SUSTAINABLE FISHERIES AND AQUACULTURE

IMPACTS

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

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

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

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

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

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

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

Imani Black, Minorities in Aquaculture
Sarah Pedigo and Matthew Gorstein, S.C. Sea Grant Consortium

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

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

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

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

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

ACCOMPLISHMENTS

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

Matt Gorstein, S.C. Sea Grant Consortium
Marilyn Hemingway, Gullah Geechee Chamber of Commerce
Jannie Harriot and Dawn Dawson-House, WeGOJA Foundation
Queen Quet, Gullah Geechee Sea Islands Coalition and Gullah Geechee Fishing Association
Alli Crandell, Coastal Carolina University

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

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

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

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

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

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

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

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

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

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

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

PARTNERS: Clemson University

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

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

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

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

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

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

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

PARTNERS: Clemson University

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

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

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

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

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

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

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

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

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

Bryan Fluech, UGA Marine Extension and Georgia Sea Grant
Angela Collins, Florida Sea Grant

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

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

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

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

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

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

Graham Gaines, Matthew Gorstein, and Jocelyn Juliano, S.C. Sea Grant Consortium
Amy MacKown, S.C. Seafood Alliance
Kathryn Rowe, College of Charleston

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

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

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

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

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

PARTNERS: S.C. Seafood Alliance

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

Robert Dunn, North Inlet-Winyah Bay NERR and University of South Carolina
Maeve Snyder, North Inlet-Winyah Bay NERR and University of South Carolina
Joshua Stone, University of South Carolina
Jocelyn Juliano, S.C. Sea Grant Consortium
Bryan Fluech, UGA Marine Extension and Georgia Sea Grant

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

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

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

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

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

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

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

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

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

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

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

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

Zhenlong Li and Cuizhen Wang, University of South Carolina
Sarah Pedigo and Matthew Gorstein, S.C. Sea Grant Consortium
Caitlyn Bierce, College of Charleston

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Sarah Pedigo, S.C. Sea Grant Consortium

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

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

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

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

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

Sarah Pedigo, S.C. Sea Grant Consortium

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

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

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

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

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

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

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

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

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

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

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

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

Aaron Watson, S.C. Department of Natural Resources
Fabio Casu, National Institute of Standards and Technology
Michael Denson, NOAA/NCCOS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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