Introduction

The Texas Gulf Coast provides a wealth of natural resources that drive the Texas economy, provide food and fuel for a rapidly growing human population, and sustain and nourish life. Balancing the economic, environmental and cultural benefits these natural resources offer is Texas' grand challenge. The Texas Sea Grant College Program's research and engagement programs responded to this challenge by capturing the academic potential of the state's universities, linking universities to the needs of Texans, building knowledge, creating innovative tools and services with a public purpose, translating research results to the public, developing the Texas workforce, sustaining industries and solving real-world problems to improve human welfare and the health of our natural resources.

Texas Sea Grant's strategic plan goals and objectives were developed from feedback solicited via public surveys and from the program's Advisory Committee. In part because the state strategic plan was completed before the National Sea Grant Strategic Plan, several of the state plan objective statements were intended to be long-term goals toward which the Program would make significant progress, but not fully achieve during the strategic plan period.

Soon after the state strategic plan was finalized, multiple events impacted Texas Sea Grant's ability to attain all of the goals it had set. In 2010, the Deepwater Horizon oil spill occurred in the Gulf of Mexico, and Texas Sea Grant responded to the needs of the state, shifting program priorities to unanticipated areas. A deficit in the State of Texas budget resulted in a 10 percent across-the-board cut at all state institutions and programs in 2011. This budget reduction led to the retirement of five of the Program's six extension specialists who returned to work for the Program as part-time employees.

New opportunities emerged with the hiring of a new director in September 2011. After 20 years located in off-campus offices, Texas Sea Grant moved back to the Texas A&M University campus and strengthened a critical partnership. The Program also built new partnerships with two of Texas' coastal universities and located extension staff there to further its reach and impacts along the coast. Retirements and cost savings from program changes in administration and communications enabled the Program to hire a research coordinator and a reporting coordinator, and expand the extension team with four new hires including four new extension specialists in social and economic sciences, coastal planning and education. Texas Sea Grant launched new programs in coastal planning, climate literacy and capacity building, workforce development for undergraduate scholars and graduate students, and outreach to inland areas adjacent to important watersheds.

Texas Sea Grant made significant contributions to science and technology, including seminal publications in high-impact peer-reviewed journals, new understanding of the complex and dynamic natural and built environments, and products, processes and technology developed and/or transferred through its competitive research funding program and extension specialists who integrate research and extension. These contributions impacted communities, the state, the region and the nation and helped the Program achieve its mission of improving the understanding, wise use and stewardship of the state's coastal and marine resources.

Texas Sea Grant's societal benefits were equally significant. The Program saved jobs and businesses in the shrimp fishery by helping the industry achieve cost savings and implement productivity improvements, helped expand the aquaculture industry, enhanced public health and safety, improved management of natural resources, and enhanced the public's knowledge of key issues impacting the natural and built environments.

Focus Area: Safe and Sustainable Seafood Supply

Commercial and recreational fishing and aquaculture are vital to Texas. All three provide important direct and indirect benefits to the Texas economy — the commercial shrimp industry, Texas' largest, contributes more than $500 million to the state economy annually; the aquaculture industry contributes an estimated $101 million; and marine recreational anglers contribute another $1.6 billion each year.

The goals of National Sea Grant College Program Strategic Plan 2009-2013 in this focus area that were addressed by Texas Sea Grant were: a sustainable supply of safe seafood to meet public demand; a healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and efficiently; and informed consumers who understand the importance of ecosystem health and sustainable harvesting practices and appreciate the health benefits of seafood.

Because of the critical importance of these industries to the economic well-being of communities all along the Texas coast, Texas Sea Grant placed this focus area within its overarching goal area of "coastal communities and economies" in its 2009-2013 Strategic Plan. The state strategic plan's strategies in this focus area concentrated on aquaculture and seafood safety and quality with goals to improve seafood quality and fuel-efficiency of seafood harvesting enterprises; developing technologies to produce new species for enhancement stocking and commercial aquaculture in the open ocean; and addressing hazards such as invasive species and harmful algal blooms.

To meet the needs of Texas and Texans, Texas Sea Grant made investments in research centered on four primary areas: enhancements to captive rearing protocols for commercially important finfish and shrimp grown by the aquaculture industry and by the State of Texas for use in restocking programs, evaluation of the success of programs that culture fish for the restoration and enhancement of wild populations, improving the understanding of the life history and ecology of wild populations of commercially valuable fish and shrimp, addressing hazards such as harmful algal blooms and developing new methods to assess the stocks of protected species such as sea turtles that have been impacted by incidental capture in commercial fisheries.

Red drum, also known as redfish, has been one of the focal species in which Texas Sea Grant has made significant research investments since the 1970s. Red drum wild stocks were dangerously depleted in the 1970s and 1980s. Today, the species is thriving: it is one of the most popular fish targeted by recreational anglers. In addition to the wild stock, Texas has a significant red drum aquaculture industry with harvests valued at about $9 million per year. At 3.25 million pounds annually, it is the third highest yielding farmed finfish in the state. Texas is the only state in the nation that has developed a red drum aquaculture industry and Texas Sea Grant funded much of the research that facilitated the development and growth of this industry.

Other focal species benefitted from Texas Sea Grant's research investments. Texas Sea Grant funded a study of short-term fluctuations in shrimp abundance that resulted in a population model for Gulf shrimp and found that modest changes in juvenile growth and mortality may have greater impact on stock size than the full range in fishing mortality and will support science-based management of the resource. Texas Sea Grant and the other Gulf of Mexico Sea Grant Programs partnered with the Gulf States Marine Fisheries Commission to lead the development of a Kemp's ridley sea turtle stock

assessment. The cutting edge stock assessment model developed was the first of its kind to incorporate shrimp fishing effort as a variable to evaluate the impact of a fishery on a sea turtle and thus its ecological sustainability. This was a critical first step toward developing a rigorous assessment tool to evaluate anthropogenic impacts on sea turtle populations, a recommendation made by a National Research Council Committee on Sea Turtle Population Assessment Methods.

The results of Texas Sea Grant's research investments in safe and sustainable seafood supply have provided state and industry aquaculture operations with new protocols and technology that are improving fish and shrimp rearing, reducing operational costs, making aquaculture less expensive and more profitable, and creating more environmentally friendly operations. Several notable projects include the research that led to a reduction in the amount of feed cultured red drum brood stock required to produce high quality offspring. This finding has changed feeding protocols at state-run facilities and reduced the cost of this restocking program that produces millions of fry each year to enhance wild populations. Another study supported by the Program, also conducted on red drum, demonstrated that fishmeal, which is in high demand worldwide and expensive, can be replaced by at least 50% with less expensive plant-based feeds.

One of the program's greatest research investments in this focus area concentrated on detecting harmful algal blooms (HABs), which are occurring more frequently and have become more intense. The biggest recent red tide on record in Texas began in 2011 and resulted in massive fish kills in coastal waters, closure of the oyster fishery and beach closures to protect people and their pets, and threatened coastal communities whose economies are reliant on tourism and fishing. Texas Sea Grant investigators developed new tools and methods to predict HABs before they pose a threat to human health and to better understand the biological and ecological environments in which HABs develop. These findings provided early warning of a HAB and helped state and federal agencies act quickly to close fisheries and safeguard the public.

Texas Sea Grant also made research investments to improve ecosystem-based management of recreational fisheries and to develop technologies to produce new species for enhancement stocking. While it does not satisfy the demand for seafood at the same scale as commercial fisheries, recreational fishing shares similar concerns with respect to ecosystem management. Texas' bays, protected from the open Gulf by a series of barrier islands, are crucial nursery grounds for important game fish. Texas Sea Grant funded three research projects that studied the critical habitats of important game species to support the recreational fishery. The studies focused on residency and habitat requirements, movement and population connectivity, and physical processes of the recruitment of larvae from the open Gulf through passes and inlets to bays and estuaries.

Texas Sea Grant also funded research to support a new game fish restocking program to assist the Texas Parks and Wildlife Department (TPWD). Using genetic markers to genotype parents and larvae at two state-operated restocking hatcheries, researchers discovered that not all female seatrout brood stock were reproducing, potentially causing many of the released fish to be closely related to each other. Ongoing genetic studies are helping the TPWD to identify the non-contributing females and replace them to increase genetic diversity of the offspring released to the wild.

Texas Sea Grant-funded research has generated a significant number of peer-reviewed publications in good journals, as well as non-peer reviewed publications that

were used to promote research findings to the public and state decision-makers. One of our most noteworthy publications, based on research begun in 2013, is not even finished yet and is generating an incredible amount of interest from industry worldwide – a manual about a new technology to culture shrimp. The Bio-floc system shifts the normal production technology from low-intensity outdoor ponds to super-intensive indoor recirculating aquaculture systems. With little or even no water exchange, this system reduces or eliminates the amount of nutrients released to the environment, escape of non-native culture species, and the spread of pathogens to the environment. If managed properly, 4 crops can be produced per tank each year, yield 9+ kg/m3 and reduce the costs of shrimp mariculture from $5/lb. to only $2/lb. This new system will expand the shrimp mariculture industry create and sustain new jobs.

Texas Sea Grant's greatest investment in safe and sustainable seafood was directed to the state's shrimp fishery because of its importance to the state economy and because this fishery has experienced numerous recent challenges that threaten its future. The Texas commercial shrimp fishery has suffered economic hardship from rising fuel prices and competition from low-priced, imported farmed shrimp. Additionally, the fishery has been impacted by natural and anthropogenic events that have reduced their catch. The Deepwater Horizon oil spill closed many areas to fishing immediately after the spill, and public confidence in and consumption of seafood following this disaster reduced demand for shrimp. Freshwater inflows into Gulf waters were impacted by too much rain in some years and too little rain in other years and created significant fluctuations in shrimp populations in the western Gulf of Mexico. Texas Sea Grant's extension team led multiple initiatives to sustain the Texas shrimp industry during the strategic plan period. The team's greatest success was leading the submission of a petition to the U.S. Department of Agriculture to allow the southeastern U.S. shrimp fishery to participate in USDA's Trade Adjustment Assistance (TAA) for Farmers program, designed to provide relief to groups suffering economic hardships as a result of foreign imports. The petition was approved and funds were provided by the USDA to the entire southeastern U.S. shrimp fishery to provide economic relief to the industry. Shrimp fishermen were given cash incentives to complete training and submit a business adjustment plan. Texas Sea Grant developed the curriculum for the training, including technology transfer of fuel-saving trawl gear and the use of brine-freezing techniques and a detailed "handling recipe" to maintain peak quality and appearance of wild-caught shrimp that can compete with imported, farm-raised shrimp. Training also included lessons about the correct installation and operation of turtle excluder devices and by-catch reduction devices to help the shrimp fleet comply with federal regulations and reduce fines and penalties associated with non-compliance. The Program's efforts through this initiative resulted in significant economic benefits to the industry and the state. Fishermen received payments and training to improve their practices, reduce their fuel costs, enhance the appearance and quality of their catch and reduce fines from non-compliance. Collectively, this saved money, jobs and businesses and sustained an industry.

The Program's other efforts to ensure and market a safe harvested product during the strategic plan period included HACCP training upon request; encouraging seafood producers to participate in Texas MarketMaker, an online resource for information on Texas seafood and agricultural products that is designed to connect producers with buyers; state-wide distribution of 40,000 information cards about the health benefits of

fish consumption and cautions about contaminants; and a "Cooking with Seafood" program that promoted local seafood and educated consumers about seafood safety.

Although the physical coastline of Texas was not as negatively affected as the other Gulf States by the Deepwater Horizon Oil Spill in 2010, the shrimp fisheries of all four states were equally impacted. Texas Sea Grant's response to the crisis included coordinating and holding outreach events to alleviate public fears about the safety of Gulf seafood; hosting a website for the four Gulf Sea Grant programs that served as a central marketplace of information about the oil spill for the public and affected stakeholders; and conducting sensory training for seafood buyers, regulatory agency staff and seafood processors to detect oil-tainted seafood. After the training, Texas seafood representatives incorporated it into their HACCP plans.

Texas Sea Grant also supported aquaculture of shrimp and finfish with its extension activities during the strategic plan period, most notably through its annual short course that provided instruction on production, handling and processing procedures; the participation of aquaculture enterprises in the TAA training discussed above; and through site visits and one-on-one instruction to local aquaculture ponds, particularly those located in the southern part of the Texas coast. Because open ocean aquaculture was not authorized on a commercial basis until 2014, Texas Sea Grant was unable to fully achieve this goal.

Texas Sea Grant's achievements in this focus area contributed to society by improving public health and safety, providing economic benefits to sustain and grow seafood industries, improving the management of game species in Texas, creating cost savings and productivity improvements to industry. The Program also made significant contributions to advancements in science and technology that are being used by the state and industry to grow seafood in captivity for public consumption and to restock wild populations, detect harmful algal blooms before they impact seafood and public health, and reduce by-catch of non-target species.

Texas Sea Grant did not achieve all of the objectives in this focus area because a few of them were developed as long-term goals. For example, one objective committed the Program to achieving 100 % compliance from fishermen who adopt and implement responsible harvesting techniques and practices. Many fishermen have adopted and implemented responsible harvesting techniques and practices such as turtle excluder devices and bycatch reduction devices, as a result of Texas Sea Grant's training and outreach. However, 100 percent compliance is very difficult to achieve. This goal was intended to be a long-term goal of the Program, and is still one that Texas Sea Grant plans to achieve in the coming years.

PIER PRP Program Focus Area Report

Texas Sea Grant

Safe and Sustainable Seafood Supply

Program Focus Area: SAFE AND SUSTAINABLE SEAFOOD SUPPLY

Program Goals

1. A sustainable supply of safe seafood to meet 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

JUMP TO REPORT SECTION

Full Text of Impacts
Program Performance Measures
Objectives

Impacts and Accomplishments toward Program Goals

1. **Program Goal: A sustainable supply of safe seafood to meet public demand at affordable prices.**
   Impact(s)
   - 16304 - Gulf Sea Grant programs bring $7 million in national resources to address regional needs, strengthen partnerships
   - 16051 - Using microzooplankton abundance to predict harmful algal blooms
   - 14295 - Genetic markers and their assay for current and future studies of spotted seatrout
   - 14210 - Texas Sea Grant-led training promotes seafood safety after Deepwater Horizon oil spill

   Accomplishment(s)
   - 16911 - Freshwater residence and habitat requirements of southern flounder determined by otolith chemistry
   - 16050 - Evaluation of laser in situ scattering and transmissometry (LISST) instruments to monitor for harmful algal blooms
   - 14406 - Freshwater exchange and larval recruitment through barrier island tidal inlets
   - 14332 - Producing viral pathogen-free Atlantic white shrimp for sustainable live bait-shrimp farming

2. **Program Goal: A healthy domestic seafood industry that harvests, produces, processes, and markets seafood responsibly and efficiently.**
   Impact(s)
   - 19653 - Promoting larval survival through broodstock diet: Implications for fish stock enhancement
   - 19634 - Texas Sea Grant improves shrimp fleet sustainability through technology transfer of fuel-efficient trawl gear
   - 19633 - Texas Sea Grant's sustainability training nets $44.8 million for Gulf shrimpers
   - 17268 - Texas Sea Grant helps shrimp fleet adopt new bycatch reduction device (BRD) designs that reduce shrimp loss
   - 16051 - Using microzooplankton abundance to predict harmful algal blooms
   - 14210 - Texas Sea Grant-led training promotes seafood safety after Deepwater Horizon oil spill

   Accomplishment(s)
   - 19717 - Determining pharmaceutical loadings and their impacts on aquatic life in Texas coastal ecosystems
   - 19701 - Texas Sea Grant helps consumers learn about local seafood options
   - 19699 - Texas Sea Grant conducts proof-of-concept trials of bycatch reduction devices for the southeastern shrimp fishery
   - 17342 - Texas Sea Grant conducts shrimp and marine finfish aquaculture short course
   - 16050 - Evaluation of laser in situ scattering and transmissometry (LISST) instruments to monitor for harmful algal blooms
   - 16047 - Investigating fishmeal replacements in diets of cultured marine fish
   - 14913 - Intensive Technical Assistance (ITA) program helps to maximize dockside shrimp prices

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**
   Impact(s)

- 19645 - Texans learn about seafood safety, preparation and health benefits through cooking program and outreach materials

Accomplishment(s)

- 14915 - Public receives information about seafood health benefits
- 14914 - Post-oil spill seafood selection and safety outreach campaign

Back to Top

Full Text of Impacts and Accomplishments

19717 - Determining pharmaceutical loadings and their impacts on aquatic life in Texas coastal ecosystems
Relevance: There is growing concern over the levels of pharmaceuticals and other contaminants of emerging concern (CECs) being found in Texas waterways. Little is known about how these CECs are entering the waterways or their potential impact on aquatic life, particularly animals in the state's productive bays and estuaries. The Texas population is expected to double in the next 50 years, which will only exacerbate the problem.
Response: Texas Sea Grant funded a study to determine seasonal loadings of targeted CECs into Texas coastal systems, determine CEC accumulation in various aquatic animals, develop tools to predict the risk of CEC exposure to fish in Texas coastal systems, and develop educational activities to teach students about CECs in the environment.
Results: In 2013, the researchers developed initial estimates for CEC loadings along the Texas coast for specific dates and developed an initial soil and watershed tool (SWAT) model to predict CEC loadings in the Guadalupe River throughout the year. They also determined CEC levels in a number of aquatic species. Initial data suggest CECs may pose hazards to fish along the Texas Coast. One teacher workshop was held and future educational activities are planned.

RECAP: Texas Sea Grant-funded research is being used to determine ways in which CECs are entering Texas waterways and the risk these human-introduced substances pose to aquatic life. Back to Goals

19701 - Texas Sea Grant helps consumers learn about local seafood options
Relevance: The growing market for naturally and locally grown food includes seafood, but it can be difficult for consumers to ds where they are available. If customers cannot find these products, they may purchase imported alternatives that do not support local economies.
Response: Texas Sea Grant was a partner on two tools to educate seafood consumers. Texas Sea Grant and the seafood industry produced a video about how seafood is caught and the differences between locally caught seafood versus imported and farmed. The video was made available online, and a link to the video was printed on shrimp packaging beginning in 2013. Additionally, Texas Sea Grant partnered with Texas A&M AgriLife Extension, the U.S. Department of Agriculture and the Gulf States Marine Fisheries Commission in Texas MarketMaker (https://tx.foodmarketmaker.com), a comprehensive interactive database of food industry marketing and business data. Part of a network of MarketMaker programs in 19 states, the online resource allows consumers to enter their location and a seafood type into a website to find nearby vendors.
Results: Seafood consumers learned more about their local fishing industry and, using the Texas MarketMaker website, were able to find naturally grown and locally caught seafood, thus supporting local fishing economies located along the Texas coast. In 2013, six Galveston County seafood markets were added to the MarketMaker database.

RECAP: Texas Sea Grant educated consumers about locally harvested seafood and helped them find nearby vendors for the products to support Texas and Gulf of Mexico seafood businesses. Back to Goals

19699 - Texas Sea Grant conducts proof-of-concept trials of bycatch reduction devices for the southeastern shrimp fishery
Relevance: In promoting a sustainable shrimp fishery in the southeastern United States, two often competing priorities are reducing the capture of other species, known as bycatch, during shrimp trawls while safeguarding the economic viability of the shrimp fishery. Shrimp trawlers are required to install devices to reduce bycatch, but these devices also reduce total catch.
Response: Under a grant from NMFS' National Bycatch Reduction Engineering Program, Texas Sea Grant staff field-tested multiple bycatch reduction device (BRD) models to determine their potential effectiveness at reducing bycatch while also limiting the loss of catch compared to BRDs currently certified by NOAA and being used in the shrimp fleet. The aim of these proof-of-concept trials was to determine potential gear that might be subjected to more in-depth certification trials.
Results: Results from the BRD models tested in 2013 have been actively disseminated by Texas Sea Grant to state and federal natural resource agencies, as well as at workshops and through personal interactions as complementary gear inspections are conducted throughout the southeastern shrimp fishery. One device was subjected to formal federal certification trials by the Gulf and South Atlantic Fisheries Foundation. In 2015, the North Carolina Wildlife Resources Commission and the North Carolina Sea Grant Program conducted additional BRD testing based on models originally tested by Texas Sea Grant.

RECAP: Texas Sea Grant staff tested bycatch reduction devices proposed for adoption under federal regulations to safeguard healthy coastal ecosystems, protect marine jobs, and promote a sustainable shrimp fishery. These trials led to additional testing as a next step in identifying designs that will be approved for use by NOAA's National Marine Fisheries Service (NMFS). Back to Goals

19653 - Promoting larval survival through broodstock diet: Implications for fish stock enhancement

Relevance: Diet-egg relationship for fish has important ecological implications. Certain fatty acids are important for growth and development of marine fish embryos and larvae and are correlated with anti-predator performance of larvae. Producers of hatchery-reared red drum for wild stock enhancement typically feed a rich diet to brood fish for many months before spawning to produce optimal egg and larval quality, but only two prior studies provide insight on the short-term dynamics of the diet-egg relationship of marine fish.

Response: Texas Sea Grant funded a project that focuses on understanding the dynamics of transfer of essential fatty acids to eggs in red drum and the importance of the egg fatty acids versus fatty acids in the larval diet to the performance of larvae.

Results: The study found that while a feeding regimen high in fatty acids is necessary to produce high-quality eggs and offspring, the length of time at least one of these nutrients is needed is much briefer than the industry's current practice. The results of this project are being used by the Texas Parks and Wildlife Department to change the feeding schedules at two of their hatcheries and decrease their fish-rearing costs, and are expected to result in improved egg and larval quality for their restocking efforts. The economic value of stocked red drum caught by anglers in Texas is estimated at $3.28 million per year.

RECAP: A Texas Sea Grant-funded research project on the transfer of essential fatty acids from broodstock to eggs in red drum aquaculture resulted in changes in fish-rearing procedures at two Texas Parks and Wildlife Department restocking hatcheries. Back to Goals

19645 - Texans learn about seafood safety, preparation and health benefits through cooking program and outreach materials

Relevance: The seafood industry is a valuable part of local economies in Texas coastal communities. Locally caught, processed and sold fresh shrimp, oysters and finfish are not only healthy for consumers but support local fishermen and women and their families. Unfortunately, many residents are unaware of seafood's health benefits, safety issues or its importance to the local economy.

Response: Texas Sea Grant staff developed a series of informative cooking demonstrations, called "Cooking with Seafood: It's not that hard!" to educate Calhoun County residents about selecting and safely handling, storing and preparing local seafood, and about its health benefits and economic significance. Experts from state agencies provided educational presentations at many sessions, including a member of the state health department who provided information about locally harvested oysters. Similar programs were held in Brazoria and Jefferson counties. Additionally, Texas Sea Grant distributed seafood recipe cards, cookbooks, and 40,000 "Fish for your Health: Advice for Pregnant or Nursing Women, Women Who May Become Pregnant & Children" information cards statewide.

Results: The demonstrations held in Calhoun County were well attended; the class began as a two-month-long weekly program, but was so successful it continued through the year on a monthly basis. Participants were surveyed multiple times, including after the oyster program, when 100% indicated they increased their knowledge of the way the Texas oyster industry is regulated, 94% increased their knowledge of marine pollution sources in Texas bays, 75% increased their knowledge of proper techniques for cooking oysters, and 54% increased their knowledge of the risks related to eating raw oysters.

RECAP: Texas Sea Grant used a seafood cooking demonstration program and outreach materials to educate Texas residents about the health benefits of seafood and its value to the local economy.

Back to Goals

19634 - Texas Sea Grant improves shrimp fleet sustainability through technology transfer of fuel-efficient trawl gear

Relevance: For the Gulf of Mexico shrimp trawl fishery, fuel costs are a major operating expense. A single Gulf shrimp trawler can consume up to 80,000 gallons of diesel per year. Reducing operating expenses through reduced fuel consumption can improve vessel profitability, thus sustaining an industry struggling to compete with foreign shrimp imports and high fuel prices.

Response: Since 2008, Texas Sea Grant has worked with cooperating shrimpers in the Gulf of Mexico and South Atlantic regions to transfer technology of fuel-efficient trawl gear by testing and conducting economic analyses of the benefits of improved net material and advanced trawl door designs.

Results: In 2014, 360 vessels in the Texas shrimp trawling fleet employed advanced webbing that Texas Sea Grant staff had previously shown decreased fuel use, saving 1,323,078 gallons of fuel worth $4.1 million. During the same period, 86 vessels in three Texas ports utilized the cambered trawl door design, saving 1,091,460 gallons valued at $3.4 million. From 2008 to 2014, the statewide fuel savings have been estimated to be more than 17.7 million gallons of fuel valued at more than $51 million, with additional savings through reductions in the frequency of oil and filter changes, major engine overhauls, and from eliminating the need for net preservatives.

RECAP: From 2008 to 2014, experimental fuel-efficient trawl gear sponsored by Texas Sea Grant

saved Texas shrimpers $51 million in fuel costs. Back to Goals

19633 - Texas Sea Grant's sustainability training nets $44.8 million for Gulf shrimpers
Relevance: Wild, domestic shrimp stocks are healthy, but U.S. shrimpers are struggling as they compete in a global market dominated by foreign, farm-raised shrimp. Relief through the USDA's Trade Adjustment Assistance (TAA) program was provided to groups able to demonstrate reduced prices, revenues, or production levels as a result of increasing foreign imports.
Response: Texas Sea Grant led a collaborative effort among state Sea Grant programs from North Carolina to Texas to submit a regional TAA petition for domestic shrimpers. To receive cash benefits, Texas shrimpers had to attend an initial orientation, complete 12 hours of intensive training, and develop and submit a long-term business adjustment plan. In-person and online training modules were developed by Texas Sea Grant and included (a) Reducing Fuel Use in the Shrimp Fisheries, (b) Steps Necessary to Produce Great-tasting, Premium-quality Wild Shrimp, (c) Understanding New Regulatory Requirements for TEDs, and (d) Developing a Business Plan.
Results: By the end of the program in 2013, 4,532 applicants met all eligibility requirements and completed all program requirements to receive 100% of their expected cash benefits. The payout from USDA to qualifying shrimp producers totaled $44.8 million since the beginning of the program. To receive cash benefits, the applicants collectively undertook 57,000 hours of intensive training.

RECAP: Texas Sea Grant developed a training program that enabled Texas shrimpers to receive cash benefits through the USDA's Trade Adjustment Assistance (TAA) program and learn how to sustain the shrimp industry. Back to Goals

17342 - Texas Sea Grant conducts shrimp and marine finfish aquaculture short course
Relevance: More than 80 percent of seafood consumed in the United States is imported. Most of the imports are farm-raised in Southeast Asia, where low labor and production costs and fewer environmental and business regulations reduce the cost of the product. As a result, domestic seafood growers must adopt best management practices to increase productivity and reduce production costs, while ensuring sustainable practices and environmental quality to remain in business.
Response: Texas Sea Grant held the 27th Annual Texas Marine Shrimp Farming and Marine Finfish Culture Short Course on Sept. 26-Oct. 2, 2012, in Port Aransas, Texas. The course combined classroom instruction with pond-side tours of working aquaculture operations. Topics included shrimp production, finfish production, post-harvest handling and processing, water quality and animal health and nutrition.
Results: During the 2010-2013 strategic plan period, 50 aquaculture professionals from the U.S., Philippines, Mexico, Mauritius Islands, Egypt and Greece attended the short course. In 2012, 92 percent of the participants completed the post-course evaluation, and all rated the overall course organization, marine shrimp farming, marine finfish farming, water quality and animal health, and closed systems instruction as "Excellent." Post-course evaluations from other years had similar positive ratings for the training and presentations.

RECAP: Texas Sea Grant's Marine Shrimp Farming and Marine Finfish Culture Short Course provided workforce development and training in best management practices to help sustain domestic aquaculture. Back to Goals

17268 - Texas Sea Grant helps shrimp fleet adopt new bycatch reduction device (BRD) designs that reduce shrimp loss
Relevance: Domestic shrimpers are battling record high fuel costs and competition from farm-raised imports, resulting in an unsustainable business model. To remain in business, fishermen must reduce their operating costs, land a higher quality product, and increase their catch per unit effort (CPUE). Shrimp fishermen are required to use bycatch reduction devices (BRDs) to reduce mortality of non-targeted species, but according to NOAA Fisheries data, the currently used Fisheye BRD contributes to a loss of 10-15 percent of the shrimp catch.
Response: New trawl gear technology has reduced fuel consumption dramatically, and back deck training has increased quality; now new bycatch reduction device (BRD) technology promises to increase CPUE. NOAA Fisheries data indicates that a new composite panel BRD and 3-inch square mesh panels contributes to a loss of only 2.8 percent of the catch. In 2012, Texas Sea Grant provided the Port of Palacios shrimp fleet with intensive technical assistance in the use of the new BRD through result demonstrations via one-on-one technology transfers.
Results: By the end of the 2012 reporting period, more than 90 percent of the Palacios fleet had adopted this new BRD design. This new technology transfer resulted in a corresponding reduction in shrimp loss on the order of 8.7 percent over conventional BRDs.

RECAP: Texas Sea Grant's bycatch reduction device (BRD) technology transfer efforts have increased shrimp catch per unit effort in the Port of Palacios fleet by nearly 9 percent. Back to Goals

16911 - Freshwater residence and habitat requirements of southern flounder determined by otolith chemistry
Relevance: Southern flounder is a broadly distributed and economically valuable species in the Gulf of Mexico and is the most sought-after flatfish on the Texas coast. Population sizes in Texas have declined dramatically over the past two decades, putting the long-term sustainability of the species at risk. A

key uncertainty is the degree to which juvenile southern flounder require low-salinity habitats for successful recruitment; knowing which habitats are most vital can aid efforts to protect critical areas.
Response: To assess freshwater residency patterns of southern flounder during juvenile life stages, researchers conducted chemical analyses of water samples from Texas estuaries, rivers and major tributaries; the otoliths of laboratory-raised fish; and the otoliths of 259 captured fish. The tests of laboratory-spawned southern flounder provided a baseline for otolith chemistry of fish residing in specific freshwater habitats and thus helped researchers assess when the wild fish had moved into lower salinity or freshwater habitats.
Results: The researchers determined that of the chemical tracers tested, Ba/Ca was the best to use for fresh water vs. estuarine residency determinations, and also concluded from chemical analysis that the signatures of rivers were consistently different from the estuarine habitats. Finally, although the average proportion of the wild-caught flounder's lifetimes spent in low salinity habitats was 15 percent, a significant portion of the sampled flounder, 41 percent, never moved into low salinity habitats, while other flounder spent a majority of their lives in low salinity.

RECAP: Southern flounder exhibit a wide range of diversity in their migratory and low-salinity residence patterns, and Texas Sea Grant-funded research suggests that the standard model of southern flounder life history -- that juveniles use low-salinity habitats during the post-settlement phase -- may not apply to all populations in Texas. Back to Goals

16304 - Gulf Sea Grant programs bring $7 million in national resources to address regional needs, strengthen partnerships
Relevance: The large number of technological (oil spills) and natural (hurricanes) disasters in the Gulf of Mexico within the past 10 years highlights the need for collaboration among federal agencies, state agencies, universities, NGOs and others to improve coastal community resilience, ensure seafood sustainability and improve the health of ecosystems Gulf-wide.
Response: The four Gulf of Mexico Sea Grant programs partnered with multiple NOAA entities, including the Gulf of Mexico Regional Collaboration Team, the EPA Gulf of Mexico Program and other federal agencies. The Sea Grant programs served in leadership positions in several regional collaborations, including the Gulf of Mexico Alliance,, partnered with the NOAA Gulf of Mexico Coastal Storms Program , and led the development of a Gulf of Mexico Research Plan (GMRP). The four state programs worked with numerous partners to bring additional resources to the region to directly address the plan's priorities.
Results: Since 2007, the Gulf of Mexico Sea Grant programs' regional research competitions expanded from one solely funded by the Sea Grant programs to five that address restoration ($1.1 million), coastal resilience ($2.1 million), climate and sea-level rise ($1.5 million), ecosystem service valuation ($1.7 million), marine mammal interactions ($650,000) and others totaling more than $7 million in research and outreach funds. Because of the importance of the original GMRP in the aftermath of the oil spill, the NOAA Gulf regional team is updating the plan. The Gulf Sea Grant programs have brought tools and services including the Sea Grant-developed Coastal Community Resilience Index, seafood safety and sustainability training, and hydrological restoration indicators to more than 72 communities across the region.

RECAP: The Gulf of Mexico Sea Grant programs built a regional research and outreach portfolio totaling more than $7 million since 2007 by building strong coalitions of partners to support regional programs. Back to Goals

16051 - Using microzooplankton abundance to predict harmful algal blooms
Relevance: Harmful algal blooms (HABs) are a growing issue for human and ecosystem health, yet the origins and mechanisms of initiation are not well known. Coastal waters provide essential habitat for aquaculture, fisheries, tourism and recreation, thus the increasing frequency of HABs is a serious concern for coastal communities in Texas. Timely discovery of blooms that pose a threat to human health are of critical importance.
Response: Texas Sea Grant funded continued operation of the Imaging FlowCytobot (IFCB) deployed in Port Aransas, which researchers used to study microzooplankton abundance to determine if "loopholes" in grazing pressure can be linked to HAB occurrences. The IFCB captures high-resolution images of cells. The image processing developed to automatically classify phytoplankton was extended to microzooplankton, and observed relationships between microzooplankton and HAB species are expected to provide the basis for predictive indices for early warning of HAB events.
Results: Prediction and early warning of Dinophysis bloom events in 2010 and 2011 were provided to the Texas Parks and Wildlife Department and Texas Department of State Health Services, enabling the latter to close (or delay opening) oyster harvesting in the South Texas region. Closure of oyster harvesting prevented the need for recalling tainted oysters and reduced/eliminated risk to human health. Data from these events has been used to develop the automated classifiers need to identify and quantify Dinophysis ovum and the microzooplankton Myrionecta rubra from the IFCB, which is continuously operating in Port Aransas.
RECAP: Microzooplankton abundance appears to be a robust indicator for prediction of harmful algal bloom occurrence and, when detected by the Imaging FlowCytobot funded by Texas Sea Grant, has provided early warnings for blooms, reducing or eliminating risks to human health. Back to Goals

16050 - Evaluation of laser in situ scattering and transmissometry (LISST) instruments to monitor for harmful algal blooms
Relevance: Harmful algal blooms (HABs) are an ongoing threat to coastal ecosystems, industry and leisure along the Texas coast. A challenge to bloom management is the early detection of HABs.
Response: Texas Sea Grant funded the evaluation of the application of laser in situ scattering and transmissometry (LISST) as a tool to detect the presence and abundance of HAB species in the water column.. LISST instruments, primarily used to measure particle size distribution in a fluid, have the potential to be a component of HAB monitoring systems as they are low-cost and easy to maintain, allowing the deployment of multiple instruments at once and therefore facilitating the monitoring of a large area in real time.
Results: Researchers have successfully measured the scattering signatures of a range of HAB species and demonstrated that they can be detected at bloom concentrations against the background of particles commonly found in natural waters.

RECAP: A Texas Sea Grant-funded research project has demonstrated that laser in situ scattering and transmissometry (LISST) may be a relatively simple and inexpensive way to detect harmful algal blooms in Texas coastal waters. Back to Goals

16047 - Investigating fishmeal replacements in diets of cultured marine fish
Relevance: Aquaculture now supplies more than half of the total fish and shellfish consumed by humans. Fishmeal is included in diets of many cultured fish species, and fishing limits on the stocks from which fishmeal is derived have also set limits for its availability as a dietary staple for aquaculture. In order for aquaculture to continue to expand, suitable alternatives to fishmeal must be developed.
Response: Texas Sea Grant funded the continuation of efforts to discover a largely or completely fishmeal-free diet for the commercial production of red drum. In feeding trials, the researchers evaluated experimental diets containing various alternative-protein feedstuffs in the presence or absence of prebiotic supplements. They also tested the responses of alternative-protein-raised red drum to a slow decrease in temperature and to handling stress at high temperatures and salinities, two stressors often found in aquaculture operations.
Results: Results from the project's feeding trials suggest that at least 50 percent of the protein from fishmeal could be replaced by alternative plant feedstuffs without adversely affecting growth performance of red drum or their responses to environmental stressors.

RECAP: Texas Sea Grant-funded researchers continued to refine red drum aquaculture diet formulations using plant-based protein alternatives to fishmeal, which is a limiting factor in the expansion of aquaculture. Back to Goals

14915 - Public receives information about seafood health benefits
Relevance: Pregnant or nursing women who eat fish that is high in omega-3 fatty acids will pass these nutrients to their babies and support their healthy brain and eye development. However, many women may avoid seafood because of concerns about mercury, which can pass through the placenta or mother's milk to the baby, while others may not be aware of the health risks in fish with high levels of these contaminants.
Response: Texas Sea Grant produced and printed 40,000 copies of a Texas-specific card based on one developed by Purdue University that describes the health benefits of consuming fish high in omega-3 fatty acids, the recommended amounts to consume each week, and which choices can help consumers avoid mercury and PCB.
Results: Texas Sea Grant partnered with two state agencies, the Texas Department of State Health Services, and the Texas A&M AgriLife Extension Service, to distributed 40,000 copies of the "Fish for Your Health: Advice for Pregnant or Nursing Women, Women Who May Become Pregnant & Children" seafood safety cards throughout the state of Texas.

RECAP: Texas Sea Grant distributed seafood safety cards emphasizing the health benefits of seafood and how to avoid heavy metal contamination to tens of thousands of Texans. Back to Goals

14914 - Post-oil spill seafood selection and safety outreach campaign
Relevance: After the 2010 Deepwater Horizon oil spill, coastal communities whose families and economies are inexorably tied to commercial fisheries directly suffered from fishing closures and indirectly from their inability to sell seafood harvested from open waters due to the public's seafood safety concerns.
Response: Texas Sea Grant agents served as lead "point of contact" for all of Texas AgriLife Cooperative Extension to ensure effective communication and coordination related to the oil spill across various state agencies. Particular focus was placed on communicating science findings pertaining to seafood safety. In addition, agents hosted several events attended by hundreds of individuals, including local, state and federal officials, industry stakeholders and the public, in communities across the Texas coast. Additionally, Texas Sea Grant participated in news interviews on local television stations.
Results: These activities helped alleviate public fears about the safety of Gulf seafood. Texas Sea Grant was honored by Texas A&M University with a Newsmaker Award that recognized the program's response to media questions concerning the Deepwater Horizon oil spill.

RECAP: Texas Sea Grant led a campaign to help alleviate the public's fears about the safety of Gulf seafood after the Deepwater Horizon oil spill. Back to Goals

14913 - Intensive Technical Assistance (ITA) program helps to maximize dockside shrimp prices

Relevance: As more premium-looking shrimp are available from large shrimp farming and processing operations in Southeast Asia and Central America, domestic producers must also supply near-perfect shrimp in product condition and pack quality in order to compete.

Response: To help improve output quality in a competitive market and also help the fishery compete against imports while minimizing additional expenditures at the vessel level during a disastrous economic period, Intensive Technical Assistance (ITA) funds were pledged from the Sea Grant Extension Programs in Texas, Louisiana and Mississippi/Alabama, and with the total program budget of $312,000, it was possible to expand the program Gulf-wide as different shrimp species come into their peak harvesting seasons. Research trials focused on every step that occurs on the back deck once shrimp are landed to create a science-based "handling recipe" to maximize the fraction of top-quality shrimp producers offload at the end of every cruise.

Results: ITA research trials documented cost-effective methods of ensuring top visual quality not just during two months of frozen storage but also after four days under refrigeration, and of increasing tenfold the volume of glazing around shrimp in the frozen storage hold. In the short run, producers can expect to minimize deductions for substandard quality shrimp. The ultimate objective is to move wild, domestic shrimp to the top of the price-point hierarchy in the American marketplace by ensuring wild shrimp appear as good as they taste and are packed on par with high-grade imports, which would also require concerted, industry-wide certification and marketing. Results are currently used in on-vessel demonstrations throughout the Gulf of Mexico.

RECAP: Research trials funded by the Intensive Technical Assistance (ITA) program were used to study shrimp handling after landing to find best practices to maximize the percentage of top-quality shrimp. Back to Goals

14406 - Freshwater exchange and larval recruitment through barrier island tidal inlets

Relevance: The salinity of Texas' bays is influenced by both freshwater inflow and by exchanges through tidal inlets in barrier islands. To estimate the effects of floods and droughts on bay salinity and the duration of those impacts, accurate exchange models for flows through the inlets are required. The same exchange models are also needed to estimate larval recruitment through the inlets.

Response: Two major field campaigns studying mixing at tidal inlets were conducted in the 2010-2011 season. In July 2010, a field experiment was conducted with the Texas Water Development Board to measure exchange flow between surface water in Corpus Christi Bay and the sequestered water in the deep shipping channel. In January 2011, a second experiment studied the flow patterns at the Aransas Pass inlet in preparation for the major tidal exchange experiment that was conducted in February 2011. Both field experiments involved measurement of currents, flow patterns, and profiles of chemical tracers.

Results: The data analysis is aiding the development of accurate models of vertical and horizontal mixing at tidal inlets and their associated shipping channels. The January field experiment identified a new mechanism for fish larvae to be captured into the bays behind Aransas Pass. The PIs have teamed with a researcher at the University of Texas Marine Science Institute to study this process for recruitment of red drum through follow-on Sea Grant funding.

RECAP: Researchers modeling mixing at tidal inlets and shipping channels identified a new mechanism for fish larvae to pass through Aransas Pass and collect in the bays. Back to Goals

14332 - Producing viral pathogen-free Atlantic white shrimp for sustainable live bait-shrimp farming

Relevance: There is a large recreational fishing industry along the Gulf of Mexico, which largely depends on a constant supply of live bait-shrimp. Wild shrimp populations may be vulnerable to a number of viruses, and introduction of these diseases can have an adverse if not devastating effect on these populations. Production of viral pathogen-free broodstock populations would minimize the risk of spreading deadly viral diseases to wild populations of shrimp. Availability and large-scale production of postlarvae can also establish the foundation for future stock enhancement programs. Postlarvae produced from viral pathogen-free broodstock can be used for the production of live bait-shrimp in research and commercial operations in Texas and other states to evaluate the economic viability of live bait-shrimp production facilities.

Response: Researchers produced viral pathogen-free F4 generation postlarvae of the Atlantic white shrimp Litopenaeus setiferus. F4 generation postlarvae were shipped to Alabama to evaluate growth and survival of the shrimp in tanks and to determine their tolerance to different salinities. Studies were also conducted at the AgriLife Research Mariculture Lab in Flour Bluff to determine the effect of different stocking densities on growth and survival in tanks and raceways.

Results: Postlarvae were raised to maturity in captivity to produce the viral pathogen-free F5 breeding population. (As of 2011, the researchers have a breeding population of F5 which is ready to produce F6 generation of viral pathogen free postlarvae.)

RECAP: Bait-shrimp for use in recreational fishing were cultured that are viral pathogen free, helping to safeguard the commercial fishery while enhancing the sustainability of the recreational fishery.

Back to Goals

14295 - Genetic markers and their assay for current and future studies of spotted seatrout
Relevance: Because of recent population declines in spotted seatrout, the Texas Parks and Wildlife Department has initiated a hatchery-based stock enhancement program similar to its current program for red drum. Knowledge about discrete subpopulations, if they exist, is necessary for successful stock enhancement, as is the ability to assess the survival of released hatchery fish. Prior to this project, only five non-multiplexed microsatellites were available for spotted seatrout.
Response: Earlier work in the project identified existing PCR primers for microsatellites for a related species, red drum, and tested these against genetic material from 30 fish caught in the Lower Laguna Madre to determine if they reliably amplified microsatellites in spotted seatrout. From the PCR primers for 268 red drum microsatellites, 132 were found to amplify microsatellites in spotted seatrout, and 99 were proven to be polymorphic and are available for future studies of spotted seatrout. In the reporting period, the researchers designed multiplexed sets of PCR primer pairs, which were further tested; two sets of multiplex panels and PCR protocols for each were developed.
Results: The two microsatellite panels are already being used in 2011 projects to genotype parents and larvae at two Texas Parks and Wildlife Department hatcheries, and a description of the multiplex panels is scheduled for publication.

RECAP: A research project successfully generated and optimized molecular-genetic markers and their multiplex assay for use in much-needed genetic studies of spotted seatrout. Back to Goals

14210 - Texas Sea Grant-led training promotes seafood safety after Deepwater Horizon oil spill
Relevance: On April 22, 2010, the Deepwater Horizon drilling rig experienced a deadly explosion, sank, and released millions of gallons of crude oil into the Gulf of Mexico. Fishing closures from Louisiana to Florida caused direct economic impacts on Texas fishermen, as did the reduced demand for seafood due to the public's concerns about the safety of seafood harvested in the Gulf of Mexico in the aftermath.
Response: Texas Sea Grant utilized National Sea Grant rapid response funds to conduct seafood safety training as part of the Harvest Open Waters program. These workshops focused on preventing oil-tainted seafood from entering the food supply. During the sensory training, shrimp were "spiked" with crude oil, and trainees were instructed how to discern obvious oil taint in treated product.
Results: In all, 41 participants representing seafood buyers, federal and state regulatory agencies, and all Texas seafood processors attended. Post-training, seafood industry representatives incorporated this activity into their Hazard Analysis and Critical Control Point (HACCP) plans to demonstrate compliance with the new requirement as a result of the spill. One seafood processor remarked that Texas Sea Grant helped tremendously to calm fears and keep Texas wild Gulf shrimp on the shelves and selling, and without this help, they might have lost accounts and access to various markets in the United States.

RECAP: Texas Sea Grant personnel trained Gulf seafood processors, buyers and regulatory personnel to detect oil on their products to help ensure seafood safety and alleviate the public's concerns.

Back to Goals

Back to Top

Program Performance Measures (2010 - 2013)

Program Performance Measure	Program Plan Target (2010-2013)	Reported	Program Comments
Economic (market and non-market) and societal benefits (jobs created and retained) derived from the discovery and/or application of new fishery production and management models or techniques that lead to increased sustainability and productivity from the fishery. (# of Jobs)	2,000	800	2013 - Since 2008, Texas Sea Grant has worked with shrimp fleets in Texas and the Southeastern U.S. to test, demonstrate, and facilitate the adoption of fuel-efficient trawl gear, including advanced webbing and trawl door designs that reduce drag and improve fuel economy. An estimated 200 jobs were saved each year during the 2010-2013 strategic plan period due to these fuel savings. Texas Sea Grant also assisted with training to provide Trade Adjustment Assistance funding to shrimp fishermen. A total of 4,532 applicants received cash benefits during 2010-2013.
Economic (market and non-market) benefits ($) derived from the	200,000	32,100,000	2013 - Since 2008, Texas Sea Grant has worked with shrimp fleets in Texas and the Southeastern U.S. to test, demonstrate and

discovery and/or application of new fishery production and management models or techniques that lead to increased sustainability and productivity from the fishery. ($ amount from new aquaculture production and marketing techniques)			facilitate the adoption of fuel-efficient trawl gear, including advanced webbing and trawl door designs that reduce drag and improve fuel economy. Economic analysis determined that $32.1 million in fuel costs were saved during the 2010-2013 strategic planning period.
Number of aquaculture enterprises that are assisted to ensure they are using sustainable and ecologically sound business practices.	160	290	2013 - Texas Sea Grant provided technical assistance to more than 60 aquaculture enterprises in 2010 and another 60 in 2011 through visits to ponds, workshop trainings, and responding to questions. In 2012, Texas Sea Grant provided training to 120 aquaculture enterprises through a Trade Adjustment Assistance program that taught sustainable and ecologically sound business practices. In 2013, Texas Sea Grant provided technical assistance to 50 aquaculture enterprises through site visits, workshop trainings, and responding to questions.
Number of suppliers of aquafeed that incorporate some level of fish meal replacements in the standard diets for red drum, reducing their dependence on wild caught menhaden.	5	0	
Percentage of shrimp fishermen who adopt and implement responsible harvesting techniques and practices.	100	346	2010 - Manufacturing errors led to some fishermen being out of compliance of TED regulations. Workshops held in 2011 for fishermen, boat owners and net shops should return TED and BRD compliance to 100 percent for 2011. 2011 - 2011 began with just 51% of Texas Gulf shrimp boats in full compliance with TEDs. Largely due to net manufacturing and installation errors, an intensive dockside educational campaign raised compliance to 82%. NOAA fisheries goal is 88% in compliance. 2013 - Throughout 2010-2013, Texas Sea Grant provided annual on-site gear evaluations on shrimp vessels to support 100 percent compliance with current TED and BRD mandates. Annually, vessels are found to not be in compliance, and Texas Sea Grant provides on-the-spot corrections and later visits to ensure the changes are maintained. 100 percent compliance is the goal the program works towards but is extremely difficult to achieve. The percent compliance reported in each year is an estimate based on the percentage compliance in the vessels inspected that year. (Average percentage compliance for 2010-2013 is 86.5 percent. This number should be used instead of the cumulative total, which adds up to more than 100 percent.)

Back to Top

Program Objectives (2010 - 2013)

Program Objective	Achieved (yes/no)	Program Comments
Annually, Texas Sea Grant will	Yes	2013 - Texas Sea Grant held its annual shrimp and

host a shrimp and finfish culture course that includes curricula on sustainability and environmental regulations. Approximately 10-15 students will attend the course each year between 2009 and 2013 for a total of 60 students by 2013. Note: The estimated number of students participating has been reduced to reflect a slower economic recovery than was originally anticipated.		marine finfish aquaculture short course in 2010, 2011, and 2012, with a cumulative total of 50 participants the course was not held in 2013 because of the retirement of key personnel. However, Texas Sea Grant considers this objective achieved, because although Texas Sea Grant did not reach a cumulative participation level of 60 students in the course for 2010-2013, attendance averaged 16 students each year, and the program used methods outside the course, including on-site outreach, to at least 50 individual aquaculture enterprises each year, to reach numbers well above the 60 in the objective who were educated about sustainability and environmental regulations in aquaculture.
Assuming offshore aquaculture is permitted,domestic aquaculture in Texas is expanded so that two new or currently produced species reach a level of production of more than $5 million per year, to join the five species/categories currently at that level (catfish, red drum, hybrid striped bass, marine shrimp, water gardens).	No	2010 - 2011 - Long-term outcome. The issue of offshore aquaculture has not yet been resolved. 2013 - Offshore aquaculture was not authorized on a commercial basis until 2014, after the end of the 2010-2013 strategic plan period. Before that, it was only authorized on an experimental basis. By 2014, no business had attempted a commercial offshore aquaculture operation. Because this objective was contingent on offshore aquaculture being permitted during the strategic plan period, and it was not, this objective could not be met.
By 2012, Texas Sea Grant will have an innovative technique for early detection of HABs as a result of a funded research project.	Yes	2012 - Texas Sea Grant funded a research project that used an Imaging FlowCytobot to determine if there is a link between predator abundance and phytoplankton blooms. Results from the project gave an early warning of a 2012 Dinophysis bloom, which the researcher provided to state agencies the information informed management decisions about oyster harvest closures. The instrument continues to operate as an early warning system for HABs on the Texas coast.
By 2013, Gulf shrimp fishermen from a Texas-based port will have taken steps to form a Shrimp Fisheries Cooperative to implement onboard handling procedures to enhance product quality.	Yes	2013 - Although no formal cooperative was established, Texas Sea Grant considers this objective to be achieved because the program provided training throughout the 2010-2013 strategic plan period to assist shrimp fishermen with adopting onboard handling procedures that improve product quality. An example of this is the brine-freezing process, tested and perfected by Texas Sea Grant, that preserves shrimp quality during storage on multi-day trips. Texas Sea Grant conducted training in every major port along the Texas coast at least once throughout the 2010-2013 strategic plan period with a minimum of three workshops and 100 attendees per year.
By 2013, production technologies developed by the research projects cited above will be transferred to all of Texasâ€™ aquaculture facilities through presentations at the Texas Aquaculture Association annual conference, the Texas Sea Grant Marine Shrimp and Marine Finfish Short Course, and through the World Aquaculture Societyâ€™s meetings, magazine and journal, and other peer-reviewed aquaculture publications. These technologies will be transferred within one year after the	Yes	2010 - 2011 - Information shared with stakeholders includes research findings of what was not successful. 2012 - Research findings (2010-2012 Gatlin project to reduce reliance on wild-caught fishmeal) were shared with Texas Parks & Wildlife Department (TPWD). 2013 - In 2012, Dr. Gatlin presented the results of a 2010-2012 study at the International Symposium on Fish Nutrition and Feeding. The proceedings from the conference were printed in a special issue of Aquaculture Nutrition in 2013. Research findings from a 2010-2012 project (Fuiman, reducing period of high-quality fishmeal diets for broodstock) were communicated to and

completion of the research project.		used by TPWD. Note: The objectives were originally listed in a different order "cited above" in the objective refers to projects that "focus on the development of aquaculture methods that reduce environmental impact."
By 2013, technology developed from Texas Sea Grant-funded research project(s) to support stock enhancement or other fishery management effort in coastal waters will be shared with Texas Parks and Wildlife Department to aid their programs within one year after completion of the research project.	Yes	2010 - Research results are not yet available for the projects, which were funded during the 2010-12 cycle. 2011 - Results from 2008-2010: Genetic Markers and Their Assay for Critical Studies of Spotted Seatrout (Gold) were in use at two Texas Parks and Wildlife hatcheries in 2011. 2012 - 2008-2010: Genetic Markers and Their Assay for Critical Studies of Spotted Seatrout (Gold). 2013 - Results from 2010-2012: Promoting larval survival through broodstock diet: Implications for fish stock enhancement (Fuiman) were shared with and used by Texas Parks and Wildlife Department in their stock enhancement program beginning in 2013.
By 2013, Texas Sea Grant Extension personnel will work with a national NGO, the Sustainable Fisheries Partnership, and members of the Gulf Shrimp Fishery to attain Marine Stewardship Council (MSC) or similar clean/sustainable international labeling. The label will allow gulf shrimp landed by qualifying vessels to bear the designation of a sustainable fishery and thus command higher dockside prices and open European markets.	Yes	2011 - 2012 - 2013 - Western Seafood in Freeport, Texas, received MSC type certification in 2011. Texas Sea Grant has partnered with the Sustainable Fisheries Partnership on a Fishery Improvement Project for white and brown shrimp. The Sustainable Fisheries Partnership developed a form, used when Texas Sea Grant conducts complimentary evaluations of shrimp fishing gear, that shrimpers can use to show seafood buyers that their product has been harvested using sustainability best practices. Two major seafood buyers, H-E-B Groceries (Texas) and Cox Seafood (Florida) now prefer to purchase from shrimpers who can provide them with this form.
By 2013, Texas Sea Grant will be actively involved in the development of guidelines and policies for open ocean aquaculture in the Gulf of Mexico. (1)	Yes	2010 - 2011 - Guidelines not yet finalized. 2012 - Texas Sea Grant personnel assisted the Gulf of Mexico Fisheries Management Council in the development of its fisheries management plan for the Gulf, more specifically its framework for permitting offshore aquaculture. Their efforts included drafting text for the plan dealing with the environmental effects of offshore aquaculture. The fisheries management plan has passed NOAA is currently working on the accompanying guidelines and policies, which are expected to be implemented sometime in 2014. 2013 - Texas Sea Grant personnel assisted the Gulf of Mexico Fisheries Management Council in the development of its fisheries management plan for the Gulf, more specifically its framework for permitting offshore aquaculture. Their efforts included drafting text for the plan dealing with the environmental effects of offshore aquaculture. The fisheries management plan has passed NOAA is currently working on the accompanying guidelines and policies, which are expected to be implemented sometime in 2014. (Note: The fisheries management plan passed and NOAA implemented additional guidelines in 2014.)
By 2013, Texas Sea Grant will begin printing and distribution of recipe cards, flyers, posters and/or other materials that promote sustainably harvested or	Yes	2013 - Participants of Texas Sea Grant-led trainings that received printed materials were surveyed in 2013 and 100% indicated they increased their knowledge of the way the Texas oyster industry is regulated, 94% increased their

farmed seafood. Consumer surveys will be conducted to determine the success of the printed materials in conveying the message.		knowledge of marine pollution sources in Texas bays, and 54% increased their knowledge of the risks related to eating raw oysters.
By 2013, Texas Sea Grant will fund at least one research project that develops technology to support stock enhancement or other fishery management effort in coastal waters.	Yes	2010 - Gold project 2010-12, Genetic effective size in hatchery-raised spotted seatrout released for stock enhancement Fuiman project 2010-12, Promoting larval survival through broodstock diet: Implications for fish stock enhancement 2011 -
By 2013, Texas Sea Grant will fund at least one research project that focuses on open ocean aquaculture techniques or technology.	Yes	2010 - 2011 - Because federal open ocean aquaculture permitting is on hold, and it is not known when permits will be issued, research awards cannot yet be made in this area. 2013 - 2012 project, Use of next generation DNA sequencing to inform regulatory decisions regarding spatial sites for marine aquaculture in the Gulf of Mexico, Dr. John Gold.
By 2013, Texas Sea Grant will fund at least one research project that focuses on sustainable open ocean aquaculture techniques or technology.	Yes	2010 - 2011 - Because federal open ocean aquaculture permitting is on hold, and it is not known when permits will be issued, research awards cannot yet be made in this area. 2013 - 2012 project, Use of next generation DNA sequencing to inform regulatory decisions regarding spatial sites for marine aquaculture in the Gulf of Mexico, Dr. John Gold.
By 2013, with assistance from Texas Sea Grant Extension personnel, 50 percent of the roughly 630 boats in the shrimp fleet in Texas, 10 percent per year from 2010-2013, will have converted to new trawl gear that increases fuel efficiency.	Yes	2011 - There are now 570 boats in the shrimp fleet in Texas due to economic factor causing them to exit the fishery. The cumulative total of boats converted in 2011 is 132. Vessel adoption is occurring in other Gulf states as well. 2012 - The cumulative total of boats converted in 2012 is 172. Trawl-gear conversions are occurring in other Gulf states as well. 2013 - Approximately 70% of the shrimp fleet in Texas has converted to braided Sapphire webbing or vented, cambered trawl doors that have been proven to improve fuel efficiency.
By the end of 2009, Texas Sea Grant personnel had conducted multiple formal workshops and individual outreach efforts throughout the Gulf states, and all 630 boats in the Texas Gulf fleet alone were in compliance with new BRD technology that was mandated in spring 2009. Though no changes in TED requirements are anticipated during the Strategic Plan period, if there are any such changes, Texas Sea Grant personnel will similarly provide support to the shrimp fishery until they are 100 percent in compliance within a year.	Yes	2013 - Throughout 2010-2013, Texas Sea Grant provided annual on-site gear evaluations on shrimp vessels to support 100% compliance with all BRD technology mandated in 2009. Annually, vessels are found to not be in compliance, and Texas Sea Grant provides on-the-spot corrections and later visits to ensure the changes are maintained. 100 percent compliance is the goal the program works towards but which is extremely difficult to achieve. A change in regulations in 2012 allowed for the use of new materials and to modify existing approved TED designs Texas Sea Grant continued to provide hands-on support to the shrimp fishery and followed up to ensure 100 percent compliance on vessels visited by the program. The average percentage for TED and BRD compliance for 2010-2013 is 86.5 percent.
During the Strategic Plan period, Texas Sea Grant Extension personnel will certify industry and regulatory personnel through its seafood Hazard Analysis and Critical Control Point program as requested/on demand. Note: Approximately 600 industry and	Yes	2011 - 41 individuals received HACCP certification in 2010 no requests were made in 2011. 2012 - There have not been any HACCP certification requests since 2010. 2013 - There have not been any HACCP certification requests since 2010. Seafood handling and safety training occurred as requested from

regulatory personnel have already been certified, and in combination with low turnover in the industry, there is not a high demand at this time for new HACCP certification. Recertification/continuing education is not required.		2010-2013. A total of 41 individuals received HACCP certification in 2010. The majority of employers in Texas have their personnel complete online HACCP training. To supplement this with hands-on training, some seafood businesses have requested Texas Sea Grant's assistance. Six requests were made during the strategic plan period to assist businesses with updating their plans or providing training to personnel.
During the Strategic Plan period, Texas Sea Grant will have funded the printing of and distributed 10,000 seafood safety cards per year, to total 40,000 by 2013, that provide advice for pregnant or nursing women, women who may become pregnant, and children ages 2-6 years.	Yes	2011 - Texas Sea Grant distributed more than 11,000 of the cards in the first year, but demand from the Texas Department of State Health Services declined in the second year. Texas Sea Grant will explore other avenues to increase distribution of the cards. 2013 - Texas Sea Grant printed 40,000 of the seafood safety cards. All were distributed throughout the state of Texas by the end of 2013 through partnerships with the Texas Department of State Health Services and Texas A& M AgriLife Extension Service.
In 2010-2013, Texas Sea Grant Extension staff will train 15 volunteers per year, to total 100 by 2013, to monitor Texas coastal waters for red tide organisms and collect samples for testing as part of the â€œRed Tide Rangersâ€ program.	Yes	2012 - Since 2009, 77 Texas Coastal Naturalists have been trained as certified Red Tide samplers. Certified samplers must collect and process 10 samples to become a Red Tide Ranger. 2013 - Since 2009, 106 Texas Coastal Naturalists have been trained as Red Tide Rangers to do water sampling and monitor Texas coastal waters for red tide.
In surveys of Texas consumers, more than 50 percent of those surveyed indicate that they are aware of seafood safety and sustainability issues and make their purchases with those factors in mind.	Yes	2010 - 2011 - Long-term outcome. 2013 - Texas Sea Grant conducted a consumer survey in Calhoun County. From 81 respondents, 65% indicated that they are aware of seafood safety issues and 55% indicated that they consider sustainability issues when purchasing seafood products.
In the event of an HAB outbreak, Texas Sea Grant will notify the public via placement in local media of press releases and public service announcements. (4)	Yes	2010 - In 2010, Texas Sea Grant personnel appeared in many prominent, widely available news media stories and no press releases were required to alert the public. Public warnings were also issued by the Texas Parks and Wildlife Department and the Texas Department of State Health Services, under whose purview such mandatory warnings fall. 2011 - Texas experienced one of its longest and geographically largest red tides on record between September 2011 and January 2012. Cameron County Coastal and Marine Resources Agent Tony Reisinger and the volunteer group he created and trained - the Red Tide Rangers - collected and analyzed water samples from the affected areas on a daily basis. They determined if red tide cells were present and, if so, they also determined the cell count, which is important for determining the severity of the outbreak. Reisinger and his volunteers transmitted their data to the Texas Parks and Wildlife Department (TPWD), which used the data to formulate public warnings it released through the media and on social media sites. Based on Red Tide Ranger data, Reisinger also posted HAB updates through social media and an email listserv that includes most of the state's major media outlets and many smaller media outlets. 2013 - Texas Sea Grant's Red Tide Rangers provide information on harmful algal blooms to state and federal agencies, which are the entities officially responsible for releasing the information

		through media advisories, public announcements and online. These agencies include the Texas Parks and Wildlife Department and NOAA's National Weather Service.
In the event of an outbreak of HAB or marine invasive species in Texas coastal waters, Texas Sea Grant will fund at least one timely mini-grant on the topic. (3)	Yes	2010 - 2011 - Texas experienced a major red tide event in 2011. Texas Sea Grant funded a mini-grant studying HABs, "Evaluation of Brevetoxin in Moribund Fish" (Zimba) in 2011. 2012 - Texas Sea Grant funded a mini-grant studying HABs to Dr. Lisa Campbell in 2012. 2013 - Texas Sea Grant funded a mini-grant studying HABs to Dr. Lisa Campbell in 2012.
Periodic surveys of 20 percent of all aquaculture businesses in Texas (35 of the 175 businesses licensed by Texas in 2008) use sustainable and environmentally friendly techniques.	No	2010 - Long-term outcome. 2011 - 2012 - 2013 - Regulatory agencies in Texas (Texas Department of Agriculture, Texas Commission on Environmental Quality, and Texas Parks and Wildlife Department) and at the federal level (U.S. Environmental Protection Agency) regularly monitor aquaculture businesses to confirm that they are using environmentally friendly techniques. Businesses are spot-checked for compliance with regulations and heavily fined if they do not meet the requirements. The majority of the state's 187 private aquaculture facilities, a far greater proportion than 20 percent, use environmentally friendly techniques for this reason. Surveys of the businesses would not yield new information in this area and would be an unnecessary duplication of effort and thus an unwise use of Texas Sea Grant resources.
Periodic surveys of seafood industry workers show that all use best practices for seafood safety.	No	2010 - Long-term outcome. 2011 - 2013 - Texas Sea Grant regularly visited with employees at seafood businesses and evaluated the adoption of best practices for seafood safety. One-on-one training was provided to individuals who were found to not be implementing best practices as outlined in their HACCP plan. These informal in-person surveys provide a more accurate picture of the adoption of best practices percent adoption is the goal the program is working towards and is extremely difficult to achieve.
Texas Sea Grant will fund at least one research project in two of the three research cycles included in the Strategic Plan period (2008-2010, 2010-2012 and 2012-2014) that focuses on the development of aquaculture methods that reduce environmental impact.	Yes	2010 - Gatlin project 2008-10, Utilization of seafood processing wastes in aquaculture through integrated nutritional and feed manufacturing technologies Samocha project 2008-10, Viral-pathogen-free Litopenaeus setiferus broodstock production for sustainable live bait-shrimp farming in Texas 2011 - Gatlin project, Sea Grant Aquaculture Research Program 2010: Advancing Fishmeal Replacement in Diets of Marine Fish for Enhanced Production Efficiency, Health and Product Quality Fuiman project 2010-12, Promoting larval survival through broodstock diet: Implications for fish stock enhancement.
The entire Texas shrimp fleet, 630 boats in 2009, adopts new TED and BRD technology.	Yes	2010 - 2011 - Long-term outcome. 2012 - The Texas Administrative Code - Title 31, Part 2, Chapter 58, Subchapter B, Rule 58.160 states that all Texas shrimp boats are required to be equipped with approved TEDs and BRDs. 2013 - 50 CFR 223.206-207 [CFR] requires shrimpers to install TEDs in each net that is rigged

		for fishing. Throughout 2010-2013, Texas Sea Grant provided annual on-site gear evaluations on shrimp vessels to support full compliance with all BRD technology mandated in 2009. Annually, there are vessels found to not be in compliance, and Texas Sea Grant provides on-the-spot corrections and later visits to ensure the changes are maintained. 100 percent compliance is the goal the program works towards but is extremely difficult to achieve.