of their business. TAA participants utilized the long-term business plans to improve their fishing business, initiate an alternative fishing-related business, or transition out of the fishery. The USDA TAA program for shrimp fishermen, guided by technical training from the Consortium, enabled 147 S.C. fishermen to increase their understanding of sustainable business practices and develop future plans for their fishing business.

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15711 - Social Media Guide Developed to Deliver Outreach to Fishery Stakeholders

Social media has become the newest outreach tool for professionally communicating with stakeholders on a variety of topics, including fisheries management issues. There are many social media platforms that have been developed in the past five years (blogs, Facebook, Twitter, etc.), with each platform requiring a specific strategy for conveying information. Determining how to effectively use each platform to reach a specific audience or deliver a targeted message can be overwhelming for organizations and agencies that are unfamiliar with the functions and attributes of each of these specific platforms. In partnership with the South Atlantic Fishery Management Council (SAFMC), the S.C. Sea Grant Consortium hosted a two-day social media workshop that assisted 31 individuals from 10 regional agencies and organizations in developing a better understanding of commonly used social media platforms. The workshop delivered interactive presentations about Facebook, Twitter, YouTube,

blogs, mobile applications for Smartphones, e-Newsletters, and websites. Group discussion followed each presentation, and the workshop offered live demonstrations of social media platforms and panel discussions with speakers on lessons learned from current applications of social media. The workshop partners produced a "How-To-Guide for Using Social Media Tools" that included in-depth summaries of each social media platform and 'Lessons Learned' and 'Tools and Tips' for developing social media strategies for natural resource organizations. The guide is being shared with the National Sea Grant network programs, regional fishery management councils, and other natural resource agencies and organizations. The workshop may also help the SAFMC develop policies and strategies for implementing social media tools for their agency. Through agency partnership, 31 social media workshop participants increased their understanding of how to effectively use social media tools to develop effective outreach strategies.

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15708 - Sea Grant Research Demonstrates that Parasites are more Damaging to Fish Health than Previously Thought

Spotted sea trout are commonly infected by various species of parasites in South Carolina estuaries, in particular by the digenean Cardicola laruei (in the heart ventricle) and the newly discovered myxosporeans Kudoa inornata (in skeletal muscle) and Henneguya cynoscioni (in the bulbus arteriosus). Because of the damage these parasites cause to the tissues they infect, they should be considered potentially highly pathogenic. It was hypothesized that the parasites negatively affect fish health. To test this hypothesis, the researchers devised new methods of rigorously quantifying parasite burden for each of the three parasite species, using species-specific scoring systems based on histological counts. This was necessary because of the distinct nature of each species of parasite; especially since they are newly discovered (researchers described two of these species in only the past three years). The study has demonstrated that these parasites are, in fact, detrimental to the health of sea trout and, in particular to those in spawning condition. These new quantification methods will allow additional researchers and other stakeholders in the industry to quantitatively monitor infections in the long-term, and compare infection levels between and among areas of geographic concern.

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15702 - Novel Analytical Approaches Used to Develop Non-lethal Telomere-Based Aging Tools for Long-Lived Marine Fishes

Accurate monitoring of fish populations and proper management of fisheries is of utmost importance to fisheries managers as increased fishing pressure and human perturbation of habitats can cause fish populations to decline. Evaluation of fish population health is generally provided by periodic model-based stock assessments, of which age structure is one critical population parameter. Management of many long-lived marine fishes lack critical age structure parameters for all or a portion of their life stages and therefore, future assessments and management will substantially benefit from the inclusion of information generated from a non-lethal, telomere-based aging tool. In light of recent publications indicating the failure of telomere-based aging tools for natural populations, and the likely high noise that was driving these conclusions, Sea Grant researchers conducted several experiments to maximize noise reduction in the estimation of telomere length from field samples. They optimized protocols to overcome restriction digestion inhibition and to ensure repeatability of telomere length estimation. In addition, an evaluation of preservative and DNA isolation protocols was completed as they both result in some degree of DNA shearing and little is known about the influence of these factors on either the overall degree of impact or pattern of impact throughout the genome. The researchers' comparison of telomere distribution among preservative/isolation protocols suggests similar distributions following isolation as well as after restriction digestion. No differences were observed in average telomere length based on preservative or isolation protocols, and these protocols were sampling approximately the same number of telomeres within each sample. Sea Grant researchers have made substantial progress in the development of the red drum standard curve for telomere-based aging. The resulting increased understanding of telomere loss patterns in natural populations has allowed researchers to develop two novel analytical approaches for the development of telomere-based aging tools, which are currently undergoing testing and evaluation.

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15683 - Modeling Drought and the Decline of Blue Crabs in South Carolina

In an ongoing effort to determine why blue crab landings decline with increasing salinity, Sea Grant researchers at Clemson University undertook quarterly censuses of blue crabs at 27 stations in the ACE Basin NERR and conducted an additional experiment to estimate crab growth, survival, and postlarval settlement. This was included in the work completed on a blue crab forecasting model for the ACE Basin NERR. This spatially-explicit individual-based model of blue crabs uses historical or projected river discharge (flow) estimates to reproduce the spatial, seasonal and annual variation in salinity. Both laboratory and field data on the impacts of salinity on crab settlement, growth, movement, disease transmission, predation, fishing effort, and natural mortality have been incorporated. The model is ready for use by fisheries managers that wish to forecast blue crab populations under various scenarios involving changes in freshwater flow, fishing effort, or both. A brief paper was published on the results of a modeling exercise using the SCBCRABS model to compare alternative management strategies to changes in future river discharge. A companion paper will be submitted this year presenting the results of our 75-year hindcast/forecast model for crabs of the ACE Basin. The simulation model predicts that crab abundance peaks at intermediate flow rates but then declines rapidly with further reductions of freshwater flow, and that increasing disease is the most important driver linking salinity to crab density.

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14152 - MarketMaker TM Recognized with Two Awards

South Carolina MarketMaker TM, an interactive web-based tool that contains a searchable database connecting consumers of South Carolina products with suppliers, recently won a 2010 Partnership Award for Multistate Efforts from the U.S. Department of Agriculture's (USDA) National Institute of Food and Agriculture. The award recognizes outstanding contributions in support of the USDA mission, and positive impacts on advancing science, education, and extension. South Carolina MarketMaker TM also won the 2011 National Food MarketMaker TM Innovation Award from Farm Credit for developing a South Carolina seafood component that was later expanded nationally to include several new states offering seafood products to consumers through MarketMaker TM. S.C. Sea Grant Extension fisheries specialist was instrumental in expanding the portal to include South Carolina seafood products, including local shrimp. Developed by the University of Illinois, MarketMaker TM is supported by the National Institute of Food and Agriculture, the Ag Marketing Resource Center, the Applied Sustainability Center, and 16 state partners. To view participating states and product offerings, visit http://national.marketmaker.uiuc.edu/. The South Carolina MarketMaker TM website is http://sc.marketmaker.uiuc.edu.

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14113 - Developing Community-based Fishery Ventures for the Commercial Fishing Industry

Federal fishery management regulations in the snapper grouper fishery have caused significant changes to the quantity and species of fish that can be harvested by commercial fishermen. Traditional market systems used by fishermen consist of fishermen landing their catch and selling their product to wholesale buyers at prices significantly lower than retail prices. This price difference results in low profits to the fishermen and higher profit margins for the middleman or distributors. Introducing local direct marketing approaches to South Carolina fishermen enables them to change the well established supply chain process by bypassing the middleman and selling directly to the consumer. The program assisted a snapper grouper fisherman, Abundant Seafood, in developing a plan and implementing the state's first Community Supported Fishery venture. The business pre-sells shares of their catch to now over 100 local citizens and is receiving an increase in price/value of approximately $10/pound more over wholesale price. This innovative business model is being considered by other commercial fishermen in the state, and the Community Supported Fishery concept is being incorporated into the S.C. Sea Grant Fisheries Extension technical training on marketing opportunities for commercial fishermen.

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14110 - S.C. Sea Grant Extension and Partners Foster Improvements in Shellfish Aquaculture Production

Relevance: Shellfish aquaculture in South Carolina has experienced a number of attempts at development in the last quarter century, from large-scale corporate entities to successful small farm development and conversion or diversification of commercial fishing into aquaculture. Aquaculture is one of the most regulated forms of food production, and shellfish aquaculture, with its associated public health concerns, may be the most regulated industries. This makes it very difficult for small, and in many cases limited resource, individuals and businesses to enter the industry and maintain viability.

Response: The S.C. Sea Grant Aquaculture Extension Specialist, through a series of industry workshops, annual meetings of the recently established S.C. Shellfish Growers Association, and close interaction between the Specialist and regulatory agency personnel from the S.C. Department of Health and Environmental Control and S.C. Department of Natural Resources, has been able to streamline the permitting process to enter the industry. Prospective culturists can also take advantage of information being generated from a Fisheries Development Grant Program that links fishermen, farmers, and researchers on further development of a small single oyster industry.

Result: The South Carolina shellfish aquaculture industry, over the last five years, has grown to be the largest aquaculture industry in the state, with three hatcheries, one of which is one of the largest on the Atlantic coast, and 54 shellfish aquaculture permits covering 1,512 acres along the coast. Five new mariculture permit areas for oyster aquaculture production have been developed in the last three years, and five commercial fishermen have diversified into aquaculture. The farmgate value of shellfish aquaculture (seed, large seed and harvested product) has more than doubled in five years to exceed $4,000,000.

RECAP: After many iterations of development the South Carolina shellfish industry has entered a sustainable development period. The regulatory process has been streamlined and developmental funds were established to stimulate the industrys development. South Carolina Sea Grant Extension, working with the SCDHEC, SCDNR and interested farmers and fishermen have utilized a multifaceted program to develop and sustain a South Carolina shellfish industry based on small farmers, diversified fishermen/farmers and diversified traditional seafood docks.

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Program Performance Measures (2010 - 2013)

Program Performance Measure	Program Plan Target (2010-2013)	Reported	Program Comments
Aquaculture and fishery businesses which received and used technical assistance from SC Sea Grant extension, e.g., energy efficient fuels/gear.	25	64	2012 - SC shellfish harvesters receiving technical information 2013 - technical advice on oyster and clam mariculture, shedding systems for crab, tourism/aquaculture partnerships
Change in industries/jobs created/retained/derived from the discovery and/or application of new fishery production and management models or techniques that lead to increased sustainability and productivity from the fishery.	0	197	2012 - Trade Adjustment Assistance (TAA)trainings 2013 - shellfish jobs created/retained TAA ceased in May
Commercial and recreational fishermen reached through SCSGC research and outreach programs, e.g., leadership and business training.	100	441	2012 - Seafood summit and various smaller meetings
Competitively awarded research studies on sustainable fisheries and aquaculture.	6	13	2011 - Core Sea Grant projects only 2012 - Omnibus, Sea Grant, and leveraged funding 2013 - Omnibus
Creation of new and enhancing the effectiveness of existing industry partnerships to enable industry participation in the regulatory process.	3	15	2012 - 1 new partnership, 3 enhanced 2013 - ECSGA and ECSGA Vibrio working group and Endosafe horseshoe crab partnership, Beaufort County educational resource on fisheries and mariculture, SCSGA, and Seafood Alliance
Number of fishermen, resource managers and seafood businesses who adopt and implement responsible harvesting and processing techniques and practices.	200	165	2012 - Seafood summit and various smaller meetings
Scientific, technical, and educational products produced by SCSGC related to safe and sustainable seafood.	20	32	2012 - East Coast Shellfish Growers Association publication distributed to all SC-licensed commercial shellfish harvesters Triploid Native Oysters Communications tools 2013 - Stone et al Triploid Native Oysters Walton et al ploidy by gear and vibrio abundances, ECSGA pubs (3), horseshoe crab pub., SRAC oyster farming pub fish egg species ID tool (Greenfield), Genetic tool to identify hatchery-raised blue crabs for stock enhancement purposes (Darden) Seasonal prevalence of hematodinium sp. Infections of blue crabs in three South Carolina (USA) rivers - Parmenter et al. 2013

			(Estuaries and Coasts 36:174-191) Development of nursery systems for black sea bass Centropristis striata The effects of temperature and salinity on early life stages of black sea bass Centropristis striata Short-term shell pile quarantine reduces the abundance of Perkinsus marinus remaining in tissues attached to oyster shell Invasive swimbladder parasite Anguillicoloides crassus: infection status 15 years after discovery in wild population of American eel Anguilla rostrata (article in JCR) CH Fall 2013: Red Lionfish: A "Super-Invader" for Supper? CS@W June 2013 CS@W December 2013
Seafood producers, retailers, and consumers educated about and adopted local, direct sales techniques to enhance market competitiveness.	50	61	2012 - TAA trainings
Shellfish aquaculture producers increase the value of production e.g., clams.	10	24	2011 - will conduct analysis after 4 years 2012 - This represents a percentage of producers, not a finite number Island Fresh Seafood 2013 - 10% increase in value of shellfish aquaculture industry (increase value due to off-bottom production methods for growing single oysters)

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Program Objectives (2010 - 2013)

Program Objective	Achieved (yes/no)	Program Comments
The South Carolina Sea Grant Consortium has changed their objectives to performance measures to more closely align with their tracking methods. The National Sea Grant College Program Director has approved this change.	Yes	2010 - N/A