



2018-2019 IMPACTS AND ACCOMPLISHMENTS

SUSTAINABLE FISHERIES AND AQUACULTURE

IMPACTS

S.C. Sea Grant Consortium Partnership Puts South Carolina Triploid Oyster Seed in the Hands of Oyster Growers Throughout the South Atlantic Region for the First Time

Susan Lovelace and Julie Davis, S.C. Sea Grant Consortium

Recap: S.C. Sea Grant Consortium (Consortium) technology transfer efforts have resulted in the propagation of South Carolina-based seed stock to supply the rapidly emerging oyster-farming industry in South Carolina and throughout the South Atlantic region. During this report period the S.C. broodstock provides a potential value (to the farmer) at harvest of \$1.8 million and restaurant retail value of \$6 million.

Relevance: In April of 2014, amid concerns over disease transfer, the state of South Carolina introduced a moratorium on importing oyster seed, which meant growers had to seek out new seed sources and develop the capacity to produce seed within South Carolina if the industry was to continue to grow. Shortly following the moratorium, a grower expressed interest in expanding nursery production and building a hatchery to meet their company's needs for seed as well as the needs of all South Carolina growers. The program set out to build an industry that is resilient to environmental and regulatory changes by providing a reliable, in-state source of oyster seed. The demand for triploid seed in 2018 held steady with 2017 demand. Demand is for triploids because of the passage of legislation allowing for harvest of maricultured oysters during the summer. The legislation mandated only triploids can be harvested from June 1 through October 1.

Response: The Consortium provided continued technical expertise on hatchery and nursery system design and standard operating procedures to allow the facility to optimize production. Beginning in 2014, the Consortium, in partnership with industry, launched a broodstock program with the goal of producing triploid oyster seed using only South Carolina broodstock. The program also aims to continually develop a diverse line of broodstock to meet the industry's needs into the future.

Results: In 2018, as a result of Consortium efforts, the seed orders for nine South Carolina oyster farms were filled with triploid seed produced in-state using only South Carolina broodstock. Growers in Florida were also able to procure seed from South Carolina. Over 3 million seed were sold, which represents a conservative average market value to the harvester of \$1.8 million and nearly \$6 million in restaurant retail value. With these oysters being of local parentage, growers have reported excellent performance, with fast-growing oysters reaching harvest size in 10 months. In addition to supporting commercial triploid production, tetraploid broodstock development continued in 2018 to help ensure a continued source of triploid oysters. Only triploid oysters are allowed, by law, for harvest during the summer months.

ACCOMPLISHMENTS

Consortium Facilitates Cohesive Aquaculture Communications Through Participation in Seafood for the Future Video Series and Panel Discussions

Julie Davis, S.C. Sea Grant Consortium

Following NOAA's Ocean Week Aquaculture Panel in Washington, D.C., the S.C. Sea Grant Consortium (Consortium) Living Marine Resources Specialist was approached about participating in a video series to tell the stories of our country's aquaculture producers. The goal of the video series was to humanize seafood production by interfacing growers, scientists, and chefs in a relatable and approachable fashion. South Carolina was selected to highlight oyster farming by telling the story of the partnership between the Consortium and Lady's Island Oyster to develop South Carolina triploid broodstock.

Video filming and interviews took place in April 2018, and the series was launched at a moderated panel discussion attended by 90 members of the public at the Aquarium of the Pacific. At a meeting prior to the launch, several aquaculture stakeholders spent 1.5 days developing a plan for cohesiveness in aquaculture communications. This effort was funded by the National Sea Grant College Program.

Consortium Leads Effort to Improve Production of Off-bottom Farmed Oysters by Examining Fouling Control Techniques Using Floating Cages Reaches Harvest

Julie Davis, S.C. Sea Grant Consortium

An effort lead by the S.C. Sea Grant Consortium (Consortium) to examine biofouling control routines in the South got started in 2017. With funding provided by the U.S. Department of Agriculture Southern Regional Aquaculture Center, the Consortium's Living Marine Resources

Specialist coordinated the project team to ensure quarterly sampling was conducted in a timely manner.

In cooperation with industry partners in seven Southern states, experimental treatments were applied (flipping of cages weekly, biweekly, every three weeks) and oysters monitored quarterly with sampling coordinated by graduate students. The oysters were harvested in June 2018. Additional sampling occurred in the South Atlantic states in September 2018 to capture degree of biofouling one-year post deployment. Samples collected as part of the project were processed in 2018, and the results will be analyzed and presented in 2019.

Outreach efforts as part of this project include production of two videos. Initial interviews, recording, and editing for these projects took place in 2018.

S.C. Sea Grant Consortium Scientists Explore Social Carrying Capacity of Expanding Oyster Mariculture Along the Coast

William Norman, Lauren Duffy, Jeffrey Hallo, and Laura Jodice, Clemson University

As a result of the promotion of local seafood and growing familiarity with shellfish products such as oysters and clams, the demand and willingness to pay a higher price for farmed shellfish has increased, especially in coastal tourism destinations on the South Carolina coast. Recent research suggests S.C. residents and tourists are broadly supportive of existing mariculture, but there is little understanding of support for expansion of oyster mariculture, which will include highly visible infrastructure.

S.C. Sea Grant researchers based at Clemson University are examining social carrying capacity among residents and waterway users who will be most directly impacted by expansion. They hope to assist shellfish management agencies, municipalities, and growers in identifying areas of probable conflict and opposition to oyster mariculture development, and determining acceptable levels of future oyster mariculture growth based on specific attributes influencing societal acceptability and social values.

Researchers worked with an advisory group comprised of shellfish managers, commercial growers, local officials, business owners, and recreational users to develop a survey designed to reach stakeholder groups in Charleston and Beaufort counties in coastal South Carolina. Eighty interviews were conducted, including social value data (e.g., aesthetic, recreational, ecological, land-use, cultural) to be digitized onto S.C. Department of Health and Environmental Control mariculture permit maps. Outcomes from the interviews and mapping will be available in the summer 2019 at the next project advisory committee meeting.

S.C. Sea Grant Consortium Scientists Examine Impacts of Relative Abundance on Genetic Diversity in Black Sea Bass

Tanya Darden, Tim O'Donnell, and Erin Weeks, S.C. Department of Natural Resources

The exploitation of reef fishes off the southeastern U.S. by commercial and recreational fishers has increased dramatically since the early 1970s. The traditional method of determining population health is through stock assessments, while a complementary, though much less-used, method is to evaluate the genetic diversity of the population. The target reef species, black sea bass, has experienced overfishing and, under a rebuilding plan, has completely recovered, providing an excellent opportunity to explore patterns of genetic changes in overfished populations.

S.C. Sea Grant Consortium researchers at the S.C. Department of Natural Resources-Marine Resources Research Institute tested whether genetic diversity changes occurred in black sea bass populations as abundance decreased (overfishing) and increased (recovery). A genetic marker panel for the target species was developed and used to monitor its genetic diversity and effective population size.

Despite large fluctuations in abundance of black sea bass, genetic diversity remained stable over time and effective population size was demonstrated to be in the hundreds or thousands. Ultimately, it appears that black sea bass in the South Atlantic Bight have not experienced a genetic bottleneck, despite an estimated 50% reduction in biomass between 1980 and 1992, when abundances remained at a depressed level before a population recovery began in the early 2000s.

S.C. Sea Grant Consortium Scientists Develop Novel Fish Aging Techniques

Joe Quattro and Michelle Passerotti, University of South Carolina; Joe Ballenger, S.C. Department of Natural Resources Marine Resources Research Institute

The ability to quickly detect changes in age and growth trajectories of fish is a key to successfully managing them. Current methods are time-consuming, expensive, and make real-time management more challenging. In addition, climate change presents new and dynamic challenges to the management of migratory fish species, potentially altering life cycles and habitat ranges. Developing novel aging methods in fish species is important to every stakeholder and end-user of fisheries resources, as it will improve the regulatory process and enhance management.

S.C. Sea Grant Consortium researchers at the University of South Carolina and the S.C. Department of Natural Resources are estimating fish ages using near infrared spectroscopy (NIRS) and aspartic acid racemization (AAR) on red snapper otoliths, a bony structure of the inner ear, and sand tiger shark vertebrae. Over 1,200 otoliths from Gulf of Mexico and Atlantic red snapper populations were scanned using NIRS, and comparisons to traditionally-aged otoliths confirm this methodology to be both faster and highly accurate for annual aging.

An addition to the planned effort is a proof-of-concept study examining whether NIRS is capable of distinguishing between daily and annual ages in otoliths. Consortium researchers confirmed that NIRS can be used to differentiate daily ages as well. In addition to developing novel

daily and annual aging techniques, a novel equipment modification was developed to assist in scanning very small otoliths and will be published. Shark vertebrae data analysis and validation of the AAR technique for both types of fish are set to begin in 2019.

S.C. Sea Grant Consortium Scientists Examine Prevalence and Impacts of Black Gill Disease in White Shrimp

Michael Kendrick, Peter Kingsley-Smith, Jeff Brunson, and Denise Sanger, S.C. Department of Natural Resources

The white shrimp (*Litopenaeus setiferus*) industry is one of the most economically valuable fisheries in South Carolina, with commercial landings revenue of almost \$7.4 million in 2017 (NMFS Annual Landings Tool). Additionally, white shrimp provide a food source for many recreationally, commercially, and ecologically important fish species like red drum (*Sciaenops ocellatus*). Black gill disease, a defense mechanism in shrimp resulting from gill irritants, has been increasing in wild shrimp populations in the Southeast U.S. since the late 1990s, and has been associated with the presence of a ciliate parasite as well as increased host fatigue, potentially impacting both immune responses and feeding rates.

S.C. Sea Grant Consortium researchers at the S.C. Department of Natural Resources wanted to enhance understanding of the drivers and consequences of black gill outbreaks for South Carolina white shrimp populations. To achieve this, they evaluated the environmental and biological factors that influence black gill in shrimp at eight sites within the Charleston Harbor watershed.

While onset and prevalence of black gill was variable across the eight sites, preliminary results demonstrate a significant relationship between temperature and black gill occurrence, but there was no indication that differences in black gill were driven by salinity. Additionally, white shrimp in the harbor were infected by at least seven species of parasite, though not all demonstrated positive correlation with black gill. Continued analysis will provide resource managers with information regarding not only the consequences of black gill for white shrimp populations, but also the biological and environmental correlates associated with black gill outbreaks.