The Sea Grant Program in New Jersey is hosted and administered by New Jersey Sea Grant Consortium (NJSGC), a not-for-profit group dedicated to advancing knowledge and wise utilization of New Jersey's marine and coastal resources. Founded in 1969 as New Jersey Marine Sciences Consortium, NJSGC serves the state and the region through research, education and outreach initiatives that advance environmental stewardship, promote STEM literacy, and address high-priority ocean and coastal issues, including sustaining New Jersey's environment and coastally-dependent economy. The NJSGC has hosted the Sea Grant program in New Jersey since 1976. In recognition of its achievements, NJSGC was awarded full Sea Grant College Program status in 1989.

While most Sea Grant programs are housed at a single academic institution, New Jersey Sea Grant benefits greatly from the talents and resources of the Consortium's membership, which includes most of New Jersey's colleges and universities and other entities with expertise and interest in marine, coastal and estuarine science. Collectively the group works to advance knowledge and wise-utilization of New Jersey's marine and coastal resources and to impact marine and coastal policy throughout the region.

New Jersey Sea Grant (NJSG) Research responds to New Jersey's marine and coastal issues. Current research themes include economic and environmental resilience, climate change adaptation and coastal hazard preparedness. For each research cycle, NJSG solicits input from its membership, board members, stakeholders, government and non-government contacts, and other partners to identify research needs, address data gaps and set priorities. **NJSG Extension Agents** work at the local level to facilitate practical application of the best available science and technology to help New Jersey's coastal decision makers, marine-dependant industries, and others increase hazard resilience, implement best management practices, and adopt sustainable development strategies and policies. Extension expertise ranges from coastal hazard resilience, shoreline engineering, and living shorelines to climate adaptation, marine recreation, shellfish aquaculture, and water resource management. **NJSG Communicators** create, prepare and transmit marine and coastally-related information and announcements to a wide range of audiences using all means and mediums, including print, radio, video, web, and social media**. NJSG Educators** work with the public and especially school-aged children to provide targeted information and direct learning experiences focused on understanding the science of the region's coastal environment and the means to sustain and care for it. As outlined in NJSGC's 2009-13 strategic plan, NJSGC's goals in education include advancing an ocean-literate citizenry able to make well-informed decisions on key marine and coastal issues, and encouraging and supporting a diverse, well-prepared STEM workforce.

Over the years, NJSGC and it Sea Grant Program have come to be recognized as one of the state's leading coastal connections. While marine and coastal research and outreach remain the cornerstones of NJSGC's activities, a current focus is to support new ways for science to create and sustain coastal communities and economies. Some of NJSG's past successes include developing fast-growing cultured oyster seeds and disease- resistant shellfish that have helped revitalize the state's oyster industry, capitalizing on new technologies to better predict and transmit warnings about potentially dangerous rip currents, and improving dunes and shoreline protection systems to increase the resilience of New Jersey's shoreline.

For more information about New Jersey Sea Grant Consortium, go to njseagrant.org

Focus Area Summary Report: Safe and Sustainable Seafood Supply (SSSS)

OVERVIEW

Each year, New Jersey's fisheries and aquaculture industries contribute nearly $2 billion to the state's coastal economy. This goes much higher when one considers the $30 billion per year that New Jersey derived from recreational fishing as part of coastal tourism. To sustain these important economic resources, NJSG dedicates significant outreach (extension and education) and research resources to the Safe and Sustainable Seafood Supply (SSSS) focus area. This commitment is reflected in NJSG's current (2014-2017) and previous (2010-2013) strategic plans.

The goal of SSSS at NJSG is to achieve profitable, healthy fisheries (commercial and recreational) and mariculture industries in New Jersey that harvest seafood responsibly, efficiently and sustainably. To achieve this goal, activities are performed that educate stakeholders to truly understand the importance of ecosystem health and sustainable harvesting practices to the future of New Jersey's fisheries and mariculture industries, and to educate the public to appreciate the health benefits of seafood consumption and to participate in sustainable management and consumption practices in order to protect and increase the supply of safe and sustainable seafood.

SUPPORTING NEW JERSEY's GROWING SHELLFISH AQUACULTURE INDUSTRY

With funding through a National Sea Grant National Strategic Investment Aquaculture Extension award, NJSG was able to hire a Shellfish Aquaculture Program Coordinator in cooperation with with Rutgers University and the Haskins Shellfish Laboratory in 2011 **(SSSS #14149).** Through leveraged funding and continued cooperation with Rutgers, NJSG has been able to maintain that position well past the end of the award in 2013. The accomplishments and impacts of the agent, Lisa Calvo, have been significant. She has been able to help maintain and increase the oyster industry in Delaware Bay, and in particular, support the continued development and production of intertidal rack and bag oyster culture. This extension includes experiments by the agent **(SSSS #15945, #18036, #18039 and #18969)** and NJSG-funded researchers **(SSSS #13957).** Most important are impacts associated with her development of a monthly forum for watermen and the development of an oyster co-op **(SSSS #21204 and #21197).** As a result, Delaware Bay's oyster farmers now have access to continued information on grow out, production and marketing support including trade fairs and organized site visits by regional restaurants. By banding together, growers have been able to reduce purchasing costs. As there is ongoing support for the agent, NJSG sees a continued and growing success in remaking oyster culture a vibrant industry in New Jersey.

Efforts in fisheries and aquaculture are also integrated with education. Project PORTS (Promoting Oyster Restoration through Schools) **(SSSS #18040 and OECEL #18976)** raises awareness of the importance of oyster reef habitat to Delaware Bay. This community-based oyster restoration education program builds oyster reefs and stewardship. Oysters, a keystone species of the Delaware Bay and an important cultural and economic natural resource in Cumberland County, New Jersey, have been in decline since the early 20th century. The county is presently the poorest county in New

Jersey having a highly disadvantaged population in terms of economic and educational wellbeing. County youth have little appreciation for the rich natural resources of the region and little opportunity for enriching educational and environmental experiences. To expand educational opportunities and excellence while improving oyster habitat and developing sustainable stewardship, NJSG's Shellfish Aquaculture Program Coordinator annually conducts the Project PORTS program. In 2013 for example, Project PORTS engaged 969 students from 8 southern New Jersey K-8 schools. Participating students constructed 2400 shell bags, which served as substrate for oyster recruitment. Formative and summative student assessments demonstrated a 106-120% increase in student awareness and knowledge. The shell bags naturally recruited oyster spat and contributed to the ongoing enhancement of oyster reef habitat at a 5-acre conservation site. The project also engaged 98 volunteers who contributed 302 service hours. The importance of oyster reefs for habitat function and biodiversity has also been developed into an educational game that NJSG Education program staff use at multiple public outreach events.

WORKFORCE DEVELOPMENT

Through leveraging of Sea Grant funds, the Shellfish Aquaculture Program Coordinator has been able to support graduate students who have produced useable data to show how oyster reefs contribute to biodiversity. Additionally, there has been opportunity for students from high school to graduate school receive scholarship funding to study in the fisheries and aquaculture field. Started in 2008, the privately-supported Stew Tweed Scholarship Fund has now supported 18 recipients **(OECEL # 18682).** One recipient, a graduate student at the time, was funded on a PD grant (Comparative Analysis of Bivalve Clearance Rates for Restoration Management) with her advisor and is now the head of the New Jersey Department of Agriculture Seafood Program. NJSG interacts with her in a variety of ways including attendance at Aquaculture Advisory Committee meetings by Agent Calvo. NJSG has also been successful in supporting two NMFS-SG Graduate Fisheries Fellowships **(SSSS #19860)** in research that will support fisheries management. Some of this work ties to previously funded work on data poor species **(SSSS #19216).** The Population and Ecosystem Dynamics Fellowship is administered through the National Sea Grant College Program and NMFS. It is awarded annually to Ph.D. and graduate students who are interested in careers related to marine ecosystems and population dynamics with a focus on modeling and managing systems of living marine resources. The goal of the fellowship program is to increase available expertise in these fields, to foster closer relationships between academic scientists and NOAA Fisheries, and to accelerate career development of graduate students through real-world experience. These examples show the commitment to professional development in fisheries and aquaculture by NJSG.

FISHERIES RESEARCH

NJSG's long standing commitment to fisheries, fisheries related science and aquaculture (oyster) research has led to multiple impacts at the state and regional level. Some researchers have been supported over multiple funding cycles to achieve these successes. A long standing impact has been research by Dr. Ximing Guo on oyster production that has resulted in disease resistant oysters that grow fast and the development of methods to select for them **(SSSS #13957).** As a result of this success, Dr. Guo has received additional NJSG funding for 2014-16 (Advancing Eastern Oyster Aquaculture through Marker-assisted Selection). Additionally, research on data poor fisheries species by Dr. Olaf Jensen **(SSSS #19216)** has resulted in model results being incorporated into models used by fisheries managers. This use of Bayesian analysis to model these species has been picked up by others in his lab with 2015 funding for a project entitled "Determining Sustainable Catch Limits for Data-Poor Fisheries in New Jersey**"** and the aforementioned NMFS-SG Graduate Fisheries Fellowship **(SSSS #19860)** entitled "An evaluation of data poor stock assessment methods using data-rich stock assessments from the RAM Legacy

Stock Assessment Database."

Some of the biggest impacts in fisheries research funded by NJSG have been on summer and winter Flounder. Research findings on the sex ratio of summer Flounder **(SSSS #19223)** (Collection of Sex-Ratio Data for Summer Flounder Landings: Commercial and Recreational) have resulted in NMFS incorporating the information into their fisheries models that affect spawning stock biomass which ultimately affects the total allowable catch that is used for developing quotas. NJSG is now supporting other Summer Flounder proposals that are studying early life history dynamics of summer flounder that affect recruitment to adult stocks at the local and regional level. Multiple research projects on winter flounder funded by NJSG (e.g., The Decline of Winter Flounder: Influences of Changes in Connectivity Between Estuaries and the Inner Continental Shelf) by Dr. Ken Able and Dr. Thomas Grothues have led to new regulations that allow winter time dredging of marinas without concern for destruction of winter flounder spawning habitats **(SSSS #21775)**. Both of these impacts will be felt outside of the state and have already impacted the mid-Atlantic region.

Other fisheries research has targeted recreational fishing, in particular, striped bass. Professor John Tiedemann used a small project development (PD) award to develop best practices for catch and release of striped bass (Assessing Impacts of Catch and Release Practices on Striped Bass (*Morone saxatilis*) Implications for Conservation and Management). Through leveraging of Sea Grant funds he obtained other funding which enabled him opportunity to video a roundtable discussion that is still available **(SSSS #19226).** Other PD grants have resulted in better understanding of fish habitat and their use of artificial reefs **(SSSS #16001).** Dr. Straub's work subsequently led to a NOAA funded research project on marine debris and the use of ROV and sidescan sonar to retrieve of ghost crab traps.

REGIONAL AND NATIONAL ACTIVITIES

During the review period, NJSG produced several fisheries related efforts with partners from the local to national scale. In 2013, NJSG hosted a legal symposium on coastal marine spatial planning in the mid-Atlantic **(SCD #19867).** This workshop was supported by the Sea Grant Law Center and brought in partners including Monmouth University's Urban Coast Institute and the Seton Hall School of Law. Articles based on the presentations, including legal issues for fishing and aquaculture, were part of a special issue of the Sea Grant Law and Policy Journal. Then, with funding from the National Marine Fisheries Service, NJSG teamed up with the James J. Howard Lab to host a benthic imaging workshop that brought together government and academic scientists from across the country to discuss the future of underwater imaging, especially in terms of assisting in estimates of habitat use and biomass estimates of commercially import fisheries and fisheries habitat **(SSSS #19865).** The report is available online. The overall conclusion is that as transition occurs to all digital formats and then other new technologies, there will still be a need for specialized platforms dependent on the species and habitats being assessed. At the regional level, which NJSG has become more involved, research on invasive species through the bait trade (blood worms) has shown that there are potential hitchhikers with the packing material, but there are ways to reduce them, thus reducing the risk of importing an invasive that might prove detrimental to local fisheries species **(SSSS #18982 and #18016).**

WATER QUALITY INITIAITIVES

Through Sea Grant funding and state support, NJSG's Marine Recreation Agent and Water Resources Extension Agents have developed and implemented programs to improve water quality in New Jersey's coastal bays. These programs also contribute to other focus areas including Sustainable Coastal Development. Activities include those accomplished through NJSG's

association with the Clean Vessel Act (CVA) Program **(SSSS #18981)** that have been ongoing for over a decade. The CVA program helps marinas install pumpout stations to handle recreational boating sewage. This program also has overseen the purchasing and deployment of 8 pumpout vessels. Overall, this project prevents the release of over 600,000 gallons of sewage annually into New Jersey's coastal waters. At its height, there were nearly 200 pumpout stations, but Hurricane Sandy reduced those by half. With continued State support, those numbers are returning to peak levels after only 3 years. In addition to his work with CVA, NJSG's Marine Recreation Agent administers a portion of the New Jersey Clean Marina Program, funded through the New Jersey Coastal Zone Management office. His work with the Clean Marina program has been ongoing for 10 years and he continues to assist marinas to adopt best management practices that reduce negative inputs into the marine and coastal environment **(SSSS #18979).** NJSG's Water Resource Agents provide individuals and communities with expertise and opportunities to build rain gardens and deploy rain barrels. It is estimated that these techniques reduce immediate runoff and input of nutrients into New Jersey's coastal bays on the order of 1.5 million gallons per year (see under HCE report). Program examples are Stormwater Management in Your Backyard and Build a Rain Barrel. As a result of these activities, coastal waters are cleaner resulting in better conditions for estuaries which are important feeding and nursery areas for estuarine finfish and shellfish species. NJSG's Marine Recreation Agent also continues to work with the State to provide boaters (mostly recreational fishers) with access to coastal waters by compiling and publishing a boat ramp guide that is now online, and with marinas to promote awareness and understanding of current recreational fishing limits in conjunction with the New Jersey Fish and Wildlife Program. This awareness and the conservation ethic that is advanced promotes sustainable seafood supplies.

PIER PRP Program Focus Area Report

New Jersey Sea Grant Consortium

Safe and Sustainable Seafood Supply

Program Focus Area: SAFE AND SUSTAINABLE SEAFOOD SUPPLY

Program Goals

1. Healthy fisheries (commercial and recreational) and mariculture industries within New Jersey that harvest seafood responsibly, efficiently and sustainably.
2. Stakeholders who truly understand the importance of ecosystem health and sustainable harvesting practices to the future of New Jersey's fisheries or mariculture industries and who appreciate the health benefits of seafood consumption will be more inclined to participate in sustainable management and consumption practices in order to help protect and increase our supply of safe and sustainable seafood.

JUMP TO REPORT SECTION

Impacts and Accomplishments toward Program Goals

1. **Program Goal: Healthy fisheries (commercial and recreational) and mariculture industries within New Jersey that harvest seafood responsibly, efficiently and sustainably.**
   Impact(s)
   - 21775 - NJSG funded research on winter flounder results in changes by fisheries managers
   - 21204 - Delaware Bay Shellfish Grower's Forum Fosters Industry Conversation with Policy and Science Experts
   - 21197 - Oyster Farmer Cooperative Sets Path for Collective Path Forward
   - 19223 - Sex at Length of Summer Flounder Landed in the New Jersey Recreational Party Boat Fishery.
   - 18973 - Delaware Bay Shellfish Grower's Forum Fosters Industry Conversation with Policy and Science Expert

   Accomplishment(s)
   - 19865 - Undersea Imaging Workshop Peers in on its Future.
   - 19226 - Stripers for the Future PD Grant Delivers Best Practices for Catch and Release Striped Bass
   - 19216 - Hierarchical Fisheries Model Tests Causes in Recruitment Variability in Marine Fishes.
   - 19209 - Upwelling System for Bivalve Culture Shows Ability to Compare Bivalve Clearance Rates for Restoration Management.
   - 19207 - The decline of winter flounder: Influences of changes in connectivity between estuaries and the inner continental shelf.
   - 18972 - Oyster Farmer Cooperative Sets Path for Collective Path Forward
   - 18971 - New Jersey Shellfish Aquaculture Situation and Outlook Survey
   - 18969 - Development of Control Measures for the Reduction of Mud Worm Biofouling of Aquacultured Oysters
   - 18109 - Reducing uncertainty in stock-recruitment relationships and fishery reference points using Bayesian meta-analysis 2012
   - 18039 - Oyster Industry Partners Receive Grant to Improve and Demonstrate Methods to Cultivate Oysters Using Containerized Systems on Traditional Oyster Planting Grounds
   - 18038 - Delaware Bay Shellfish Growers Forum Fosters Industry Conversation with Policy and Science Experts
   - 18037 - Delaware Bay Shellfish Growers Forum Fosters Industry Conversation with Policy and Science Experts
   - 18036 - Site-Specific Performance Evaluations of Disease Resistant Oyster Stocks Enhance Oyster Aquaculture Production
   - 16001 - Underwater survey and mapping of temperate artificial and natural reef habitats for modeling of productivity and trophic linkage to black sea bass and tautog fisheries 2011
   - 15948 - Delaware Bay Shellfish Growers Forum Fosters Industry Conversation with Policy and Science Experts, 2011
   - 15946 - Needs Assessment Conducted to Identify New Jersey Oyster Aquaculture Industryâ €™s Training and Research Priorities, 2011
   - 15945 - Site-Specific Performance Evaluations of Disease Resistant Oyster Stocks Enhance Oyster Aquaculture Production, 2011
   - 14149 - Aquaculture Agent
   - 13957 - Marker Assisted Breeding in Eastern Oysters - Guo
   - 13951 - Impacts of swim bladder parasites on American eel - Sullivan

2. **Program Goal: Stakeholders who truly understand the importance of ecosystem health and sustainable harvesting practices to the future of New Jersey's fisheries or mariculture industries and who appreciate the health benefits of seafood consumption will be more inclined to participate in sustainable management and consumption practices in order to help protect and increase our supply of safe and sustainable seafood.**
Impact(s)
   - 21204 - Delaware Bay Shellfish Grower's Forum Fosters Industry Conversation with Policy and Science Experts
   - 21197 - Oyster Farmer Cooperative Sets Path for Collective Path Forward
   - 19223 - Sex at Length of Summer Flounder Landed in the New Jersey Recreational Party Boat Fishery.

Accomplishment(s)
   - 19860 - Free â€" Fisheries Fellowship SG/NMFS research An evaluation of data-poor stock assessment methods using data-rich stock assessments from the RAM Legacy Stock Assessment Database.
   - 19226 - Stripers for the Future PD Grant Delivers Best Practices for Catch and Release Striped Bass
   - 19216 - Hierarchical Fisheries Model Tests Causes in Recruitment Variability in Marine Fishes.
   - 19209 - Upwelling System for Bivalve Culture Shows Ability to Compare Bivalve Clearance Rates for Restoration Management.
   - 18982 - A Mid-Atlantic Regional project â€œPreventing Aquatic Invasive Species Through Vector Management: Live Bait Vector as a Model in the Mid-Atlantic.
   - 18981 - New Jersey Sea Grant Helps Prevent Sewage Discharges from Recreational Vessels
   - 18979 - New Jersey Sea Grant (NJSG) Helps Marinas Implement Best Management Practices
   - 18109 - Reducing uncertainty in stock-recruitment relationships and fishery reference points using Bayesian meta-analysis 2012
   - 18040 - Stewardship and Environmental Awareness Promoted Through Community-Based Oyster Restoration Project
   - 18016 - A Mid-Atlantic Regional project â€œPreventing Aquatic Invasive Species Through Vector Management: Live Bait Vector as a Model in the Mid-Atlantic
   - 16001 - Underwater survey and mapping of temperate artificial and natural reef habitats for modeling of productivity and trophic linkage to black sea bass and tautog fisheries 2011
   - 14149 - Aquaculture Agent
   - 13957 - Marker Assisted Breeding in Eastern Oysters - Guo
   - 13951 - Impacts of swim bladder parasites on American eel - Sullivan

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Full Text of Impacts and Accomplishments

21775 - NJSG funded research on winter flounder results in changes by fisheries managers
Relevance: At the southern extent of the SNE/MAB stock there are differences between inshore and offshore populations of winter flounder as well as across the area managed. There is disagreement on the connectivity of the stock in the sense of it being composed of one or more populations Understanding distributional shifts at this fine scale are important for identifying local impacts to the ecosystem and maritime community. Interpreting these distributional shifts is important for defining essential fish habitat that is no longer being used by winter flounder.
Response: Researchers utilized various tagging methods, including archival tags, along with historical data available for state and federal resources to assess the changing distribution of winter flounder across southern New England and the Mid-Atlantic Bight and to investigate reproductive connectivity between shelf waters and estuarine habitats.
Results: There is evidence of a northward shift of population in the Mid-Atlantic Bight that is being considered by managers seeking to ease dredge restrictions in the Cape May area. Second, although this work was unable to definitively determine the existence of a non-migratory offshore stock, it presented some evidence thereof and provided for methodology to do so in the future. A closure on the winter flounder was partially lifted for offshore commercial fishing this year in alignment with yet unpublished findings, providing economic relief to one sector. Third, a valuable algorithm for determining habitat use and movement of Mid-Atlantic Bight littoral fishes from archival tags was developed.

RECAP: NMFS representatives, stakeholders and fisheries managers are seeking the easing of dredge restrictions in Cape May and will likely redraw Critical Habitat delineations for winter flounder in response to this research and other recent data. Back to Goals

21204 - Delaware Bay Shellfish Grower's Forum Fosters Industry Conversation with Policy and Science Experts
Relevance. The development of a responsible and sustainable shellfish aquaculture industry is dependent on an understanding of sound science-based policy and practices. It is important that shellfish growers have an opportunity to continuously educate themselves on evolving regulations, emerging science and technologies, and marketing landscapes.

Response. A bimonthly seminar series for shellfish growers (Shellfish Growers' Forum) was conducted to foster information exchange between industry members and relevant experts from academia, and state and federal agencies, providing pertinent information to encourage sound culture practices, and the production of safe seafood.

Results. The Shellfish Growers' Forum, which served to educate and inform industry members on a variety of via direct conversation with experts. The Forum engaged growers in conversation with state and federal agents, extension agents, scientist, and communication specialists; with topics ranging from policy to climate change to grant writing. The Forum has been well attended with 10-24 industry members and others participating each session. An additional benefit of the series is that it has fostered community and information exchange among industry members and facilitated an exchange of information and ideas among growers. Since initiation in December 2011, 18 Forums have been offered.

RECAP: Fifteen New Jersey shellfish growers modified farm practices based on information received at the Shellfish Growers' Forum, supporting increased farm profitability and sustainability, and product safety. A bi-monthly seminar program, the Shellfish Growers' Forum, was developed to promote an educated industry and responsible and sustainable aquaculture. Through the Forum industry members have become familiar with cutting edge science, policy and regulations, safe handling of shellfish, marketing and communication strategies, grant writing and funding opportunities, and new technologies. The programs have been well attended. Back to Goals

21197 - Oyster Farmer Cooperative Sets Path for Collective Path Forward
Relevance. The geographic centralization of oyster farms in the lower Delaware Bay creates an ideal opportunity for farmers to work cooperatively as they produce consistently high quality oysters in similar growing conditions. Cooperative engagement presents opportunities to better meet product demand, build capital investments, increase profits, reduce competition, stabilize price points, and build community.

Response. The aquaculture extension agent supported the development of an oyster grower's cooperative by providing expertise and information and by facilitating weekly to monthly meetings of the Cape May Oyster Cooperative steering committee represented by 3 oyster farms. The agent worked collaboratively with County officials to acquire a grant to purchase a refrigerated van for the co-op, which facilitated direct market sales.

Results. NJMSC assisted Delaware Bay oyster growers in identifying ways that growers could work cooperatively to enhance the production potential, marketing opportunities, and long-term sustainability of their farms. The co-op steering committee received guidance from Rutgers University New Jersey Aquaculture Innovation and Food Innovation Center experts, and cooperative development consultant, Adam Schwartz (CDS Consulting Co-op). In February 2014 the Cape May Oyster Cooperative was established as a 308B Cooperative in Minnesota, where there is a robust legal basis for farmer cooperatives. The Cooperative continues to work closely with the experts to ensure proper execution of the cooperative endeavor and associated marketing strategies. Funding was acquired via a grant from USDA REBEG to acquire a refrigerated van for the co-op, enabling the co-op to conduct direct sales.

RECAP: Three NJ oyster growers formed a cooperative that has enabled them to increase farm profitability by 30% via shared infrastructure for direct market sales. Back to Goals

19865 - Undersea Imaging Workshop Peers in on its Future.
Relevance: Underwater imaging systems are making a transition from analog to digital systems; however, this change over will occur gradually and new collected digital images must be aligned to older systems to allow reliable comparisons.

Response: The New Jersey Sea Grant Consortium received funding from NOAA/NMFS to host a workshop on undersea benthic imaging systems. The workshop was held in Red Bank, New Jersey late in the year. Major themes of the workshop concerned cost effectiveness and comprehensive sampling imagining methodology for characterizing benthic communities; document the advantages and limits of various systems currently being used; and consider the future needs regarding imaging systems. The workshop was designed as an informal, invitation-only gathering for people who use benthic imaging systems to meet and compare notes about how to best use the equipment, improve imaging quality and discuss future of benthic camera systems. Over 20 participants, mostly from Federal agencies and academia, from across the nation attended the workshop.

Results: Although there will be a gradual change in underwater imaging as new digital techniques and delivery platforms arise, it is clear that these systems will be habitat and inquiry specific. No one system can do it all. A summary of the presentations and discussions from the workshop will be led by Dr. Richard Langton of NOAA/NMFS James J. Howard Laboratory on Sandy Hook and will result in a web based document produced by NJSGC.

RECAP: Benthic imaging system workshop reveals that current technologies will continue to be significant and necessary as transition is made to newer digital platforms. Back to Goals

19860 - Free - Fisheries Fellowship SG/NMFS research An evaluation of data-poor stock assessment methods using data-rich stock assessments from the RAM Legacy Stock Assessment Database.

Relevance: Many fisheries in USA remain unassessed and unmanaged because insufficient resources and data exist to drive a complex stock assessment. In the Northeast Atlantic, reliable information on deep-water stocks has also lagged behind exploitation. Data-poor fisheries affect vulnerable ecosystems and stocks and are critical to global economic and food security; it is important to assess and manage them even when few data are available.

Response: The purpose of the proposed project is to evaluate and improve the "Only Reliable Catch Series" (ORCS) Working Group data-poor catch estimator using the RAM Legacy Stock Assessment Database (RAMLD). PI plans to use reliable stock assessments to evaluate effectiveness of the ORCS Table of Attributes (TOA) scores for predicting stock status. PI will evaluate consistency of TOA scores from different stakeholders to identify criteria that will be widely seen as objective. Finally, PI plans to develop priors and proxies for application to data-poor stocks through a meta-analysis of the data-rich stocks in the RAMLD.

Results: PI is updating the RAM Legacy database and develops a protocol for automatic inclusion of future assessments in the RAM Legacy database. PI is evaluating the robustness of the alternative stock assessment methods identified by the ORCS Working Group by applying these methods to data subsetted from data-rich fisheries and comparing the results to the results of traditional assessments.

RECAP: Graduate Fellow research to determine identifying reliable stocks for the analysis and scoring the TOA. Preliminary results from this work will be presented at the "Next Generation of Fish Stock Assessments" session at the American Fisheries Society meeting in Quebec City NMFS-SG Fellows Meeting in Seattle. Back to Goals

19226 - Stripers for the Future PD Grant Delivers Best Practices for Catch and Release Striped Bass

Relevance: Voluntary catch and release is practiced by large numbers of conservation minded anglers. However, bag limits and size limits require large numbers of striped bass to be released resulting in some released fish dying as a result of poor capture, handling and release techniques (8% mortality rate estimate - ASMFC). Others experience sublethal effects such as injury, physiological disturbance, behavioral alterations, and fitness impairments

Response: PI conducted a broad scale examination of the impacts of catch and release angling on the physiology, behavior and survival of coastal striped bass. In order to develop scientifically quantified best practices that can aid in conservation of this important species. Researchers would then disseminate a suite of best practices for the catch and release of striped bass in partnership with the recreational angling community.

Results: The researchers produced four major pieces of outreach materials including the use of social media. They produced a technical report Assessing Impacts of Catch and Release Practices on Striped Bass: Implications for Conservation and Management technical report www.monmouth.edu/uploadFiles/Resources/Urban_Coast_Institute/BestPracticesStriped Bass%20BassCatch and ReleaseReport.pdf; a lay article in On the Water Magazine entitled Stripers for the Future: Employing Best Practices to Increase Survival of Released Striped Bass; a brochure and poster entitled Best Practices for Catch and Release of Striped Bass; and YouTube video with a small group of respected striper anglers, authors, and proponents of catch-and-release and 'talked story' about what anglers can do to ensure survival of released fish entitled Stripers for the Future: Striped Bass Catch-and-Release Roundtable http://www.youtube.com/watch?v=z5t1vYC7Xfc&feature=c4-overview&list=UUZlJlOPTvZs2vWk0liHislw

RECAP: Information on best practices for Striped Bass catch and release reaches striper recreational fishing communities through reports, articles, posters, and YouTube. Back to Goals

19223 - Sex at Length of Summer Flounder Landed in the New Jersey Recreational Party Boat Fishery.

Relevance: Female summer flounder grow faster than males and experience a lower natural mortality rate. As such, fisheries models that do not take into account this sexual dimorphism will result in poor fisheries management. A desire exists to develop similar assessment techniques for summer flounder, but some prerequisite data are not available, especially for the recreational fishery.

Response: The PI developed a cooperative research program with the recreational summer flounder fishery to assess sex ratios in catch in improve the stock assessment of this species while also providing some insight on how current management strategies might impact the sex structure of the population. PI collected data on sex and length of summer flounder (n = 4,437) that were landed in the New Jersey recreational fishery.

Results: Females dominated the recreational catch (95% female overall). The proportion of landed fish at a given length that were females was greater at lower latitudes and earlier in the summer suggesting a highly dynamic sex dependency in the population dynamics of summer flounder. Project results were presented at the 2013 formal summer flounder stock assessment. The data from tis study

indicate the importance of developing a sex-structured model for summer flounder. Two of the SARC 57 reviewers mentioned our study results and emphasized the need to develop a sex-structured model.

RECAP: Variation in sex ratio in both the recreational and commercial summer flounder fisheries has resulted in its incorporation into fisheries management models. Back to Goals

19216 - Hierarchical Fisheries Model Tests Causes in Recruitment Variability in Marine Fishes.
Relevance: Recruitment often varies substantially in fish populations and residual variability may have serial autocorrelation due to environmental effects even after accounting for a stock-recruit relationship. However, the likely magnitude of variability and autocorrelation in recruitment has yet to be formally estimated. Establishing a relationship will support fisheries management.

Response: PI developed a hierarchical model for recruitment variability and autocorrelation, and applied it to data for 154 fish populations.

Results: Results show that autocorrelated recruitment has a marginal standard deviation of 0.76 (SD=0.37) and an average autocorrelation of 0.44 (SD=0.28) when predicting for an unobserved taxonomic order. Estimates differ somewhat among taxonomic orders and stocks, and also support a hypothesized positive relationship between age at maturity and autocorrelation in recruitment. Results can be used as a Bayesian prior for recruitment variability in models for data-poor stocks, and to distinguish recruitment from other process errors in models for data-rich stocks. Estimates can also be used in the design of future simulation models and management strategy evaluations, and in theoretical research regarding life history variation.

RECAP: Hierarchical models reveal autocorrelation in recruitment variability that can be used for data-rich and data-poor species models that can lead to better management strategy evaluations.
Back to Goals

19209 - Upwelling System for Bivalve Culture Shows Ability to Compare Bivalve Clearance Rates for Restoration Management.
Relevance: Bivalves, such as the non commercial species Geukensia demissa have become popular in restoration efforts from both water quality and shoreline stabilization in estuarine waters. However, little is known about the impact augmenting the population of a single species may have on the food availability for a community of bivalve filter feeders.

Response: PI developed a bivalve upwelling system with flow imaging for measurement of phytoplankton (food particles) and filtration rates. This research examines the interactions of bivalve shellfish native to New Jersey waters- Crassostrea virginica, Mercenaria mercenaria, and Geukensia demissa- to determine what impact augmenting the population of a single species may have on the food availability for a community of bivalve filter feeders.

Results: The building and testing of the portable upweller was achieved. Preliminary data on single species filtration showed the effectiveness of the upweller design as well as its usefulness in application towards evaluating bivalve molluscan shellfish interactions via planktonic filterfeeding. Modification to the upweller design was made for multispecies experiments. These experiments verified the ability of the system to examine filtration interactions among bivalve filterfeeders in series, in parallel or under co-habitation.

RECAP: Successful testing of bivalve upwelling design will allow for studies that examine filtration interactions among bivalve filterfeeders and thus address potential completion among bivalve species in estuarine restoration projects. Back to Goals

19207 - The decline of winter flounder: Influences of changes in connectivity between estuaries and the inner continental shelf.
Relevance: Winter flounder are considered estuarine spawners, but evidence exists that in the southern part of their range they may spawn offshore on the continental shelf. If this is so, then understanding of winter flounder connectivity between estuarine and continental shelf habitats is needed to address issues related to the decline of winter flounder and management of its habitats. Additionally, climate change may have an impact of the apparent decline.

Response: PI will address questions by evaluating the decline of winter flounder and the distributional response from historical databases from the northeastern U. S. (NMFS and NEAMAP)and off the coast of New Jersey (Bureau of Marine Fisheries NJDEP) and further determine connectivity between estuarine and continental shelf habitats for adults using state-of the-art archival tags.

Results: Through use of tagged fish through the American Littoral Society tag/recapture data most recaptured winter flounder stayed in their defined state of bay (94%) while a few moved large distances (e.g., NJ to NC). NJDEP trawl data suggests that center of biomass for winter flounder in NJ is in northern inshore waters. NMFS data of NJ fish suggests a northward shift of center of biomass. Length and weight of fish did not significantly change spatially. However, NJDEP winter flounder abundance sampled in the trawl surveys is not being affected in the same way that the NJNMFS offshore winter flounder abundance (catch and CPUE) is in relation to temperature for the defined seasonal and overall parameters. Of 50 archival tags released, only one recapture has occurred.

Analysis suggests that winter flounder move in relation to temperature preferences.

RECAP: Winter flounder off New Jersey tend to northern coastal waters, stay in general region, and will move in response to temperature changes. Back to Goals

18982 - A Mid-Atlantic Regional project "Preventing Aquatic Invasive Species Through Vector Management: Live Bait Vector as a Model in the Mid-Atlantic.
Relevance: Invasive species can be spread through the distribution and use of live bait

Response: Sea Grant Programs from New Jersey, Delaware, Maryland, Virginia and North Carolina, the Smithsonian Environmental Research Center (SERC) and the University of Maryland are working on a project that integrates research and outreach to reduce the spread of invasive species.

Results: The regional team provided funding for a social science research project targeting the bloodworm bait trade at both the wholesale and recreational fisher level. Results of the research have been used to develop outreach products and conduct follow-up with bait and tackle to determine their willingness to help educate anglers on the importance of proper disposal of packing materials included with marine worms.

RECAP: Research and extension efforts will help to understand the spread of invasive species and determine the effectiveness of vector management. Back to Goals

18981 - New Jersey Sea Grant Helps Prevent Sewage Discharges from Recreational Vessels
Relevance: Untreated sewage discharges from recreational boating activities can impact water quality.

Response: The New Jersey Sea Grant (NJSG) Extension Program continued its partnership with federal, state and local agencies to reduce discharges from recreational and commercial vessels.

Results: The federal Clean Vessel Act and New Jersey Fish and Wildlife have provided funding for 168 pumpout facilities at marinas and eight pumpout vessels to meet the sewage disposal needs of boaters.
Superstorm Sandy had a devastating effect on the operational status of the pumpouts, destroying approximately 50% of them. A substantial effort by all the partners involved in the project have been invested to return the pumpouts destroyed back into operation.

RECAP: NJSG clean boating efforts improved coastal water quality, enhanced recreational boating and helped sustain marina business. Back to Goals

18979 - New Jersey Sea Grant (NJSG) Helps Marinas Implement Best Management Practices
Relevance: Recreational boating activities can contribute to nonpoint source pollution.

Response: The New Jersey Sea Grant (NJSG) Program continued its partnership with the New Jersey Department of Environmental Protection Office of Coastal Management to implement the New Jersey Clean Marina Program to minimize the impact recreational boating activities have on the environment.

Results: Over 200 marinas have participated in Clean Marina related workshops, 270 marinas have received the guidebooks. One marina obtained Clean Marina status in 2013 bringing the total to 48 marinas in the state. Marinas have implemented best management practices to reduce spills that occur during fueling, capture water from hull washing, rent dustless sanders, improve recycling efforts, collect mercury containing devices, develop emergency response plans, educate boaters and installed pumpout facilities.

RECAP: NJSG Clean Marina efforts improved coastal water quality, enhanced recreational boating and helped sustain marina business. Back to Goals

18973 - Delaware Bay Shellfish Grower's Forum Fosters Industry Conversation with Policy and Science Expert
Relevance: Oyster aquaculture culture has emerged as a vital and growing industry in Delaware Bay, NJ. The potential for growth is tremendous and recent advances of New Jersey State aquaculture policy promote new opportunities for expansion. The development of a responsible and sustainable oyster aquaculture industry is dependent on an understanding of sound science-based policy and practices.

Response: New Jersey Sea Grant (NJSG) developed a bimonthly seminar series for shellfish growers to engage the industry in direct conversation with relevant experts from academia and state and federal agencies, providing pertinent information to encourage sound culture practices, and the production of safe seafood. The Forum also serves as a platform for informal information sharing among industry members.

Results: NJSG hosted a bimonthly seminar series, The Delaware Bay Shellfish Growers Forum, which served to educate and inform industry members on a variety of issues from water quality and safe seafood handling to genetic improvement of oyster stocks via direct conversation with experts. The Forum has been well attended with 10-15 industry members participating each month.

RECAP: NJSG offered the Delaware Shellfish Growers Forum, a monthly seminar program for NJ shellfish aquaculturists to promote an educated industry and responsible and sustainable aquaculture.

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18972 - Oyster Farmer Cooperative Sets Path for Collective Path Forward

Relevance: Oyster aquaculture culture has emerged as a vital and growing industry in Delaware Bay, New Jersey. The potential for growth is tremendous and recent advances of New Jersey State aquaculture policy promote new opportunities for expansion. The geographic centralization of the farms in the lower Delaware Bay creates an ideal opportunity for farmers to work cooperatively as they produce consistently high quality oysters in similar growing conditions.

Response: New Jersey Sea Grant (NJSG) in collaboration with Rutgers University has supported the development of a oyster grower's cooperative by providing expertise and information and by facilitating weekly to monthly meetings of the Cape May Oyster Cooperative steering committee represented by 6 oyster farms.

Results: An oyster grower's cooperative, the Cape May Oyster Cooperative, was incorporated as a 308B Cooperative in Minnesota where there is a robust legal basis for farmer cooperatives. The cooperative establishes a supportive community of oyster growers who will work together and share resources to provide fresh, high-quality cultured oysters to local and regional markets; and adopt science-based best management practices to improve production efficiencies, ensure environmentally responsible and sustainable farming.

RECAP: NJSG has worked with oyster growers to form the cape Shore Oyster Growers Cooperative. The cooperative will provide distinctive high-quality cultivated oysters to discerning local restaurants and specialty markets in the Philadelphia area, while enhancing the farms and lives of the Cooperative's community of oyster growers.

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18971 - New Jersey Shellfish Aquaculture Situation and Outlook Survey

Relevance: New Jersey has a small but expanding shellfish aquaculture industry. Two species are grown: the hard clam Mercenaria mercenaria , and the eastern oyster, Crassostrea virginica. Hard clams have been cultivated in New Jersey since 1976, while hatchery seed based oyster culture did not occur on a
commercial scale until 1997. New Jersey's shellfish aquaculture industry is poised for expansion. Documentation of the extent and economic value of this industry has been lacking.

Response: New Jersey Sea Grant (NJSG) in collaboration with the Haskin shellfish Research Laboratory, Rutgers University established a survey program to document various statistics associated with shellfish aquaculture in the State. The survey program will be conducted on an annual basis and represents the first aquaculture reporting program for the State.

Results: NJSG administered the first annual New Jersey Shellfish Aquaculture Situation and Outlook Survey using the on-line survey program Survey Monkey. Known industry members (n = 56) were sent an invitation to participate via email. Survey results were analyzed and interpreted and reported out through written report. The report was made available through a link on the home page of the Haskin Shellfish Research Laboratory and New Jersey Sea Grant web sites. This census fills a critical information need at municipal to national levels and will help build an awareness of the economic importance of the industry.

RECAP: NJSG developed and initiated a census program for shellfish aquaculture in New Jersey. The census program fills a critical information need at municipal to national levels.

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18969 - Development of Control Measures for the Reduction of Mud Worm Biofouling of Aquacultured Oysters

Relevance: Biofouling caused by marine polychaetes belonging to the genus Polydora is a serious problem for New Jersey's oyster farms located in the lower Delaware Bay. These ubiquitous mud worms can kill oysters, reduce oyster growth and decrease product appeal and marketability. Husbandry associated with mudworm control is extensive and increases labor costs by 20%.

Response: New Jersey Sea Grant (NJSG) conducted field experiments in collaboration with industry members to develop efficient and effective methods for control of Polydora infestation. Life history aspects of the worm, including season planktonic abundance and settlement patterns, were investigated to establish treatment regimes that target the worm at the onset of infestation. Three control methods, hypersaline, freshwater, and lime dips were evaluated.

Results: The experiments elucidated natural history aspects of mudworms in Delaware Bay, providing important information for enhanced targeting of treatment times and duration. Overwintering infestations were observed and recurring worm settlement was noted throughout late spring, summer, and early fall with peak abundances correlating with lunar periodicity. Evaluated control measures had limited success in eliminating the fouling problem; however, they will inform future evaluations of treatment options that will include a multi-step control process, including a longer air exposure period and late winter treatment to reduce overwintering infestations.

RECAP: New Jersey Sea Grant conducted field experiments in collaboration with industry member to develop efficient and effective methods for control of Polydora infestation. The results of the investigation are being used to enhance Polydora control measures and reduce husbandry labor costs, thereby enhancing farm production and profitability. Back to Goals

18109 - Reducing uncertainty in stock-recruitment relationships and fishery reference points using Bayesian meta-analysis 2012
In collaboration with colleagues at Dalhousie University, we have substantially improved the underlying stock assessment database, including the addition of over 70 new stock assessments (a 30% increase in the database size) since the project began including updated assessment information for the target species of this proposal. In collaboration with colleagues at University of Washington, we have implemented mixed-effects models to understand the distribution of Bmsy relative to carrying capacity across all stocks in the database with sufficient information to calculate surplus production. This work addresses the question: In a well-managed fishery, how much smaller should we expect the population to be relative to the unfished state?

An analysis of coherence in productivity of fish populations within and across Large Marine Ecosystems (LMEs) of the world (including the Northeast U.S. Shelf LME) is nearing completion and will likely be submitted in summer 2013. Preliminary results suggest that positive correlation (coherence) in productivity is more common than negative correlation. In some cases, this appears to be the result of bottom-up processes (e.g., primary production) synchronizing productivity of the ecosystem as a whole. In other cases, however, it appears that management action has had an impact on several stocks within the same LME, causing them to increase together at approximately the same time.

We completed development of the RAM Legacy Stock Assessment Database (http://ramlegacy.marinebiodiversity.ca/ram-legacy-stock-assessment-database). A manuscript describing the database design and contents has been published in the journal Fish & Fisheries (Ricard et al. 2012). More than 16 published papers have now been based on the database and several others are in review or in preparation. The paper has already received 9 citations in less than a year since publication.
A Rutgers University graduate student supported by this grant, Mikaela Provost, has been an integral part of the database development effort. This work has been published in the journal Canadian Journal of Fisheries & Aquatic Sciences (Thorson et al. 2012).

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18040 - Stewardship and Environmental Awareness Promoted Through Community-Based Oyster Restoration Project
Relevance: Oysters, a keystone species of the Delaware Bay and an important cultural and economic natural resource in Cumberland County, NJ have been in decline since the early 20th century. The County is presently the poorest county in New Jersey having a highly disadvantaged population in terms of economic and educational wellbeing. County youth have little appreciation for the rich natural resources of the region and little opportunity for enriching educational and environmental experiences.

Response: To expand educational opportunities and excellence while improving oyster habitat and developing sustainable stewardship, NJSG, Rutgers University, and NGO, the American Littoral Society conducted a community-based oyster habitat restoration project (Project PORTS: Promoting Oyster Restoration Through Schools) that engaged local students.

Results: In 2012, Project PORTS partnered with 10 southern New Jersey K-8 schools engaging 1015 students in the stewardship of the Delaware Bay oyster resource while promoting student scholastic achievement and personal growth. More than 2 million oyster seed, which settled on student-constructed shell bags were transplanted to a 2-acre conservation site. This effort involved a number of NGO partners, the NJDEP Shellfisheries Bureau, 124 volunteers, and a commercial waterman.

RECAP: Stewardship and environmental awareness was promoted through a community-based oyster restoration project that engaged 1015 students in the enhancement of 2.5 million oysters at a New Jersey conservation site. Back to Goals

18039 - Oyster Industry Partners Receive Grant to Improve and Demonstrate Methods to Cultivate Oysters Using Containerized Systems on Traditional Oyster Planting Grounds
Relevance: In recent years traditional oystermen have had growing interest in evaluating the production potential of selectively bred disease resistant oyster stocks on the leased bottom (planting grounds) of Delaware Bay. The revitalization of production on the once productive planting grounds would support the development of local bayshore and regional economies and promote the sustainability of the Delaware Bay oyster resource.

Response: NJSG worked with two oystermen to develop a successful NE SARE Farmers Grant to improve handling and husbandry methods and demonstrate the tremendous potential of cage-culture

as a means to increase Delaware Bay oyster production on the planting grounds.
Results: NJSG aided industry partners in developing a scientifically sound project and successful proposal to the NE SARE Farmers Grant Program. Elder Point Oyster Company, Port Norris, New Jersey. The project was initiated in spring 2012. Two cage systems and two husbandry routines were evaluated for efficiency and production yield. A flip top cage system offered some advantages to a three tier system; however, differences in oyster growth and mortality between the two systems were not significant and do not warrant a complete replacement of three-tier systems that farmers already have in operation. Fouling of the cages varied temporally and a two-week cleaning regime yielded higher, though not statistically significant, oyster survival and growth than a four- week cleaning regime. The results suggest that subtidal cage culture of oysters is a viable option for growing oysters on the traditional planting grounds of the Delaware Bay.
RECAP: NJSG assisted traditional oystermen in developing and acquiring funding for a project to demonstrate containerized oyster culture methods as a means to revitalize production on the historic planting grounds. Back to Goals

18038 - Delaware Bay Shellfish Growers Forum Fosters Industry Conversation with Policy and Science Experts
Relevance: Oyster aquaculture culture has emerged as a vital and growing industry in Delaware Bay, NJ. The potential for growth is tremendous and recent advances of New Jersey State aquaculture policy promote new opportunities for expansion. The geographic centralization of the farms in the lower Delaware Bay creates an ideal opportunity for farmers to work cooperatively as they produce consistently high quality oysters in similar growing conditions.

Response: NJSG in collaboration with Rutgers University offered a single day workshop focusing on cooperative approaches in shellfish aquaculture and has been working with interested oyster growers to establish an oyster growers cooperative.

Results: An oyster growers cooperative has been registered as a 308B Cooperative in Minnesota where there is a robust legal basis for farmer cooperatives. Finalization of incorporation documents is in process. The cooperative establishes a supportive community of oyster growers who will work together to provide fresh, high-quality cultured oysters to local and regional markets and adopt science-based best management practices to improve production efficiencies, ensure environmentally responsible and sustainable farming.

RECAP: NJSG has worked with oyster growers to form the Cape Shore Oyster Growers Cooperative. The cooperative will provide distinctive high-quality cultivated oysters to discerning local restaurants and specialty markets in the Philadelphia area, while enhancing the farms and lives of the Cooperative's community of oyster growers. Back to Goals

18037 - Delaware Bay Shellfish Growers Forum Fosters Industry Conversation with Policy and Science Experts
Relevance: Oyster aquaculture culture has emerged as a vital and growing industry in Delaware Bay, NJ. The potential for growth is tremendous and recent advances of New Jersey State aquaculture policy promote new opportunities for expansion. The development of a responsible and sustainable oyster aquaculture industry is dependent on an understanding of sound science-based policy and practices.

Response: NJSG developed a monthly seminar series for shellfish growers to engage the industry in direct conversation with relevant experts from academia and state and federal agencies, providing pertinent information to encourage sound culture practices, and the production of safe seafood. The seminars also serve as a platform for informal information sharing among industry members.

Results: NJSG hosted a monthly seminar series, The Delaware Bay Shellfish Growers Forum, which serves to educate and inform industry members on a variety of issues from water quality and safe seafood handling to genetic improvement of oyster stocks via direct conversation with experts. The Forum has been well attended with 10-15 industry members participating each month.

RECAP: NJSG offered The Delaware Shellfish Growers Forum, a monthly seminar program for New Jersey shellfish aquaculturists to promote an educated, responsible and sustainable aquaculture industry. Back to Goals

18036 - Site-Specific Performance Evaluations of Disease Resistant Oyster Stocks Enhance Oyster Aquaculture Production
Relevance: Oyster aquaculture presents a viable means to supplement depleted wild oyster harvests to meet the growing demand for safe and sustainable seafood and support economic development in New Jersey's Delaware Bayshore region.

Response: Common-garden experiments were conducted in partnership with two oyster growers to evaluate survival growth and production potential of five oyster strains including triploid and diploid selected disease resistant strains and wild stocks. The experiments proved important in identifying site-specific best performing production stocks, informing grower's future oyster seed purchases, and enabling oyster growers to increase production and reduce costs by growing the best performing oyster strains.

Results: The experiments were conducted in Fall 2011 through November 2012. Cooperating industry members learned how to establish appropriate experimental designs and assess oyster stock performance. Significant differences in survival and growth between stocks were observed with one stock exhibiting high mortality and low yields. Wild seed available later in the first grow out season, exhibited similar growth and survival rates as the best performing selected oyster stocks during the study period and should be further evaluated for integration in production systems.

RECAP: NJSG has integrated scientific assessments of oyster stock performance at two local oyster farms. As a result growers identified best performing oyster strains, which will be preferentially purchased in the future, thereby enhancing oyster production, supporting the growing consumer demand for quality oysters, and promoting economic development in the New Jersey's Delaware Bayshore region. Back to Goals

18016 - A Mid-Atlantic Regional project "Preventing Aquatic Invasive Species Through Vector Management: Live Bait Vector as a Model in the Mid-Atlantic
Relevance: Invasive species can be spread through the distribution and use of live bait.
Response: Sea Grant Programs from New Jersey, Delaware, Maryland, Virginia and North Carolina, the Smithsonian Environmental Research Center (SERC) and the University of Maryland collaborated on a project that integrates research and outreach to reduce the spread of invasive species.
Results: The regional team selected and provided funding for a social science research project targeting the bloodworm bait trade at both the wholesale and recreational fisher level. Each state program provided the researchers with assistance to survey anglers to assess their use of blood worms as bait, how they disposed of packing material and leftover bait, knowledge of aquatic nuisance species (ANS), and willingness to participate in reducing the spread and introduction of ANS.

RECAP: Research and extension efforts will help to understand the spread of invasive species and determine the effectiveness of vector management. Back to Goals

16001 - Underwater survey and mapping of temperate artificial and natural reef habitats for modeling of productivity and trophic linkage to black sea bass and tautog fisheries 2011
The collection of ecological knowledge and parameters on the ecosystem and trophic linkages of artificial reefs has been limited by traditional sampling techniques. This researcher is utilizing video and sonar technology to address this lack of knowledge. Using the ROV Shearwater fitted with digital side scan sonar, video and water quality sonde surveys were completed on the Little Egg Reef, a part of the New Jersey Department of Environmental Protection's (NJDEP) Artificial Reef Program. Since the side scan swaths were geo-referenced, the developing overlay map locates the various subsea structures precisely and will allow the PI to produce overlay layers of physical and biological data. Many hours of video have been collected over discrete sites on the reef and analyzed for abundance of fish and invertebrates that have colonized the reefs.

Pilot studies have demonstrated the techniques and technologies necessary to develop a comprehensive study of the reef ecosystem and the drivers of reef production. A conceptual ecological production model has been developed from observations made during this study and can be used to synthesize data collected on the reef into a working production model to predict determinants of reef fish production. This project will begin to develop models for better management and siting of artificial reefs in the Mid-Atlantic region which are an important economic driver in our region as they support an important recreational fishery. Better information on the goals of the artificial reef program and the specific underwater structures has been provided to the public in a number of outreach settings. Fishermen and students were particularly appreciative of the video productions that have been done to highlight the work. Data is also being shared with the NJ DEP artificial reef program and the Bureau of Marine Fisheries.

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15948 - Delaware Bay Shellfish Growers Forum Fosters Industry Conversation with Policy and Science Experts, 2011
RELEVANCE:
Oyster aquaculture culture has emerged as a vital and growing industry in Delaware Bay, NJ. The potential for growth is tremendous and recent advances of New Jersey State aquaculture policy promote new opportunities for expansion. The development of a responsible and sustainable oyster aquaculture industry is dependent on an understanding of sound science-based policy and practices.

RESPONSE:
NJSG has developed a monthly seminar series for shellfish growers to engage the industry in direct conversation with relevant experts from academia and state and federal agencies, providing pertinent information to encourage sound culture practices and the production of safe seafood. The Forum also serves as a platform for informal information sharing among industry members.

RESULTS:
NJSG is hosting a monthly seminar series, The Delaware Bay Shellfish Growers Forum, which serves to educate and inform industry members on a variety of issues from water quality and safe seafood

handling to genetic improvement of oyster stocks via direct conversation with experts. The Forum has been well attended with 10-15 industry members participating each month.

RECAP: NJSG has developed the Delaware Shellfish Growers Forum, a monthly seminar program for New Jersey shellfish aquaculturists to promote an educated industry and responsible and sustainable aquaculture. Back to Goals

15946 - Needs Assessment Conducted to Identify New Jersey Oyster Aquaculture Industry's Training and Research Priorities, 2011

RELEVANCE:
The cultivation of eastern oysters using rack and bag, and other containerized culture techniques in the Delaware Bay, New Jersey has emerged as a vital and growing aquaculture industry, with production increasing 10 fold since 2000. The potential for growth is tremendous and recent advances of New Jersey State aquaculture policy promote new opportunities for expansion.

RESPONSE:
In order to better direct NJSG extension efforts, a survey was conducted to define the needs and challenges of the oyster aquaculture industry in New Jersey.

RESULTS:
NJSG conducted a needs assessment survey, which was completed by eleven industry participants, including all current oyster aquaculturists working in Delaware Bay, NJ. Participants ranked water quality, fouling, and disease as high priority industry issues and viewed the evaluation of genetically improved oyster stocks, control of fouling organisms, and Vibrio as priority research topics. The survey has informed NJSG aquaculture program development and implementation, which will focus on areas of greatest priority to the industry.

RECAP: NJSG conducted a needs assessment to identify training and research priorities of New Jersey oyster culturists. The assessment results are being used to inform the development of extension programs and better promote the expansion of oyster aquaculture in New Jersey. Back to Goals

15945 - Site-Specific Performance Evaluations of Disease Resistant Oyster Stocks Enhance Oyster Aquaculture Production, 2011

RELEVANCE:
Oyster aquaculture presents a viable means to supplement depleted wild oyster harvests to meet the growing demand for safe and sustainable seafood and support economic development in New Jersey's Delaware Bayshore region.

RESPONSE:
Working in partnership with two oyster growers, common-garden experiments were initiated to evaluate survival growth and production potential of 5 oyster strains including triploid and diploid selected disease resistant strains and wild stocks. The experiments will prove important in identifying site-specific best performing production stocks, informing grower's future oyster seed purchases, and enabling oyster growers to increase production and reduce costs by growing the best performing oyster strains.

RESULTS:
The experiments were initiated in Fall 2011 and the study remains underway. Cooperating industry members have learned how to establish appropriate experimental designs and assess oyster stock performance. Annual stock assessments will be implemented to identify best production stocks for their farm locations.

RECAP: NJSG has integrated scientific assessments of oyster stock performance at two local oyster farms, enabling growers to identify best performing oyster strains, thereby enhancing oyster production, supporting the growing consumer demand for quality oysters, and promoting economic development in the New Jersey's Delaware Bayshore region. Back to Goals

14149 - Aquaculture Agent

In 2010 New Jersey Sea Grant (NJSG) and Rutgers University's Institute of Marine Sciences' Haskin Shellfish Research Laboratory submitted a successful proposal to the NSGCP through its NSI to support a shellfish aquaculture agent for three years. Rutgers and NJSG have developed and signed an MOA to manage the grant and the shellfish aquaculture agent. The agent will be hired and begin extension work in 2011.

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13957 - Marker Assisted Breeding in Eastern Oysters - Guo

(2010) This project targeted new breeding technologies in support of the oyster aquaculture industry. The PI successfully developed a 16-multiplex microsatellite assay, a first, in a single reaction in an aquaculture species. This is a breakthrough in microsatellite genotyping in oysters. This high level of multiplexing greatly saves time and cost, making marker-assisted breeding feasible. It provides a powerful tool in pedigree analysis, population genetics and other genetic studies. Vigor in certain hybrid families was most likely due to improved survival by larvae with high genetic diversity. However, results suggest that disease resistance at the adult and larval stage may not be from the

same trait. The PI identified top 10 families to be used in their breeding program.

The eastern oyster is one of the most important marine resources in the US supporting important fishery and aquaculture industries. During the past 50+ years, over-fishing, habitat destruction and diseases have decimated eastern oyster populations and their attendant communities in much of the mid-Atlantic region including Delaware Bay. Oyster aquaculture has the potential to ease the economic stress in coastal communities and to satisfy the demand for high quality oysters without adding additional fishing pressure to wild stocks. Many states and federal agencies have been actively promoting oyster aquaculture and restoration. The disease-resistant strains developed at Rutgers University are widely recognized by the industry. This study provides key technologies for family-based selection, which may lead to the development of new and superior lines and contribute significantly to the eastern oyster industry.

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13951 - Impacts of swim bladder parasites on American eel - Sullivan
(2010) The PI's main objectives were to establish the pattern of Anguillicola crassus infection from American eels collected in New Jersey; evaluate the biological consequences of infection via metabolic profiling; and develop a significant outreach component to the reseearch.

This study showed that the prevalence of the parasite across all samples collected in New Jersey was 26.3%, but with young-of-the-year individuals omitted this value rose to 55.2%. Glass eels and early stage eels through stage 3 did not show evidence of infection with A. crassus. The low infection rate among early young-of-the-year individuals may reflect aspects of diet or a physical size limitation of the bladder itself. Efforts to artificially infect wild-caught glass eels in the present study were unsuccessful.

Preliminary analysis from this study suggests that parasitized eels show more variability in their metabolic make-up than non-parasitized eels (controlling for stage, size, and location effects). This result is possibly tied to the increased energy needs of harboring an invasive parasite.

This project had an extensive outreach component that ranged from public continuing education lectures and programs, to trade newsletters, teacher workshops, Sea Grant staff presentations, undergraduate classroom activities, lesson plans and curricula for K-12 educators, as well as significant interactions with NJDEP colleagues and their sampling programs involving commercial fishers. The project supported 17 Stockton undergraduates and 4 graduate students from various institutions, and 30 Stockton undergraduates that took part in eel parasite dissections as part of the PI's Introduction to Ichthyology course.

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Program Performance Measures (2010 - 2013)

Program Performance Measure	Program Plan Target (2010-2013)	Reported	Program Comments
Targeted RFP	1	5	2011 - anticipated to add 1 for 2012 RFP 2012 - 2012 - added SSSS research relevancies to omnibus RFP. Acheived number (3) is cumulative.
Determination of economic value of recreational fishing by NJMSC/NJSG sponsored research.		0	2010 - Directed RFP for this research project to be released in January 2012. 2011 - anticipate RFP release in 2012 to determine answer 2012 - 2012 - have included this relevancy in Omnibus RFPs with no success in funding. Will work with PO to eliminate.

Number of fisheries management and industry decisions incorporting information supplied by NJMSC/NJSG and NMFS as measured by citation or reference.	4	0	2010 - targeted for 2013 2011 - working with NMFS on methods to supply information re-evaluate PM as well 2012 - 2012 - This PM will be eliminate after discussion with PO.
Number of oyster aquaculture operations created due to paricipation in a 2-year training program expected to continue to develop commercial operations after the training period.	2	3	2010 - Aquaculture agent hired in Sept 2011. 2011 - agent to begin training in 2012 2012 - (2012) â€" monthly forum series inform growers, training program scheduled for 2014
Number potential consumers reached during events.	1,200	0	2010 - This item on hold for reconsideration or modification pending discussions with NJDA Seafood Program 2011 - reassessing ability to do so with NJDA Seafood Program 2012 - 2012 - after continued discussion with NJDA Seafood Program, this PM will be eliminated.

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Program Objectives (2010 - 2013)

Program Objective	Achieved (yes/no)	Program Comments
By 2012, the economic value of recreational fishing in NJ coastal communities will be determined through NJMSC/NJSG research, then presented in a document.	No	2010 - Directed RFP for this research project to be released in January 2012. 2011 - Directed RFP for this research project to be released in January 2012. 2012 - Eliminating this objective. See notes in PM section. Working with PO on this.
By 2013, NJMSC/NJSG will exhibit jointly with the NJ Dept. of Ag, Seafood Program at public outreach events during which a combined total of 5000-10,000 potential consumers have access to information about sustainable harvest.	No	2010 - This item on hold for reevaluation pending discussions with NJDA Seafood Program. 2011 - This item on hold for reevaluation pending discussions with NJDA Seafood Program. 2012 - Discussions with NJDA Seafood Program indicate that this objective cannot be reached. Will eliminate it working through PO.
By 2013, NJMSC/NJSG will have identified needs for research in the area of safe and sustainable seafood supply.	Yes	2010 - SSSS research priorities were identified by the NJSGC Stakeholder Advisory Board and included in the 2011 RFP. 2011 - SSSS research priorities were identified by the NJSGC Stakeholder

		Advisory Board and included in the 2011 RFP.
By 2013, two fisheries management and industry decisions have incorporated information supplied by NJMSC/NJSG and NMFS.	No	2010 - Have worked with Sandy Hook NMFS to begin this activity. 2011 - Have worked with Sandy Hook NMFS to begin this activity. 2011 - still working on protocol to do so. Neeed to reaccess 2012 - Have discussed with NMFS Howard Lab. Objective not acheivable. Will work with PO to eliminate or modify.
By 2014, the economic cost savings of various oyster aquaculture techniques will be determined and made available to the industry.	Yes	2010 - Shellfish Aquaculture Agent was hired in Sept. 2011. 2011 - Shellfish Aquaculture Agent was hired in Sept. 2011. 2012 - . (2012) subtidal gear evaluations completed
By 2014, twenty oyster aquaculturalists adopt appropriate cost effective harvest restrictions and production methods that reduce Vibrio in oysters that result in improved public safety.	No	2010 - Shellfish Aquaculture Agent was hired in Sept. 2011. 2011 - Shellfish Aquaculture Agent was hired in Sept. 2011. 2012 - (2012) two harvesters implementing proper methods three others will adopt fall 2012. Will work with PO to modify to lower target.
Two oyster aquaculture individuals that participate in a 2-year training program will continue to develop commercial operations after the training period by 2014.	No	2010 - Shellfish Aquaculture Agent was hired in Sept. 2011. 2011 - Shellfish Aquaculture Agent was hired in Sept. 2011. 2012 - (2012) monthly growers forum offered, training program in development