Sea Grant Mississippi-Alabama

About our program

Since 1972, the Mississippi-Alabama Sea Grant Consortium (MASGC) has focused on marine and coastal science. Our research, extension, legal, communication and education efforts cooperatively address emerging and long-standing coastal issues facing the two states and Gulf of Mexico.

Nimble and Adaptive
Economic downturns, natural disasters (Hurricane Katrina) and unprecedented technological disasters (Deepwater Horizon Oil Spill) define MASGC's need to be nimble and adaptive. These stressors caused negative coastal impacts in Mississippi and Alabama. MASGC responds using multifaceted approaches to adapt programming to rapidly respond to emerging needs. Examples include funding innovative research and implementing new outreach activities to improve recovery and resilience of communities and industries.

An Uncommon Sea Grant Model
MASGC is one of only two bi-state Sea Grant programs in the 33-program network. We're different because we have nine member institutions, while most programs are hosted at one university. The vice presidents of research or lab directors from the nine member institutions form MASGC's Board of Directors. The board oversees our program and creates policies. A 19-member advisory council, which includes coastal experts from diverse backgrounds, provides input on coastal needs and opportunities and strategic direction for our research and outreach programs.

MASGC is a boundary organization using a matrix management approach for education, extension, communications and legal staff who are housed at seven different locations and are employed by six universities/laboratories/environmental centers. University appointments and cost-share positions with other organizations allow us to increase our capacity. Our education and workforce development efforts also take an integrated approach. Our program supports three learning centers on the Gulf Coast, helping to fund key staff members, training for teachers, camps and programs for K-12 students, and science learning opportunities for adults.

A Leader in the Region
Through a four-year strategic plan, MASGC addresses high priority local needs of regional and national importance. MASGC is a leader in regional partnerships, regional coordination, strategic planning and implementing on-the-ground programs around the region. MASGC partners with other agencies and Sea Grant programs in the Gulf to address regional research, outreach and restoration needs. With input from thousands of people, we developed the Gulf of Mexico Regional Research Plan, which has identified priorities that funding agencies have used to competitively fund $7M in research projects. In addition, we have supported restoration of more than 3,000 acres through coordinating a partnership between the NOAA Restoration Center and the four Gulf Sea Grant programs.

Service-Oriented
A core value for MASGC is to serve others. We fund research that can be used by others; translate novel and applied science-based results; and implement innovative outreach, extension and education programs to improve the lives of people, communities and ecosystems. We address a range of issues including habitat restoration and conservation, coastal community resilience, climate change, marine aquaculture, workforce development and environmental literacy, sustainable fisheries and working waterfronts.

Sea Grant Mississippi-Alabama

MASGC efforts help shrimp fleet stay in business

Although shrimp continues to be the leading seafood item consumed in the United States, domestic producers of wild-caught shrimp face an uncertain future. While the shrimp resource is healthy, operational circumstances over the years have taken their toll on producers. Increasing fuel costs, continued by-catch reduction regulations, shrimp imports and the general lack of business planning skills place additional stress to an industry historically caught in a unique set of operating conditions best characterized as "landing a high-dollar product that provided a low profit margin."

Since 2001, record volumes of imported shrimp have caused the domestic shrimp industry to experience unprecedented declines in the prices fishermen receive for their catch. On the cost side, the dramatic run-up in diesel fuel prices significantly increases production expense for operators. This combination of conditions creates a significant operating-cost burden for wild-caught shrimp producers.

How MASGC responded:

- In Alabama and Mississippi, 789 shrimpers each received 12 hours of Intensive Technical Assistance under the Trade Adjustment Assistance Program for Shrimpers, making each eligible for $4,000 in cash benefits. So far, this totals $3,156,000 in additional earnings for these shrimpers.

- More than 20 shrimp vessels have adopted the use of energy-efficient trawl gear. All reported fuel savings similar to MASGC field trials, and most operators have continued to use the gear. Each vessel is saving about $10,000 a year in operating costs. Total savings to the fleet has topped $1 million since the program's inception.

- MASGC held "Seafood Savvy" community events and educated more than 300 people on why to buy, how to buy, and how to cook local seafood. More than 300 people met chefs and fishermen and tried their recipes.

- MASGC developed training materials and held workshops and one-on-one meetings to help businesses create profiles for the online MarketMaker marketing tool. Hundreds of seafood producers, processors and suppliers in Mississippi and Alabama created listings on MarketMaker, which lists locations of food businesses and the local products they sell.

MASGC performs free gear inspections

Shrimpers are required by law to have their gear properly outfitted with turtle excluder devices (TEDs) and bycatch reduction devices (BRDs). In 2014, MASGC fishery specialists conducted dockside TED and BRD courtesy examinations on more than 50 vessels in Mississippi and Alabama. Using the same protocols that enforcement agents use, MASGC staff demonstrated the proper methods for measuring grid angles, escape openings and cover flap length. About a third of the boats had gear compliance issues that were fixed before the boats left the dock.

Oyster aquaculture becomes new industry in Alabama

Despite thriving off-bottom oyster aquaculture in other parts of the United States, establishing similar businesses in the Gulf of Mexico have been slow to develop. This is primarily due to the lack of technology transfer programs, effective means of controlling bio-fouling and the perception that the dockside value was too low. While these immediate obstacles were overcome with MASGC-funded research and extension, the small, newly established industry faces a number of challenges, including regulatory issues, the need for insurance and loan programs, food safety concerns, threats to water quality and the need for business planning tools and training.

Despite hurdles, with recent regulatory changes, the industry is poised to start in Mississippi, with additional interest in spat-on-shell for bottom culture.

MASGC's research and outreach on oyster farming industry has led to many impacts:

- Nine new commercial oyster farms have been established in Alabama, with a total farm-gate value exceeding $825,000 to date, which is expected to more than double in 2015, increasing incomes and generation of local jobs (at least 6 full-time positions and over 10 part-time positions).
- At least 5 wholesalers in Alabama also profited from the sales of farmed oysters.
- Two new oyster equipment companies were established in Alabama, with total sales since inception of well over $100,000.
- Alabama House Bill 361 led to a streamlined permitting process, which cut leases from about $6,000 per acre to around $200 per acre.
- In partnership with Organized Seafood Association of Alabama, MASGC has conducted a hands-on training program Oyster Farming Fundamentals, which has trained 16 adult students that have collectively raised 350,000 oyster seed, and developing a "vo-tech" program that trains high school students to be oyster farmers.

Potential oyster farmers learn about the industry in a hands-on training program.

High Salinity Depuration shows promise in reducing risks of consuming raw oysters

MASGC-funded scientists tested if depuration under high salinities could be used as an alternative post-harvest processing (PHP) method that will reduce the pathogen to desired levels without killing the oysters (to preserve the raw oyster market during the summer months).

Data showed that reduction of *V. vulnificus* numbers in oysters is possible through depuration using high salinity. High salinity (35 psu) was the most efficient treatment and was able to eliminate bacterial numbers to non-detectable levels in 2 out of 4 of the trials. The second three trials supported the effectiveness of high salinities, but did not see an effect of temperature on the process. It supports the potential of using high salinities to reduce *V. parahaemolyticus* in oysters.

Cost-effective test kit detects bacteria in oysters

With MASGC funding, a team from Mississippi State University and the U.S. Food and Drug Administration developed a rapid, easy-to-use and reliable *Vibrio vulnificus* test for oyster processing.

Six companies and universities are evaluating the low-cost *Vv* kit that will expand the

industry's capacity to develop new post-harvest processing approaches, such as high salinity relaying or depuration. Another company is expressing interest in commercializing the test.

Rapid (18-20 h), simple sample preparation (5 min/sample) and definitive interpretation (easy to read on result, positive-black, negative-yellow) on the *Vv* assay kit significantly reduced operational requirements.

Project boosts awareness of farmed oysters

MASGC-supported survey results indicated that Gulf residents are willing to pay at least some premium price for branded Gulf oysters, and non-Gulf consumers are also favorable toward Gulf oysters.

Based on the results of this project, the Gulf Oyster Industry Council received external funding to market branded Gulf oysters.

MASGC improves inland, on-shore aquaculture techniques

Over the past decade, there have been numerous attempts at establishing inland marine shrimp farms, marine bait production and better blue-molting technologies. Most have been unsuccessful. Poor survival of larvae, marketing, and land/labor costs, make it difficult to compete with foreign imports and wild production. A small number off successful private sector operations have been able to survive by developing specialty products and niche markets. Examples include bait shrimp production and inland marine shrimp farms located away from expensive coastal property. This is a new paradigm for producers in the region and is being fueled by the slow-foods movement for shrimp and more reliable supplies of soft-shell blue crabs and marine bait.

Research, outreach increase shrimp survival

In Alabama, producers are now more aware of the effects of shifting temperature and salinity and their effects on shrimp survival. Adoption of these techniques has led to better survival during the production season. Increased survival at acclimation has allowed farmers to increase their production at harvest by more than 500 pounds per acre compared to when the study began in 2008.

The annual economic impact is approximately $1.2 million to date ($200,000 per year).

New filter improves water quality in system

Recirculating aquaculture systems address many of the risks associated with pond or open-ocean aquaculture and provide opportunities for the development of a domestic aquaculture industry. In partnership with Aquaculture Systems Technology, LLC, MASGC designed and installed a two-stage treatment system.

The system incorporates geotextile bags to dewater the solid wastes, and it uses a series of mechanical and biological processes to remove excess nutrients, such as phosphorus and nitrates, so that the water can be recycled and effluent minimized. Recirculation marine aquaculture systems removed nutrients from water. Solids collected from the geobags increased several indicators of growth in two species of marsh plants compared to the control. Some plant species adapted better to the high salinity than others, indicating the need for acclimation to maximize nutrient removal.

Seminal publication

Nakatsuji, T., Watson, R.D., and Sonobe, H. (2011) Endocrine control of molting in crustaceans. In: Biology of Molting and Metamorphosis: Mechanism of Hormonal Regulation in Insects and Crustaceans, H. Sonobe and H. Nagasawa (Eds.), Tokai University Press, pp. 399-418.

Fishermen, crews receive required boat safety training

Commercial fishing is the most dangerous occupation in the United States. Unfortunately, the Gulf of Mexico region leads the nation in fatal occupational injuries sustained during fishing operations each year. In order to address this issue, the Coast Guard and Maritime Transportation Act of 2012 contains requirements for crew training and vessel safety equipment, which are currently being phased in across the entire U.S. commercial fishing fleet.

Information and technology transfer to fishers in the northern Gulf is hampered by the large numbers of Asian-American vessel owner/operators, many of whom have limited English language skills. In order to be most effective, instructors for the required safety training courses need to be fluent in the Vietnamese language, as well as English, while at the same time possessing the required Coast Guard instructor certifications. There is currently a shortage of instructors with Vietnamese language credentials in the region.

Top: MASGC Fisheries Technologist Peter Nguyen works with fishermen on how to make Mayday calls. Bottom: He performs water safety drills.

How Sea Grant responded:

To date, a total of 73 fishermen in Mississippi and Alabama have become Coast Guard Certified Commercial Fishing Vessel Safety Drill conductors as a result of MASGC's role in organizing and implementing training. At least one fisherman survived an at-sea accident after his MASGC training.

MASGC seafood safety training saves large seafood sales account

Hazard Analysis and Critical Control Points (HACCP) training by an MASGC extension specialist prevented one seafood processor from losing a significant national supermarket chain account and shutting down permanently because its employees did not have adequate HACCP training.

Working with the owners of the processing company, MASGC quickly certified employees in HACCP, and the operation reopened within 36 hours. This training saved the account and the business.

MASGC executes quick, local response to oil spill needs

On April 20, 2010 the Deepwater Horizon oil rig exploded and released approximately 200 million gallons of oil that spread across 29,000 square miles in the Gulf of Mexico. This event was the largest environmental disaster ever experienced in the United States.

Communities, both natural and human, throughout the region were directly or indirectly impacted by the oil spill. Fishing grounds were closed, tourists went elsewhere, resource managers and cities scrambled to identify and protect sensitive habitats, and residents throughout the region had many unanswered questions about the scope, scale and longevity of the spill's impacts on them, their families and their communities.

Oil spill responders and coastal residents suffered mental and physical health issues. Many questions remain unanswered five years after the oil well was capped, and the long-term impacts are not yet known.

MASGC led or provided substantial support for 48 oil-spill-related trainings, workshops and forums.

How Sea Grant responded:

MASGC addressed the oil spill and the communities it serves through all four focus areas including the following activities within Safe and Sustainable Seafood Supply:

- Developed an oil spill science outreach program, which includes a dedicated extension specialist in each of the four Gulf of Mexico Sea Grant programs to work exclusively on oil spill science outreach. In addition, the half-time coordinator of this effort is based at MASGC. Funding is provided by the Gulf of Mexico Research Initiative.
- Organized a seafood working group with cooperative extension to provide guidance and coordination regarding seafood safety, fisheries closures and approaches to re-opening closed fisheries.
- Brought Alaska fisheries experts to the region to meet with fishing industry and resource managers and learn what to expect based on the Exxon Valdez oil spill
- Serves as science advisor on Alabama Seafood Marketing Commission.
- Led or facilitated large-scale town hall meetings (more than 500 attended) and small-scale dockside meetings to inform residents and community leaders of the status of the oil spill.
- Trained (directly or indirectly) more than 7,000 peer listeners to help friends and family with mental-health challenges related to the oil spill.
- Provided legal explanations, translation services, assistance regarding the damage claim process and other services.
- Cooperative extension and Sea Grant extension formed a team consisting of four task forces to address oil-spill issues.
- Worked with NOAA's external affairs office to foster communication between constituents and NOAA. Served as the local-knowledge source to help federal partners understand the political landscape within affected communities.
- Was involved with the development and implementation of state oil-spill recovery plans in Alabama and Mississippi and the implementation of recommendations from the Gulf Coast Ecosystem Restoration Task Force.
- Led or provided substantial support for 48 oil-spill-related trainings, workshops and town hall meetings with more than 2,600 participants.

PIER PRP Program Focus Area Report

Mississippi-Alabama Sea Grant Consortium

Safe and Sustainable Seafood Supply

Program Focus Area: SAFE AND SUSTAINABLE SEAFOOD SUPPLY

Program Goals

1. A sustainable supply of safe seafood that meets public demand at affordable prices.
2. A healthy domestic seafood industry that harvests, produces, processes and markets seafood responsibly and efficiently.
3. Informed consumers who understand the importance of ecosystem health and sustainable harvesting practices to the future of our domestic fisheries, who appreciate the health benefits of seafood consumption and who understand how to evaluate the safety of the seafood products they buy.

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Full Text of Impacts
Program Performance Measures
Objectives

Impacts and Accomplishments toward Program Goals

1. **Program Goal: A sustainable supply of safe seafood that meets public demand at affordable prices.**
   Impact(s)
   - 21402 - Trawl gear programming reduces operation costs of Gulf of Mexico shrimpers
   - 21399 - HACCP training helps local seafood business retain national supermarket account
   - 21397 - Inland shrimp farming operations improve production and projects by increasing survival of juvenile shrimp
   - 21387 - Ecosystem services provided by oyster projects funded by MASGC
   - 21322 - Mississippi-Alabama Sea Grant serves coastal communities during oil-spill crisis

   Accomplishment(s)
   - 21508 - MASGC Offers Dockside TED and BRD Courtesy Exams
   - 21507 - Project increases awareness of Gulf of Mexico oyster appellations
   - 21506 - New, efficient and cost effective test kit detects bacteria in oysters and nears commercialization
   - 21426 - MASGC provides critical leadership coastal science and outreach throughout Gulf of Mexico

2. **Program Goal: A healthy domestic seafood industry that harvests, produces, processes and markets seafood responsibly and efficiently.**
   Impact(s)
   - 21402 - Trawl gear programming reduces operation costs of Gulf of Mexico shrimpers
   - 21401 - Integrated program responsible for the creation of oyster farming industry in Alabama.
   - 21400 - Commercial Fishing Vessel Safety Drill Conductor Training
   - 21399 - HACCP training helps local seafood business retain national supermarket account
   - 21397 - Inland shrimp farming operations improve production and projects by increasing survival of juvenile shrimp
   - 21396 - Trade Adjustment Assistance training leads to more than $2M in direct payments to Alabama, Mississippi shrimpers
   - 21387 - Ecosystem services provided by oyster projects funded by MASGC

   Accomplishment(s)
   - 21516 - Innovative application of classic microbiology for detecting Vibrio vulnificus in raw and post-harvest processed oysters
   - 21515 - Next generation sequencing methods provide the bases for sustainable genetic management of stock enhancement
   - 21511 - The Impacts of Gear Regulations in the Northern Gulf of Mexico Recreational Reef Fish Fishery
   - 21508 - MASGC Offers Dockside TED and BRD Courtesy Exams
   - 21506 - New, efficient and cost effective test kit detects bacteria in oysters and nears commercialization
   - 21503 - High Salinity Depuration shows promise in reducing risk associated with consumption of raw oysters
   - 21502 - New filter improves water quality in recirculating marine aquaculture system, provides nutrients to enhance marsh plant growth
   - 21501 - Linkages among urbanization, human health, and ecology enhance detection of

contaminated shellfish across two states.
- 21498 - Sea Grant expands information on the environmental requirements for the culture of bait shrimp.
- 21426 - MASGC provides critical leadership coastal science and outreach throughout Gulf of Mexico

3. **Program Goal: Informed consumers who understand the importance of ecosystem health and sustainable harvesting practices to the future of our domestic fisheries, who appreciate the health benefits of seafood consumption and who understand how to evaluate the safety of the seafood products they buy.**

Impact(s)
- 21381 - The Oyster Trail public art, education project supports oyster gardening program
- 21332 - Gulf Sea Grant programs leverage more than $10 million in resources to address regional needs, strengthen regional partnerships
- 21322 - Mississippi-Alabama Sea Grant serves coastal communities during oil-spill crisis
- 21194 - More than 150,000 K-12 teachers and students increase marine science and STEM literacy through hands-on programs

Accomplishment(s)
- 21516 - Innovative application of classic microbiology for detecting Vibrio vulnificus in raw and post-harvest processed oysters
- 21514 - Smartphone Apps Help Protect Marine Mammals in the SE US
- 21513 - Research indicates that blue crabs may be at risk from the invading Asian tiger shrimp
- 21512 - Research finds native brown and white shrimp are only rarely consumed by Asian tiger shrimp
- 21511 - The Impacts of Gear Regulations in the Northern Gulf of Mexico Recreational Reef Fish Fishery
- 21510 - MASGC Seafood Marketing Outreach Connects Consumers with Local Seafood
- 21509 - Seafood Savvy Events Teach Consumers How to Buy, Cook Local Seafood
- 21507 - Project increases awareness of Gulf of Mexico oyster appellations
- 21506 - New, efficient and cost effective test kit detects bacteria in oysters and nears commercialization
- 21503 - High Salinity Depuration shows promise in reducing risk associated with consumption of raw oysters
- 21457 - Certified Master Naturalists provide 4,265 volunteer hours and reach 15,996 coastal residents
- 21413 - Educational TV messages teaches large numbers of coastal residents best stewardship practices
- 21407 - Formal and informal educators improved their content knowledge and pedagogy (instructional skills) of the Deepwater Horizon Oil Spill

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Full Text of Impacts and Accomplishments

21516 - Innovative application of classic microbiology for detecting Vibrio vulnificus in raw and post-harvest processed oysters

Relevance: Recently implemented strict time and temperature controls appear to have had little success in reducing V. vulnificus illness and mandatory PHP of Gulf oysters continues to be FDA's policy toward reducing this risk. The need for more efficient and cost effective Vibrio detection methods for PHP validation and verification is likely to increase. The high cost of current V. vulnificus methods deters PHP progress for all but the largest processors and threatens the viability of the Gulf oyster industry. A simple and economical in-house testing program in the oyster processing facilities provides a smarter business model to advance PHP technology and sustain the Gulf oyster industry.

Response: The team of Mississippi State University and FDA has developed a simple, rapid and low cost Vv assay kit to currently accepted methods that will expand industry capacity to develop new PHP approaches such as high salinity relaying or depuration.

Results Rapid and simple sample set-up (5 min/sample), short time to results (18-20 h), and easy to read results (positive=black, negative=yellow) of the Vv assay kit significantly reduces operational requirements. Low-cost reagents and components in assay kit also reduce the total cost of Vv analysis. The Vv assay kit is designed for minimally equipped laboratories to test Vv for validation and verification of PHP oyster processes.

RECAP: The rapid, easy-to-use and cost-effective Vv assay kit can be used as a reliable tool to detect V. vulnificus in oyster samples. Back to Goals

21515 - Next generation sequencing methods provide the bases for sustainable genetic management of stock enhancement

Relevance: Delineation of management units for stock enhancement of marine species is currently

limited because traditional methods to assess population structure cannot assess effectively local genetic adaptation although the latter is of primary importance when planning releases of organisms during enhancement.

Response: A new approach based on next generation sequencing (RAD-Tag sequencing) and genome mapping is used to develop genome scans and detect genomic regions involved in local adaptation of populations. The method is tested to analyze population structure and assist in the design of management units in the red snapper, a species candidate for stock enhancement.

Results (in progress): A linkage map is being developed based on 5 red snapper families and used to map and orient genome contigs. Geographic populations of the red snapper are being characterized using the RAD-Tag sequencing method. Analysis of three populations off the U.S. east coast, eastern and Western Gulf of Mexico to date revealed some candidate SNPs and genomic regions involved in spatially divergent selection. Data analysis is still on going and the results will be used to assist in the design of a genetic management plan including the spatial allocation of releases and the design of a panel of genetic markers suitable for accurate monitoring of targeted populations during enhancement.

RECAP: Implementation of the RAD-tag sequencing method provides information needed to develop sustainable genetic management plans for an exploited species candidate for stock enhancement. The results will be available to facilitate decision regarding permitting and spatial allocation and assessment. The approach can be easily developed in other non-model species. Back to Goals

21514 - Smartphone Apps Help Protect Marine Mammals in the SE US

Relevance: All marine mammal species are federally protected under the Marine Mammal Protection Act (MMPA), and several of these species are afforded protection under Endangered Species Act (ESA). As such, NOAA and other federal agencies are faced with numerous challenges to enhance the protection, conservation, and management of these protected species. One of the main challenges involves stranded marine mammals. Agency scientists are confronted with the challenge of trying to first locate stranded animals and then respond to them in a timely manner in order to obtain valuable data and/or initiate rescue/rehabilitation efforts. These efforts are particularly hindered in large areas of the Southeast U.S. coast that are sparsely populated and visited by humans on a relatively infrequent basis. Data on mortality rates and causes of death of marine mammals are critical to understanding the health of populations and for informing management decisions. In addition, quick responses to live stranded animals increase their chance of survival, thus promoting conservation of the species or population.
Another challenge in the conservation of protected species involves public harassment. There is a great need for education of the general public and tour operators when it comes to interactions with wild marine mammals. Many people who encounter wild marine mammals do not abide by the MMPA feeding and harassment regulations or NOAA's viewing guidelines to minimize harassment. Harassment and feeding violations are particularly evident in the Southeast U.S. where food provisioning is common, and tour operators do not always follow the viewing guidelines to minimize harassment.

Response: Geo-Marine, Applied Research Associates, and the NOAA Fisheries Service worked together to promote marine mammal conservation by developing and disseminating two smartphone apps to enhance accurate and timely reporting of strandings and encourage responsible viewing of marine mammals in the Southeast U.S. The use of smartphone apps to assist in the reporting of stranded marine mammals is an innovative and potentially extremely effective method for increasing the overall number of reports as well as the awareness of the general public. In addition to the stranding app, the viewing/identification app will inform the public on appropriate ways to enjoy viewing wild marine mammals without harming or harassing them.

Results: The apps are published and currently being downloaded for free by the public. NOAA is promoting these apps via their outreach plan which is targeting the general public. As of April 1, 2015 the apps have had a total of 6,213 downloads. The program has been successful and NOAA is currently modifying the app to expand the data for its use in the Northeastern U.S. region and plan to further expand to other regions.

RECAP: In partnership with NOAA Fisheries, MASGC funded the development of two smartphone apps that are being used to identify and promote responsible viewing of dolphins and facilitate the reporting of stranded animals to the network. Back to Goals

21513 - Research indicates that blue crabs may be at risk from the invading Asian tiger shrimp

Relevance: As Asian tiger shrimp continue to appear in commercial shrimp catches in estuarine and coastal water of the Gulf coast, researchers are anxious to determine what species may be impacted by the new invaders.

Response: To determine what estuarine species may be prey for Asian tiger shrimp, researchers at the Dauphin Island Sea Lab examined the tiger shrimp's food preferences amongst multiple estuarine species including marine worms, small bait fish, juvenile shrimp, and juvenile blue crabs.

Results: Tiger shrimp often preferred to eat small marine worms or juvenile blue crabs amongst all

other species indicating that blue crabs and blue crab fisheries may be impacted if tiger shrimp populations rise on the Gulf coast.

RECAP: Tiger shrimp readily consume blue crabs in tanks and further research is needed to understand how tiger shrimp may impact blue crab fisheries. Back to Goals

21512 - Research finds native brown and white shrimp are only rarely consumed by Asian tiger shrimp

Relevance: The newly established exotic Asian tiger shrimp are extremely large compared to native shrimp species, often weighing up to 0.5 lb per shrimp, and are known to eat shrimp and other crustaceans in their native habitats in the Indo-Pacific Ocean provoking concerns that this new invader may pose a predation risk to commercially important brown and white shrimp. However, no one has previously determined whether tiger shrimp can and/or will consume Gulf coast shrimp species or how native shrimp will respond to newly invasive tiger shrimp.

Response: Researchers at the Dauphin Island Sea Lab utilized the cooperation of local shrimpers to obtain live tiger shrimp and examined the propensity of tiger shrimp to consume adult and juvenile native brown and white shrimp in lab tank experiments. They also examined how native shrimp behaviorally responded to large tiger shrimp predators.

Results: Tiger shrimp generally attempted to attack and eat native shrimp; however, their success rate in capturing shrimp was very low, resulting in low overall predation rates on adult native shrimp and moderate-low predation rates on juveniles. These low predation rates indicate that tiger shrimp do not pose a significant predation threat to native shrimp; however, attempted predation by tiger shrimp also often chased native shrimp out of their preferred sandy bottom habitats.

RECAP: Tiger shrimp do not pose a significant predation threat to native shrimp which may lessen the threat to commercial shrimp populations. Back to Goals

21511 - The Impacts of Gear Regulations in the Northern Gulf of Mexico Recreational Reef Fish Fishery

Relevance: The northern Gulf of Mexico reef fish fishery is composed of several million anglers from multiple commercial and recreational sectors across the 5 Gulf states. Reef fish resources are managed using a complex system of annual quotas, trip limits, daily bag limits, and minimum length limits, which result in millions of reef fishes being discarded each year. Many released fishes do not survive and thus represent wasted fishery resources. Minimizing fishery waste is a top priority of U.S. fisheries management as evidenced by the reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) in 2007. The MSFCMA mandated the use of non-stainless steel circle hooks when fishing for reef fishes to increase survival of released fishes and help rebuild overfished stocks. Subsequent research efforts reported positive benefits to the fishery but other potential effects of gear regulation changes have not been empirically evaluated.

Response: Through two field experiments we tested the effect of different hook types and sizes on reef fish traumatic hooking rates, catch composition, catch rates, and selectivity. Modeling exercises are being conducted to incorporate empirical data into stock assessments for red snapper and gray triggerfish.

Results: Traumatic hooking of red snapper and gray triggerfish was generally low (<10%) for both circle and J-hooks but greatly increased for smaller, lower value reef fishes. Mandating the use of large circle hooks would likely increase the proportion of catch comprised by red snapper during closed seasons and increase discards. Selectivity functions indicated no significant size selectivity shifts in the red snapper fishery after circle hooks were mandated in 2007 and agrees with sensitivity analyses performed in the red snapper stock assessment. Dome-shaped selectivity patterns estimated in modeling exercises suggest larger gray triggerfish are not selected by gears typically used in the recreational fishery and that selectivity may have shifted to smaller size gray triggerfish as a consequence of regulations in Amendment 27. The direct impact of gear selectivity changes to stock assessment estimates is currently being evaluated as part of this research.

RECAP: Understanding the relationships between hook-and-line gear and catch helps improve regulations intended to reduce bycatch and improve fishery conditions through waste reduction. Back to Goals

21510 - MASGC Seafood Marketing Outreach Connects Consumers with Local Seafood

Relevance: The closures of significant portions of the Gulf of Mexico federal and Mississippi and Alabama state waters to commercial and recreational fishing because of the Deepwater Horizon oil spill in April 2010 altered the production and consumption decisions of residents and tourists in affected communities. The changes in the market perceptions and flow of goods and services generated by the damaged natural resources affected not only households but also the seafood producers and service providers dependent on these natural resources. Following the oil spill, the Gulf States Marine Fisheries Commission (GSMFC) funded MarketMaker programs for each of the five Gulf of Mexico states via the Oil Disaster Recovery Program to help with economic recovery efforts for the Gulf seafood industry.
Response: The Mississippi MarketMaker website went live in 2007, and the Alabama MarketMaker website went live in 2011. The sites offer Alabama and Mississippi fishermen, seafood processors, wholesalers, retailers and restaurants, charter boats for hire, and farmers a free opportunity to connect

with potential customers and establish networks with other producers online. The MarketMaker websites use an interactive mapping system coupled with a searchable database to locate producers and businesses with local products for sale. MASGC conducted extensive outreach to familiarize producers with the tools and resources available through MarketMaker, developed and disseminated training materials, and conducted training workshops for producers, regulators, and research/extension faculty and staff on how to create profiles and connect with producers and sellers.
Result: The Alabama and Mississippi MarketMaker websites are available to all seafood businesses at http://al.foodmarketmaker.com and http://ms.foodmarketmaker.com/. Since launching the MarketMaker websites, there has been an increase in the listing and registrations of online profiles for fisheries and marine-related establishments to 781 businesses and an increase in the number of web users to 17,111 users and web views to 39,237.

RECAP: Mississippi-Alabama Sea Grant led efforts to help seafood producers, restaurants, and other seafood-related businesses take advantage of the free marketing online marketing tool, MarketMaker.

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21509 - Seafood Savvy Events Teach Consumers How to Buy, Cook Local Seafood
Relevance: The Gulf of Mexico is known for its seafood, but very little is consumed locally. Residents and visitors alike are often unaware of where their seafood comes from or may be afraid to prepare fresh seafood at home.

Response: As part of MASGC seafood marketing outreach efforts, MASGC developed the Seafood Savvy educational seminars to provide consumers a direct connection to local, seasonal seafood and industry members and chefs. The goal of the Seafood Savvy seminars was to help educate consumers about what questions to ask about local seafood so that they can make informed purchasing decisions and be confident in preparing it at home. The seminars were also an opportunity to inform local consumers about tools available to find local seafood, including the Alabama MarketMaker website (http://al.foodmarketmaker.com/). Attendees learned what to look for at a fish market if they are looking to prepare food at home, or what to ask for at a local restaurant when ordering seafood. They also gained a basic understanding of the biology and habits of the featured species.

Result: To date, MASGC has held five Seafood Savvy programs about local seafood at the Windmill Market in Fairhope, Alabama. The seminars have highlighted a number of local wild-harvest and cultured species, including blue crabs, oysters, shrimp, sheepshead, catfish, and red drum. Over 300 people attend these events.

RECAP: To help seafood consumers make informed purchasing decisions, MASGC developed the Seafood Savvy educational series. Five programs have been held to date with over 300 people receiving information on purchasing and preparing local seafood.

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21508 - MASGC Offers Dockside TED and BRD Courtesy Exams
Relevance: Shrimpers are required by law to have their gear properly outfitted with turtle excluder devices (TEDs) and bycatch reduction devices (BRDs). Through normal wear and tear, these devices may fall outside of original design specifications. When this happens, fishermen may inadvertently kill sea turtles and be subject to stiff fines from enforcement agencies who measure TEDs and BRDs for compliance.

Response: In 2014, MASGOP fishery specialists conducted dockside TED and BRD courtesy examinations on over 50 vessels in Mississippi and Alabama. Using the same protocols that enforcement agents use, we demonstrated the proper methods for measuring grid angles, escape openings and cover flap length. When discrepancies were found, we instructed fishermen on how to bring the devices into compliance.

Results: About a third of the boats the MASGC examined had gear compliance issues that were fixed before the boats left the dock.

RECAP: TED and BRD courtesy exams provided by MASGC save turtles and money, while giving fishermen peace of mind that their gear is legal.

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21507 - Project increases awareness of Gulf of Mexico oyster appellations
Relevance: Although they are the same species (eastern oyster, Crassostrea virginica), oysters marketed along the Atlantic Coast sell under regional names such as Wellfleets (from Cape Cod), Blue Points (Long Island) and Chincoteagues (Virginia). Gulf oysters are usually sold as generic oysters with the exception of Apalachicolas (Florida), which comprise the bulk of Florida's oyster harvest. Although there is no clear evidence that they sell at a premium, it is evident that a market has developed for these branded oysters. It was not known if other branded Gulf oysters could demand a premium price.

Response: Promotional tastings of place-named oysters were held in Galveston, Texas, and Dauphin Island, Ala. Results indicated the potential for demand for these premium oysters. An industry member reported that several restaurants in Texas have begun selling a variety of named oysters for a premium price. Three taste panels and online surveys conducted as part of this research have increased the awareness of a variety of Gulf oyster appellations among a targeted audience of oyster consumers at high-end restaurants both inside and outside of Gulf markets.

Results: Preliminary results indicate that Gulf residents are willing to pay at least some premium for branded Gulf oysters, and non-Gulf consumers are also favorable toward Gulf oysters (although there is evidence of a price discount). Also, this project led to the Gulf Oyster Industry Council receiving external funding to market branded Gulf oysters.

RECAP: Awareness of Gulf of Mexico oyster appellations increased as a result of Sea Grant research and industry marketing efforts. Back to Goals

21506 - New, efficient and cost effective test kit detects bacteria in oysters and nears commercialization

Relevance: Recently implemented strict time and temperature controls appear to have had little success in reducing illness from the bacteria (V. vulnificus) and mandatory post-harvest processing (PHP) of Gulf oysters continues to be FDA's policy toward reducing this risk. The need for more efficient and cost effective Vibrio detection methods is likely to increase. The high cost of current V. vulnificus (Vv) methods deters PHP progress for all but the largest processors and threatens the viability of the Gulf oyster industry. A simple and economical in-house testing program in the oyster processing facilities provides a smarter business model to advance PHP technology and sustain the Gulf oyster industry.

Response: Through funding by Sea Grant a team from Mississippi State University and FDA has developed a simple, rapid and low cost Vv kit to currently accepted methods that will expand industry capacity to develop new PHP approaches such as high salinity relaying or depuration.

Results: Rapid (18-20 h), simple sample preparation (5 min/sample) and definitive interpretation (easy to read on result, positive-black, negative-yellow) on the Vv assay kit significantly reduced operational requirements. Low-cost chemical substances in the assay kit also reduced the total cost of the Vv analysis. The Vv assay kit is designed by oyster processors to test Vv in PHP oyster using minimal equipment (portable incubator). Six companies and universities are now evaluating the test kit and another company is expressing interest in commercializing it.

RECAP: The rapid, easy-to-use and cost-effective Vv assay kit can be used as a reliable tool to detect V. vulnificus in oyster samples. Back to Goals

21503 - High Salinity Depuration shows promise in reducing risk associated with consumption of raw oysters

Relevance: Infections caused by Vibrio vulnificus can be fatal in susceptible people and are almost exclusively associated with the consumption of raw oysters. Currently approved postharvest methods eliminate this pathogen but kill the oyster, which results in processed products that lack the taste and appearance of a raw oyster. The Food and Drug Administration is advocating for the implementation of a new guidance requiring postharvest processing (PHP) of Gulf Coast oysters harvested during the months of April through October. If this regulation is approved, the oyster industry will be negatively affected.

Response: We tested if depuration under high salinities could be used as an alternative PHP method that will reduce the pathogen to desired levels without killing the oysters hence preserving the raw oyster market during the summer months.

Results: Our data showed that reduction of V. vulnificus numbers in oysters is possible through depuration using high salinity. High salinity (35 psu) was the most efficient treatment and was able to eliminate bacterial numbers to non-detectable levels in two out of four of the trials. Our second three trials supported the effectiveness of high salinities, but did not see an effect of temperature on the process. It also supports the potential of high salinities for reducing V. parahaemolyticus in the oysters.

RECAP: New oyster processing technique shows promising results in reducing risk associated with consuming raw oysters and is being further examined to reduce variation in the process. Back to Goals

21502 - New filter improves water quality in recirculating marine aquaculture system, provides nutrients to enhance marsh plant growth

Relevance: Recirculating aquaculture systems address many of the risks associated with pond or open-ocean aquaculture and provide opportunities for the development of a domestic aquaculture industry. However, the increased carrying capacity and high water quality required to make recirculating aquaculture systems competitive, as well as stringent discharge regulations, have complicated effluent management. It is therefore critical that a significant percentage of the effluent be recycled to conserve salt and reduce the discharge. To accomplish this, solids must be sequestered from the liquid and the nutrients in the liquid must be reduced before recycling back into the production system.

Response: In partnership with Aquaculture Systems Technology, LLC we designed and installed a two-stage treatment system that incorporates geotextile bags to dewater the solid wastes and uses a series of mechanical and biological processes to remove excess nutrients such as phosphorus and nitrates so that the water can be recycled and effluent minimized.

Results: Recirculation marine aquaculture systems removed nutrients from water. Solids collected from

the geobags increased several indicators of growth in two species of marsh plants compared to the control. Some plant species adapted better to the high salinity than others, indicating the need for acclimation to maximize nutrient removal.

RECAP: An engineered approach to treating marine recirculating aquaculture systems effluent successfully sequesters solids and promotes reuse of the water, and solid and liquid effluent from marine recirculating aquaculture systems serve as an adequate nutrient source for common marsh plants. Back to Goals

21501 - Linkages among urbanization, human health, and ecology enhance detection of contaminated shellfish across two states.
Relevance: As urbanization continues to increase within coastal communities, wastewater discharged into coastal waters increases as well. The inputs of nutrients and pathogens associated with wastewater can adversely impact coastal and estuarine ecosystems, including oysters. In addition, harvesting areas for oysters and other shellfish may be closed due to human health concerns. The fecal coliform indicators that are traditionally used to determine if oysters are safe for human consumption are not always accurate, and there are opportunities to improve approaches to assess the status of oyster habitat and fishing areas.

Response: MASGC-funded researchers partnered with the USFDA and others to examine the relationship between sewage outfalls, ecosystems health, and oyster growth and survival. They sampled locations near and relatively far from sewage outfalls and collected oyster tissue samples to determine wastewater influence on oyster habitat and biology. In addition, they tested two newly coupled indicators (stable nitrogen isotopes and a male-specific bacteriophage) to determine if they were more appropriate to link elements or contaminants in shellfish to wastewater.

Results: When ecological indicators such as oyster growth and survival rates were not apparently affected by wastewater and fecal coliforms were unable to directly link shellfish contamination back to wastewater, the two newly coupled indicators tested in this study discovered oyster exposure to wastewater. The work also revealed relationships between wastewater dilution and the transport of materials via a ship channel. Based on the positive results of this research, researchers expanded and refined testing approaches to evaluate oyster suitability for human consumption. Based on this initial success, the research team has expanded their work to now include two states (Mississippi and Alabama) and are partnering with the appropriate agencies in both states.

RECAP: Based on Sea Grant funded research related to oyster growth in sewage affected areas, local researchers and the USFDA have enhanced knowledge of oyster responses to nutrient and microbial inputs, refined methodology for assessing the safety of oysters for human consumption, and expanded the scope of work to two states. Back to Goals

21498 - Sea Grant expands information on the environmental requirements for the culture of bait shrimp.
Relevance: Recreational fishing in the North Central Gulf of Mexico region is a multi-billion dollar industry. The size of this industry places a huge demand on wild bait harvest such as shrimp. Creating a sustainable bait shrimp aquaculture industry would provide a reliable source of bait for recreational fishermen and reduce fishing pressure.

Results: The development of a coastal bait shrimp industry has been limited due to the lack of knowledge of environmental requirements of bait shrimp species raised in captivity. This lack of information has impeded coastal farmers from raising a bait product for which there is a steady market in coastal regions of the Southeastern U.S.

Response: The effects of environmental factors (temperature and salinity) on native shrimp survival are being used to help understand the ecology and distribution of bait shrimp in coastal estuaries. Data may also be utilized to build a bait shrimp aquaculture industry which will reduce pressure on native fisheries.

RECAP: Sea Grant determines temperature and salinity requirements of bait shrimp species.
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21457 - Certified Master Naturalists provide 4,265 volunteer hours and reach 15,996 coastal residents
Relevance: Mississippi and Alabama face major challenges in managing fisheries, rehabilitating coastal wetlands, protecting coastal water quality, and maintaining stable shorelines. Although covering a relatively small geographic area, the coastal region is one of the fastest growing in the United States. Year after year, more pressure will be put on our beaches, wetlands, fisheries, and the health of our coastal and marine environment.

Response: Participants a 40-hour adult volunteer education course that met once a week for seven weeks. Extension agents, professors, state and federal resource managers, and other professionals taught the classes in classroom settings and out in the field. Class topics included ecology, natural history, water quality, and habitats and ecosystems of Mississippi. Dr. Chris Boyd is the Program Director for the Mississippi Master Naturalist Program hosted by the Mississippi State University Extension Service.

Results: In 2008-13, 118 people participated in the Mississippi Master Naturalist Program. Of those participants, 35 people earned certification as Mississippi Master Naturalists. They donated a total of 4,265 hours valued at $65,809. Their donated time helped more than 15,996 clients. The Master Naturalist volunteers worked on various environmental education projects. Many of them helped assist state, federal and non-governmental agencies in the wake of the Deepwater Horizon oil spill. Naturalists helped monitor beaches and conducted coastal bird and surveys in all Mississippi coastal counties. The data was reported to several organizations, including the Hancock County Emergency Operations Center, the Moss Point Audubon Center, the Grand Bay National Estuarine Research Reserve and the National Wildlife Federation.

RECAP: Mississippi-Alabama Sea Grant's Mississippi Master Naturalist volunteer program increased environmental literacy and expanded outreach capabilities in restoring and protecting coastal ecosystems. Back to Goals

21426 - MASGC provides critical leadership coastal science and outreach throughout Gulf of Mexico

Relevance: There are many NGO's, state agencies, federal agencies, businesses, and university-based organizations that are addressing Gulf-wide research, restoration, and other issues that align with MASGC's strategic plan. Often these organizations and agencies are looking for expertise to serve on boards, panels and committees to provide insight on the state of the region and provide input on strategic planning and related activities.

Response: MASGC staff serve on eight regional committees including ones associated with the National Academy of Science, regional ocean observing system, regional governance structure, NOAA's regional coordination team and ones focused on topics ranging from oil spill science to fisheries to climate. In addition, the four Gulf of Mexico Sea Grant programs have collaborated on several regional efforts and developed a track record of success in implementing regional activities.

Results: MASGC has been asked to lead the Gulf of Mexico Alliance's Regional Research Funders Forum that provides a platform for groups funding Gulf of Mexico research to share ideas and identify opportunities to collaborate. The Gulf of Mexico Research Initiative is investing $500 million in oil spill science and identified the four Gulf of Mexico Sea Grant programs to develop and outreach team. There are now four Sea Grant oil spill science outreach specialists and a part time coordinator focused on sharing GoMRI and related oil spill science to target audiences. NOAA, recognizing the outreach reputation of the four Gulf Sea Grant programs, asked the four programs to join proposals that NOAA submitted to RESTORE. One of these proposals builds on the success of a community-based restoration partnership between the four Gulf Sea Grant programs and NOAA.

RECAP: MASGC and the other Gulf Sea Grant programs are viewed as an asset to the region through repeated requests for staff to be involved in regional advisory groups or committees and through regional partners investing in MASGC to develop and lead region-wide outreach activities with the other three Sea Grant programs. Back to Goals

21413 - Educational TV messages teaches large numbers of coastal residents best stewardship practices

Relevance: The Mississippi-Alabama Sea Grant Consortium works to improve environmental and economic health of its communities. To do this, MASGC must make residents and leaders aware of issues along the Gulf Coast and actions that may lead to enhancement and conservation of our natural resources and more resilient communities.

Response: MASGC contracted with Gary Finch Outdoors (a 30-minute TV outdoors program that has aired for years on the Alabama coast and the Florida panhandle) and produced informational videos to air during the outdoors show on WSRE-TV, a public television station in Pensacola, Florida. The videos were 2 minutes and 21 seconds long and explained 14 different Gulf Coast issues or resources to a residential audience.

The 33 videos were produced using local science experts. Each aired twice a week for one or more weeks on WSRE-TV (PBS, Pensacola, Fla.) during the third and fourth quarters of 2012 or in 2013. Each Gary Finch Outdoors show reaches more than 480,000 households. Nine 2-minute videos on the subjects also were created and aired on Channel 3 WEAR-TV (ABC, Mobile, Ala.) during the 6 a.m. newscast, which reaches 531,000 households.

Topics included artificial reefs, clean marinas, stormwater issues, rain barrels, nature tourism, living shorelines, the Magnuson-Stevens Act and fisheries management, boater safety, natural hazards, fortified building, green building, buying local seafood, oyster farming, oyster gardening, working waterfronts, Sea Grant education programs, fish venting and others.

Each of the 33 educational videos about coastal issues ran on PBS television reaching 480,000 households.

Nine 2-minute videos on many of the same topics also reached 531,000 households each airing on Channel 3 WEAR-TV (ABC, Mobile, Ala.).

The videos are posted to our YouTube channel, Mississippi-Alabama Sea Grant, https://www.youtube.com/user/MSALSeaGrant.

RECAP: The Mississippi-Alabama Sea Grant Consortium created short videos about coastal issues, which potentially reached hundreds of thousands of residents while they were aired during a popular outdoors show on a PBS TV station in Pensacola, Fla., and on a morning TV news station in Mobile, AL.

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21407 - Formal and informal educators improved their content knowledge and pedagogy (instructional skills) of the Deepwater Horizon Oil Spill

Relevance: Formal and informal educators found themselves responding to questions relative to the Deepwater Horizon oil spill but did not have the knowledge base to address them. During the initial days of the crisis, misinformation and hearsay perpetuated misunderstandings and created a need to deliver unbiased science content. Education professionals throughout the four impacted coastal states needed credible, fact-based information for teaching.

Response: Mississippi-Alabama Sea Grant supported two separate videoconferences, which presented a total of eight regional experts on topics related to the oil spill. Educators onsite and connected virtually learned from presentations by experts, experienced several relevant activities suitable for K-12 students and received curriculum support. Key elements of the two programs focused on the following topics: oil impacts on marine mammals and sea turtles; sargassum communities in the Gulf; environmental impacts on the marine environment; seafood safety; Oil Pollution 101; birdlife response to the Deepwater Horizon Oil Spill; toxicity risk, bioavailability and biodegradation of oil; and dispersants. The five principal partner organizations were: Institute for Marine Mammal Studies, Discovery Hall Programs at Dauphin Island Sea Lab, Florida Sea Grant, Louisiana Sea Grant, and Mississippi State University.

Results: Four hundred and sixteen participants in the two programs received fundamental, factual, up-to-date information relative to the Deepwater Horizon Oil Spill not readily available to pre- or in-service teachers or informal educators. Curriculum activities were demonstrated and resources provided to educators.

RECAP: Three hundred and sixty-three education professionals improved their Deepwater Horizon Oil Spill content knowledge by participating in videoconferences and classroom activity demonstrations.

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21402 - Trawl gear programming reduces operation costs of Gulf of Mexico shrimpers

Relevance: Diesel engines power the majority of fishing vessels in the United States, and diesel fuel is the largest component of operating costs on Gulf shrimp vessels. To survive, shrimpers need to increase fuel efficiency to decrease operational costs.

Response: The use of energy-efficient trawl gear with less drag can reduce fuel costs. The Mississippi-Alabama Sea Grant Consortium (MASGC) conducted field research and documented the fuel savings and catch retention associated with available energy-efficient trawl gear and more efficient turtle excluder/bycatch reduction devices. To inform decision-making, MASGC shared the results with fishermen through gear demonstrations at dockside visits and as part of other outreach efforts. Vietnamese-Americans with limited English language skills own and operate a large percentage of the offshore fishing fleet in the northern Gulf. An MASGC staff member used his Vietnamese language skills to reach this underserved clientele group.

Results: Over 20 shrimp vessels have adopted the use of energy-efficient trawl gear. All reported fuel savings similar to the field trials, and most have continued to use the gear. Based on conservative estimates of fuel savings (1.5 gallons per hour, a 12-hour fishing day, 180 days per year and fuel cost of $3 per gallon), each vessel is saving about $10,000 a year in operating costs. Cost savings continue to accrue and are greater with rising fuel costs. Total savings to the fleet has topped $1 million since the program's inception.

RECAP: MASGC programming leads Gulf shrimp fishermen to adopt energy-efficient trawl gear and save over $1 million in operating costs.

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21401 - Integrated program responsible for the creation of oyster farming industry in Alabama.

Relevance: The Gulf Coast oyster industry has suffered a number of setbacks, both natural and manmade, that are challenging an industry built around inexpensive, plentiful oysters. Off-bottom oyster farming for the high-value, half-shell niche market, as practiced on the northeast and Pacific coasts, provides an opportunity for Gulf residents to create jobs, increase profits and diversify the oyster industry.

Response: Sea Grant-funded scientists established two large oyster farming parks that serve as platforms for training and business development, as part of a partnership between Louisiana Sea Grant, the Mississippi-Alabama Sea Grant Consortium (MASGC), Auburn University, and Louisiana State University. The parks demonstrate grow-out and harvesting technology and techniques. Scientists also provided technical advice and evaluations of possible sites to potential oyster farmers. Along with scientists, Sea Grant legal specialists were integral in providing research to inform passage

of state legislation that clarified and simplified the permitting process.

Results: Nine new commercial oyster farms have been established in Alabama, with a total farm-gate value exceeding $825,000 to date, which is expected to more than double in 2015, increasing incomes and generation of local jobs (at least 6 full-time positions and over 10 part-time positions). At least 5 wholesalers in Alabama also profited from the sales of these oysters. Two new oyster equipment companies were established in Alabama, with total sales inception well over $100,000. Several applications for new commercial farms are pending the results of the governor's review board mandated by Alabama HB 361 (on which Dr. Walton served). This work has also led the Gulf Oyster Industry Council to invite Dr. Walton to participate in their annual 'Walk on the Hill' in Washington, D.C. as a technical advisor on oyster farming since 2012. In partnership with Organized Seafood Association of Alabama (OSAA), MASGC has conducted a hands-on training program Oyster Farming Fundamentals, which has trained 16 adult students that have collectively raised 350,000 oyster seed, and developing a "vo-tech" program that trains high school students to be oyster farmers.

RECAP: Mississippi-Alabama Sea Grant research and outreach leads to development of commercial off-bottom oyster farming industry in Alabama that approaches $1,000,000 per year. Back to Goals

21400 - Commercial Fishing Vessel Safety Drill Conductor Training
Relevance: Commercial fishing continues to be the most dangerous occupation in the United States. According to National Institute for Occupation Safety and Health (NIOSH) fatality statistics for the commercial fishing industry, almost a quarter (9, 24%) of the 2010 fatalities occurred in the shrimp fishery, seven of which were in the Gulf of Mexico. To address commercial fishing-related fatalities, federal law requires that captains of vessels operating in federal waters ensure that crew members receive safety instructions and onboard safety drills are conducted once a month by certified Commercial Fishing Vessel Drill Conductors. A limited number of trainers are available to offer courses in the Gulf of Mexico, which can make it difficult for the Gulf fleet to operate in compliance with the law.

Response: To meet this educational need, Mississippi-Alabama Sea Grant Consortium (MASGC) outreach personnel obtained U.S. Coast Guard certification to offer Commercial Fishing Vessel Drill Conductor training courses. MASGC organized and implemented two 12-hour courses for 25 professional fishermen in 2014. Upon completion of the course, the fishermen met Coast Guard requirements to become certified Commercial Fishing Vessel Safety Drill Conductors. MASGC was able to provide most of the oral and written material in the Vietnamese and English languages.

Result: To date, a total of 73 fishermen in Mississippi and Alabama have become Coast Guard Certified Commercial Fishing Vessel Safety Drill conductors as a result of MASGC's role in organizing and implementing training.

RECAP: The Mississippi-Alabama Sea Grant Consortium helps commercial fishermen meet U.S. Coast Guard safety drill requirements by offering training to fishermen (many who speak Vietnamese) that allows them to obtain certification. Back to Goals

21399 - HACCP training helps local seafood business retain national supermarket account
Relevance: The national economic downturn negatively impacted a large cross section of water-dependent businesses along the Mississippi and Alabama coasts. Low seafood prices and complex seafood processing regulations have adversely impacted many sectors including the seafood industry.

Response: Mississippi-Alabama Sea Grant Consortium (MASGC) extension specialists worked with processors to ensure that their Hazard Analysis Critical Control Points (HACCP) training was up to date so they could remain operational.

Results: HACCP training by an MASGC extension specialist prevented one seafood processor from losing a significant national supermarket chain account and shutting down permanently because its employees did not have adequate HACCP training. Working with the owners of the processing company, MASGC quickly certified employees in HACCP, and the operation reopened within 36 hours. This training saved the account and the business.

RECAP: Mississippi-Alabama Sea Grant Consortium enabled a local seafood business to remain open and retain a contract with a major national supermarket chain. Back to Goals

21397 - Inland shrimp farming operations improve production and projects by increasing survival of juvenile shrimp
Relevance: Poor survival of post-larvae shrimp following acclimation to low-salinity waters has been a problem for farmers raising shrimp inland since the beginning of the west Alabama inland shrimp industry in 1999. As post-larvae are a significant expense for inland farmers, improved acclimation techniques were required to increase survival and subsequently improve profit margins.

Response: A growth trial was conducted at different salinities and temperatures to explore the effects on growth and survival of juvenile shrimp. Another study was conducted to evaluate how various aqueous sodium-potassium ratios at different temperatures impacted survival, growth and osmoregulatory capacity of shrimp. Researchers are transferring research results to local farmers to

improve on-site acclimation of post-larval shrimp.

Results: Alabama producers are now more aware of the effects of shifting temperature and salinity and their effects on shrimp survival. Adoption of these techniques has led to better survival during the production season. Increased survival at acclimation has allowed farmers to increase their production at harvest by more than 500 pounds per acre compared to when the study began in 2008. The annual economic impact is approximately $1,200,000 to date ($200,000 per year).

RECAP: Mississippi-Alabama Sea Grant improved acclimation techniques that inland shrimp farmers in Alabama use, thus increasing survival and production of shrimp by 500 pounds per acre. Back to Goals

21396 - Trade Adjustment Assistance training leads to more than $2M in direct payments to Alabama, Mississippi shrimpers
Relevance: Producers in the U.S. shrimp industry are experiencing economic hardships because of rising production costs and competition from imported shrimp causing many shrimpers to be forced into leaving the industry. In order for the domestic fishery to remain viable, producers need to learn how to reduce operating costs and get more money for their catch. In 2010, the Southern Shrimp Alliance successfully petitioned for shrimp harvested in the Gulf of Mexico and South Atlantic (North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas) to be considered an eligible commodity for the Trade Adjustment Assistance (TAA) for Farmers program in FY2010. Nearly 4,000 members of the shrimping industry from throughout the eight states applied to participate in the FY2010 TAA program.

Response: Before becoming eligible for cash benefits, each producer must receive 12 hours of TAA Intensive Technical Assistance and develop an initial business plan that will help them become more competitive in the world marketplace. In 2011, 22 3-hour TAA workshops were conducted on topics designed to increase the global competitiveness and economic levels of Gulf and South Atlantic shrimpers. Mississippi-Alabama Sea Grant outreach personnel developed training modules, help industry members fill out forms and paperwork, and assisted with workshop advertisement, logistics, and facilitation. More than 750 commercial fishermen from Alabama and Mississippi participated in the TAA workshops.

Results: In Alabama and Mississippi, 789 shrimpers each received 12 hours of Intensive Technical Assistance under the Trade Adjustment Assistance Program for Shrimpers, making each eligible for $4,000 in cash benefits. So far, this totals $3,156,000 in additional earnings for these producers, which will increase as more applicants complete the training requirements.

RECAP: Mississippi-Alabama Sea Grant Consortium outreach was instrumental in helping shrimpers obtain training and cash benefits under the USDA Trade Adjustment Assistance Program. For more information on this program, visit www.taaforfarmers.org. Back to Goals

21387 - Ecosystem services provided by oyster projects funded by MASGC
Relevance: Excessive nutrients and loss of habitat are two types of stress placed on coastal ecosystems. Stormwater runoff from within watersheds is a recognized source nutrient pollution within estuaries. Nutrients such as nitrogen can lead to periodic hypoxic conditions and prevent the growth of submerged aquatic vegetation (SAV). Loss of SAVs and the loss of shoreline habitat due to shoreline development has resulted in a gradual decline of habitat for living marine resources.

Response: Oyster gardening has been a successful restoration and environmental stewardship program in the Mobile Bay estuary since 2002. Over the last four years oyster farming has taken root in Alabama and now provides jobs and high quality oysters for consumers. Ecosystem services like regulating services and habitat services are secondary benefits from oyster gardening and oyster farming. Documenting these services using valid economic values provide a more accurate representation of the importance of oysters and the role they play in our estuaries.

Results: Combining the results of the oyster gardening restoration-focused program and the commercial off-bottom oyster farming program, the projects conservatively resulted in nearly $300,000 ecosystem services. There were 19,915 pounds of nitrogen removed from the local coastal ecosystems in Mobile Bay and Mississippi Sound; a service valued at $117,500. Additionally, these projects created critical habitat for a number of species that are commercially and/or recreationally important. Since the projects began, they collectively provided almost $182,000 in habitat benefit.

RECAP: Oysters create habitat and serve a vital role in removing nutrients estuarine environments. In addition to the value of farmed oysters for the consumer, oyster farming and oyster gardening provide habitat and remove nitrogen from the water. Back to Goals

21381 - The Oyster Trail public art, education project supports oyster gardening program
Relevance: The Mobile Bay Oyster Gardening Program is a volunteer-based project that focuses on education, restoration/enhancement and research by bringing the reef to the people. Since the program began in 2001, oyster gardeners have produced nearly 700,000 oysters (enough to restore approximately 34.5 acres) for restoration and enhancement efforts within Mobile Bay, which is enough to restore 34.5 acres. Additional volunteers and funding were needed to support these restoration

efforts.

Response: MASGC launched The Oyster Trail, an interactive scavenger hunt through Mobile and Baldwin counties in Alabama. The Oyster Trail currently has 20 5-foot-tall oyster statues that local artists have painted. A business, group or nongovernmental organization pays a yearly fee to sponsor an oyster on their property or in a public space. Each fiberglass oyster statue includes a fact plaque that displays information about oysters or estuaries. Maps and a scavenger hunt form (which includes a list of questions about the oyster facts) can be found around town or on The Oyster Trail's website. Proceeds from oyster sponsorships go to support the ongoing restoration efforts of the Mobile Bay Oyster Gardening Program.

Results: 18 businesses, groups, NGOs are active sponsors of The Oyster Trail. Statues placed in 18 locations around Mobile Bay provide a visual reminder of our connection to the estuarine environment and generated $32,400 in proceeds to support the Trail and Mobile Bay Oyster Gardening Program. Proceeds go toward material, logistical and equipment costs associated with gardening and planting efforts in Mobile Bay and Mississippi Sound.

RECAP: MASGC Oyster Trail raises awareness and funds for the Mobile Bay Oyster Gardening Program's restoration efforts. Back to Goals

21332 - Gulf Sea Grant programs leverage more than $10 million in resources to address regional needs, strengthen regional partnerships

Relevance: The Gulf of Mexico has experienced severely damaging technological (oil spills) and natural (hurricanes) disasters within the last ten years. These stressors have reinforced the importance of collaboration among federal agencies, state agencies, universities, non-government organizations and others to address a wide range of regional concerns facing coastal communities and the environment.

Response: Mississippi-Alabama Sea Grant Consortium (MASGC) responded to current and emerging regional needs and developed a unified approach to address these needs. MASGC partnered with the three other Gulf Sea Grant programs and multiple National Oceanic and Atmospheric Administration (NOAA) groups, the NOAA Gulf of Mexico Regional Collaboration Team, the Environmental Protection Agency Gulf of Mexico Program and other federal agencies. The Sea Grant programs also served in leadership positions in several regional collaboration efforts, including the Gulf of Mexico Alliance (the coastal regional governance structure), Gulf of Mexico Coastal Ocean Observing System, National Academy of Science Gulf Program and others. Led by MASGC, the Gulf Sea Grant programs and the NOAA's Coastal Storms Program partnered to improve coastal community resilience, ensure seafood sustainability and improve the health of ecosystems Gulf-wide. In addition, MASGC in partnership with the Gulf Sea Grant programs led the development of the Gulf of Mexico Research Plan (GMRP) and are addressing regional research priorities identified in it. The four Sea Grant programs also implemented a community-based restoration partnership with NOAA.

Results: Between 2007 and 2013, the Gulf of Mexico Sea Grant programs expanded from managing one regional research competition solely funded by the Sea Grant programs to managing multiple regional research, restoration and resilience competitions and managing several regional outreach efforts. In many cases MASGC led the development and implementation of the regional activities during this timeframe. The regional activities (and funding levels) that the four Gulf of Mexico Sea Grant programs managed and/or implemented during this time period cover wide range of regionally-relevant topics, such as restoration ($1.7 million), coastal storms ($3.4 million), climate and sea-level rise ($2.1 million), ecosystem service valuation ($1.7 million), marine mammal interactions ($340,000), regional research planning activities ($790,000) and oil spill related and other activities ($305,000). The programs represent more than $10 million in research and outreach funds for the region. Because of the success of Sea Grant's regional activities, in 2014 MASGC began two new regional activities. This includes coordinating an oil spill outreach program with the three Gulf Sea Grant programs and coordinating NOAA's sentinel site program in the Gulf of Mexico and when combined total more than $1.5 million additional funds. Through these regional activities the network of Gulf of Mexico Sea Grant extension agents has successfully brought regional tools and services, such as the Sea Grant-developed Coastal Community Resilience Index, peer-listening training and seafood safety and sustainability training to more than 72 communities across the region.

RECAP: The four Gulf of Mexico Sea Grant college programs successfully built a regional research and outreach portfolio totaling more than $10 million between 2007 and 2013 by building strong coalitions of partners to address regional concerns and due to this success new regional activities have begun in 2014. Back to Goals

21322 - Mississippi-Alabama Sea Grant serves coastal communities during oil-spill crisis

Relevance: The Deepwater Horizon Oil Spill was caused by an explosion of a deepwater drilling platform, which capsized and sank on April 22, 2010. In addition to loss of life and injuries to rig workers, the incident created an environmental and economic catastrophe as approximately 200 million gallons of oil spilled into the Gulf. Mississippi-Alabama Sea Grant's ability to step in as a "boots-on-the-ground," honest broker of information was valuable to coastal communities and federal response agencies.

Response: MASGC worked closely with the other Gulf of Mexico Sea Grant College Programs, National Oceanic and Atmospheric Administration (NOAA), other federal agencies, state agencies, non-governmental organizations, universities and land grant cooperative extension services to identify and address oil-spill-related needs of Gulf Coast residents. Sea Grant led or provided substantial support for 48 oil-spill-related trainings, workshops and town hall meetings with more than 2,683 participants. The Gulf of Mexico Sea Grant College Programs developed a regional website with links to oil-spill-related resources. Sea Grant also used its staff capabilities to ensure that the underserved Vietnamese-American community had access to information related to the claims process, financial management and BP's Vessels of Opportunity Program.

A peer-listening program trained residents to help friends and family with mental-health challenges related to the oil spill. MASGC directly or indirectly trained more than 7,000 peer listeners from non-governmental organizations, faith-based groups, city governments and communities. Sea Grant and the Alabama Cooperative Extension System developed a training program with BP for homeowners to teach them how to protect people, pets and property when cleaning up oil on their property. Sea Grant and Cooperative Extension also organized a seafood working group to provide guidance and coordination regarding seafood safety, fisheries closures and approaches to re-opening closed fisheries. They also formed a team consisting of four task forces to address oil-spill issues: damage assessment, family stress and financial management, food safety and consumer confidence, and oil-spill communications.

The MASGC legal program and extension specialists assisted those impacted by the spill by providing legal explanations, translation services, assistance regarding the damage claim process and other services.

MASGC conducted public forums using credible experts from 12 federal, state and local programs, and more than 500 people attended.

MASGC worked with NOAA's external affairs office to foster communication between constituents and NOAA. Sea Grant served as the local-knowledge source to help federal partners understand the political landscape within affected communities. Sea Grant provided information through community meetings and leadership visits about commercial fishing industry issues, including seafood safety and fisheries closures; recreational fishing and charter boat issues; oil spills and hurricanes; volunteer coordination; response capacity of university programs; and services available through community outreach organizations.

Gulf Sea Grant programs in partnership with NOAA and regional partners developed an online database that allowed people to upload or query oil-spill research and monitoring activities. The database included more than 200 activities, and more than 5,700 unique visitors accessed the database. The four Gulf Sea Grant programs are coordinated an update to the Gulf of Mexico Regional Research Plan. MASGC served as the science advisor to the Alabama Seafood Marketing Commission.

MASGC continues to help five years after the spill by providing expertise on oil spill related activities such as the National Academy of Science Gulf Program and through leading and implementing an oil spill science outreach program for the Gulf of Mexico Research Initiative with the other three Gulf
RECAP: Since 2010 Mississippi-Alabama Sea Grant Consortium (MASGC) has provided science-based information through its extension, outreach and education programs to coastal residents and businesses regarding all aspects of the Deepwater Horizon Oil Spill, helping to mitigate the negative economic, environmental and social impacts. Back to Goals

21194 - More than 150,000 K-12 teachers and students increase marine science and STEM literacy through hands-on programs
Relevance: People are more likely to act as good stewards of the natural environment if they understand what is of value and how it works. Training for in-service teachers and experiential student learning experiences are efficient ways to disseminate new and relevant research results to enhance environmental stewardship and increase STEM literacy.

Response: The Mississippi-Alabama Sea Grant Consortium's education program, which is comprised of Dauphin Island Sea Lab's Discovery Hall Programs, Mobile County Public Schools' Environmental Studies Center and The University of Southern Mississippi Gulf Coast Research Lab's Marine Education Center, worked with scientists and other content experts to develop and implement 84 professional development programs related to the four Sea Grant focus areas, including but not limited to climate change, oil spills, fisheries, restoration and wetland ecology. On-site field based programs at each facility and off-site experiential programs enabled K-12 students and their teachers to develop a personal understanding of estuaries, rivers, watersheds, salt marshes, beaches and more.

Results: Pre- and post-test assessments indicated significant improvement in student content knowledge after student programs. Between 2010 and 2013, professional development workshops engaged 1,533 teachers in active learning experiences to learn specific content and how to align it to age-appropriate learning standards for their students. Also during this time, the MASGC education program reached 94,760 K-12 students and teachers through on-site programs and 70,692 K-12 students through off-site experiential programs.

RECAP: The Mississippi-Alabama Sea Grant Consortium's education program addresses all four Sea Grant focus areas, and between 2010 and 2013 the education program reached more than 1,500 teachers who took part in professional development programs and significantly improved their content knowledge and almost 95,000 K-12 students who participated in on-site field-based programs and more than 70,000 K-12 students who participated in off-site experiential programs. Back to Goals

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Program Performance Measures (2010 - 2013)

Program Performance Measure	Program Plan Target (2010-2013)	Reported	Program Comments
Economic (market and non-market) benefits ($) derived from the discovery and/or application of new fishery production and management models or techniques that lead to increased sustainability and productivity from the fishery.	440,000	5,521,910	2012 - Actual: TAA program and Oyster farms created Anticipated: More oyster farms created and savings from aquaculture techniques.
Number of fishermen, resource managers and seafood businesses (harvesters, aquaculturists, processors and recreational fishermen) who adopt and implement responsible harvesting and processing techniques and practices.	4,048	5,996	
Number of producers, distributors and consumers of seafood who modify their practices using knowledge gained in	1,592	3,020	2013 - Includes 506 due to Market Maker enrollment. 2014 Update: Revised total for the 2010-2013 timeframe is 3,020, which exceeds the original target. We now realize we have achieved this Performance Measure because several items had not been included in our previous count. We found 1,917 additional new producers and consumers. The previously reported number of 1,103 includes the following: In 2010: 562 (494 from the MASGC Outreach team, 5 from the Shippee Dolphin research project, 10 from the Davis research project, 53 from the Walton research project). In 2011: 16 (10 from the Walton research project and 6 from

fishery sustainability, seafood safety and the health benefits of seafood.			the Walton extension NSI project). In 2012: 6 from the Walton extension NSI project. In 2013: 519 (506 from the Market Maker enrollment and 13 from the Arias and Walton research NSI projects) We would now like to include the following: 259 additional commercial fishermen in AL and MS participated in TAA workshops between 2010-2014. In 2011: 207 (161 participants in Market Maker workshops, 29 attendees at Aquaculture 101 workshops, 17 attendees at Oyster Gardening workshops). In 2012: 118 (70 attendees at fishing vessel safety and energy efficiency workshops, 20 attendees at Fact and Fishinâ€™ workshops, 22 attendees at Aquaculture 101 workshop, 6 attendees at Oyster Gardening workshops). In 2013: 534 (66 attendees at fishing vessel safety and energy efficiency workshops, 177 attendees at sport fishing workshop, 268 attendees at TED workshop, 23 attendees at Aquaponics 101 workshop). In 2014: 799 (275 additional Market Maker enrollments, 228 attendees at Seafood Savvy events, 150 attendees at the Farm to Table dinner, 25 attendees at Aquaponics workshop, 28 attendees at fishing vessel safety workshop, 3 attendees at Aquaculture Marketing workshop, 75 attendees at the Love of Oysters event, 15 attendees at the Forage & Field event).

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Program Objectives (2010 - 2013)

Program Objective	Achieved (yes/no)	Program Comments
By 2013, at least 200 individuals will be able to identify at least three differences between coastal shellfish aquaculture and other forms of aquaculture.	Yes	2012 - The investigator on this project has noted success in the outreach component through multiple media hits, numerous tours, and multiple workshops. 2013 - The investigator on this project has noted success in the outreach component through multiple media hits, numerous tours, and multiple workshops.
By 2011, four shrimp farmers (food and bait) will increase production by 100 pounds per acre on farms totalling 200 acres leading to an overall increase in production of 20,000 lbs worth more than $20,000. through optimization of salinities and temperatures.	Yes	2010 - Production increased by 500 pounds per acre and results in a total economic impact of $175,000 per year. 2013 - Due to improved acclimation techniques production of shrimp in inland saline waters has been increased from an average of 2700 lbs / acre to over 3000 lbs / acre. This is an improvement of 300 lbs / acre totaling an increase in production of 24,000 lbs valued at $84,000 (pond bank price of $3.50 per lb.). It is anticipated that as acclimation techniques are refined, based on data obtained in this project, production will continue to improve.
By 2012, 15 charter boat captains and 1,000 private fishermen will adopt improved fish handling techniques to improve survival of regulatory discards of red snapper and other recreationally important species.	Yes	2012 - Mandatory NMFS regulations aided in this objective. 2013 - Mandatory NMFS regulations aided in this objective.
By 2012, three bait dealers in Mississippi and/or Alabama will report an increase of 100 shrimp per delivery surviving to be sold live.	Yes	2010 - Bait distribution center (Prichard, AL) discontinued project. Extension specialist still providing information for local bait dealers. 2013 - Although the bait distribution center that the extension specialist was originally working with for this objective no longer requires our assistance, the objective has been achieved by the extension agent assisting other bait dealers on a case-by-case on request basis.
By 2013, 5,000 people will access information	Yes	2012 - Online users of Mississippi Market Maker from Jan 2010 to Dec 2012 was 3,947 per month.

through MASGC outreach and education programs on seafood nutrition and sustainable fishing practices, and 250 of them will apply the information to their seafood purchases.		2013 - Online users of Mississippi Market Maker from Jan 2010 to Dec 2012 was 3,947 per month. A report dated January 2014 states that there are 746 establishments registered in MarketMaker in MS and AL alone 4,075 in the Gulf region and 6,428 in all member states.
By 2013, at least two shellfish farmers each with annual minimum gross sales of $25,000 will be established in coastal Alabama.	Yes	2012 - 2 farms have been permitted, one with gross sales over $30,000 per year. 2013 - Due to permitting hurdles, the objective was reached in early 2014 (instead of 2013 as stated in the objective). In early 2014 five individuals had obtained commercial oyster aquaculture permits, with combined gross sales of over $200,000 during the harvest from fall 2013 to spring 2014. Harvest and sales are expected to increase in fall 2014.
By 2014, 18 teachers and 900 students will incorporate map skills and watershed concepts into their stewardship of coastal ecosystems.	Yes	2013 - A leveraged project funded by the NOAA Bay Watershed Education and Training program has achieved this objective.
Shrimpers in Mississippi and Alabama will save $100,000 in operating costs during the 2010-2013 time frame through 1) the use of fuel-saving gear, 2) better use of BRDs and TEDs, 3) more efficient use of catch preservatives, and 4) increased knowledge of and compliance with state and federal fishery management regulations.	Yes	2012 - The TAA program for shrimpers helped us exceed this goal. 2013 - The Mississippi-Alabama Sea Grant Consortium (MASGC) conducted field research and documented the fuel savings and catch retention associated with available energy-efficient trawl gear and more efficient turtle excluder/bycatch reduction devices. MASGC shared the results with fishermen through gear demonstrations at dockside visits and as part of other outreach efforts. Over 20 shrimp vessels have adopted the use of energy-efficient trawl gear. All reported fuel savings similar to the field trials, and most have continued to use the gear. Based on conservative estimates of fuel savings (1.5 gallons per hour, a 12-hour fishing day, 180 days per year and fuel cost of $3 per gallon), each vessel is saving about $10,000 a year in operating costs. Cost savings continue to accrue and are greater with rising fuel costs. Total savings to the fleet has topped $1 million since the program's inception. MASGC continues to support this program