Texas Sea Grant College Program
Annual Report: 2009

Texas Sea Grant reports the following achievements during the 12-month period from February 1, 2008, through January 31, 2009. This information is reported every year to the National Sea Grant Office.

During this annual reporting period, Texas Sea Grant faced a number of challenges in the aftermath of Hurricane Ike making landfall on the Texas coast in September 2008, including direct impacts on Extension agents and research projects that were abruptly interrupted. However, Sea Grant staff and its funded researchers rose to those challenges, providing assistance to impacted populations or coming up with alternative strategies to be able to complete their research projects as close to on schedule as possible. Some of those accomplishments are included in this annual report.

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Introduction

As of the last census, the population of Texas stood at 22 million, with that number projected to reach almost 28 million by 2010. More than a third of the state's current population, jobs and economic activity are located within 100 miles of the Texas coast, including industries such as oil refineries that are crucial to the prosperity of the United States. Texas leads the nation in marine commerce, with 12 deep-draft ports, 15 shallow-draft ports, extensive barge facilities and 426 miles of the Gulf Intracoastal Waterway, a man-made waterway extending from Florida to the border with Mexico.

Rich in natural resources, coastal Texas also provides opportunities for fishing, hunting, bird watching, boating and many other tourism-related activities. The growing challenge is how to maintain the quality of life of coastal communities while allowing business and industry to thrive. The Texas Sea Grant College Program is helping to meet that challenge.

Texas Sea Grant was one of the first four state programs established in 1971 under the National Sea Grant College and Program Act of 1966. Its mission is to develop a better understanding of Texas coastal resources through research, outreach and educational programs in support of the sustainable use and conservation of those resources for the benefit of the economy and environment. The program is headquartered at College Station, Texas, in Texas A&M University's College of Geosciences.

The approximately $1.9 million that Texas Sea Grant receives annually from NOAA is matched by about $600,000 from the state as a combination of special item funding from the Texas Legislature and support from Texas A&M University. Additional funding periodically comes from grants and contracts from other NOAA programs and from other federal and state agencies.

The program awards about $800,000 annually in research grants to marine researchers at universities across the state. Current focus areas for research are coastal ecosystem health, coastal community and economic development, and marine education.

The Texas Sea Grant Extension Program, supported by Sea Grant in cooperation with the Texas AgriLife Extension Service, Texas A&M University and the county commissioners' courts in several coastal Texas counties, has seven county agents serving the needs of eight coastal counties and seven specialists in the areas of aquaculture, marine business, environmental quality, coastal community development, marine fisheries, marine education, marine policy, and seafood quality, marketing and economics. An eighth position, the national Ports and Harbors Specialist, was part of Texas Sea Grant but the position was moved to another department at the end of August 2008.

The Marine Information Service, the communications arm of Texas Sea Grant, supports the program's research and public service mission by disseminating information on a wide variety of coastal and marine topics, including beach and boater safety, research

projects and extension activities. Many of MIS's publications are available in both English and Spanish.

The program also supports fellowship programs at the federal level. In nearly every year for the past 20 years, Texas Sea Grant has had at least one fellow accepted to the one-year Dean John A. Knauss Marine Policy Fellowship, which offers graduate students the opportunity to gain valuable experience while providing expertise to government agencies, including NOAA and the National Science Foundation, or to the executive branch in Washington, D.C., to aid their marine policy or natural resource efforts. When funding has been available, the program has supported a Texas Fellow, modeled on the Knauss Fellowship, at a state public resource agency. Texas Fellows have been placed with the Texas Parks and Wildlife Department and the Texas General Land Office.

Program Administration

Texas Sea Grant Administration oversees the program's daily operations, is responsible for awarding about $800,000 in grants annually to the best marine researchers in the state, and coordinates the annual Researcher Conference, which brings together investigators from Texas Sea Grant's funded research projects to share their results and build collaborative relationships with colleagues at other universities or state natural resource agencies.

It also oversees the review of applications for Dean John A. Knauss Marine Policy Fellowships and, during the reporting period, was the unit responsible for hosting the National Ocean Sciences Bowl regional competition.

The plan of work for the Texas Sea Grant Administration during the funding cycle February 1, 2008, through January 31, 2010, was:

Objectives:
1. To plan, administer and direct all activities of the Texas A&M University Sea Grant College Program.
2. To solicit and evaluate marine research, advisory and education proposals and select projects based on quality of proposed work and Sea Grant program goals.
3. To provide financial management and administrative support for Texas Sea Grant projects.
4. To foster participation by other educational institutions, agencies, organizations, businesses and industries as active partners in Sea Grant projects where their expertise contributes to further the goals of the Program.
5. To interact with federal, state and local agencies and the public at large in identifying and responding to marine and coastal needs and opportunities.
6. To represent the Texas Sea Grant College Program's interest within the state and nation and internationally.

Methodology: Planning, supervision, coordination, administration and fiscal management will be provided for the network of people and projects that make up the Texas Sea Grant College Program. In addition, the management staff will participate in state, county and national aspects of the Program and will work with industrial, educational, citizen and political groups with interests in marine affairs.

Rationale: We must ensure that our Sea Grant Program is responsive to the needs of those who deal with the marine environment and its resources. We do this by involving representatives from academia, business, industry, private organizations, and local, state and national governments in identifying problems and issues needing solutions. We ensure the applicability and excellence of our projects with help from our Sea Grant Advisory Committee, Marine Advisory committees and personnel, and extensive external review of project proposals.

The Administration reported the following accomplishments during the 2009 Annual Report period, February 1, 2008, through January 31, 2009:

Marine Policy

- Texas Sea Grant responded to a request from a Texas Congressman in February 2008 involving a new red snapper rule adopted by the Gulf of Mexico Fishery Management Council. The requested information was provided to the Congressman's staff so they could better answer questions about the new rule.

- Drilling for oil and gas is being extended into ultra-deep water (water more than 1,500 feet deep), but little is known about how that activity will affect the biological communities. Texas Sea Grant assisted with the planning of a forum on the topic that was held in October 2008 at the Houston Advanced Research Center (HARC) in Houston. The Research Partnership to Secure Energy for America (RPSEA) Technical Advisory Committee took the information from the forum and rolled it into their research project solicitation. HARC, in collaboration with Texas A&M University, ultimately submitted a proposal to RPSEA. The decision on that proposal had not been made within the reporting period.

- Eight Knauss Fellowship applications were received in 2008 for the class of 2009. Interviews were conducted in March and the maximum allowable six applications were forwarded to the National Sea Grant Office. Two of the applicants were subsequently accepted as 2009 Knauss Fellows.

Regional Initiatives

- Representatives from Texas Sea Grant participated in two of five workshops developed in conjunction with the Gulf of Mexico Research Plan, a collaborative effort of the four Gulf of Mexico Sea Grant Programs. The workshops were held after a Gulf-wide survey was conducted among every research group that could be identified. The purpose of the workshops was to prioritize marine-related research needs in the Gulf region. The activity was coordinated by Mississippi-Alabama Sea Grant and has led to strengthening relationships among the Gulf region's Sea Grant programs, NOAA, and various other state and federal agencies.

- The four Gulf of Mexico Sea Grant programs each provided $50,000 per year to support a regional research competition initiated for the February 2007 through January 2009 funding cycle. Proposals selected for funding had to have investigators from at least two of the four Gulf program states involved in the research. The directors agreed in November 2008 to continue the program during the 2010-2012 funding cycle and decided to increase the annual contribution from each program to $75,000. The programs also agreed to try to find other agencies that might be willing to contribute resources to enlarge the program. The 2010-2012 focus of the call for proposals was once again in the area of

coastal hazards. Some interest was expressed within NOAA, the Gulf of Mexico Alliance, and other organizations. The request for proposals was developed in a timely manner and was incorporated in the calls for pre-proposals that were released by each of the four Gulf Sea Grant programs in mid-December 2008.

Other Collaborations

- Texas Sea Grant personnel are working closely with the Gulf Coast Ocean Observing System (GCOOS), and the Director of Texas Sea Grant chaired the Stakeholder Committee of GCOOS. The Stakeholder Committee was asked to provide one or more of its members to serve on steering committees for GCOOS workshops. In April 2008, such a steering committee was put together to plan Recreational Boating Workshops scheduled for Florida and Texas. The Texas workshop was scheduled for November 2008, but had to be postponed because of Hurricane Ike, which devastated that city in August. The Florida workshop was scheduled for February 2009. The purpose of the workshops is to bring various sectors of the recreational boating community together to ascertain the types of observations they would like to have made to assist them in their boating-related activities. Texas Sea Grant had two staff members appointed to the steering committee and was instrumental in helping identify the types of individuals who should attend the workshops and in making contacts with potential attendees and speakers. This activity provides Texas Sea Grant with the opportunity to become engaged with the U.S. efforts associated with implementing the goals of the International Ocean Observing System.

Research Support

- The 8th Annual Texas Sea Grant Researcher Conference was held on September 24, 2008, in College Station. Principal Investigators, and in some cases their graduate students, made presentations on the work they are conducting with Texas Sea Grant support. Presentations on research activities by Texas Sea Grant Extension personnel were also included in the program. This activity has resulted in new collaborations being developed among researchers within and between institutions of higher education in the state who often develop ideas for interdisciplinary research, for which they may in the future seek research support from Sea Grant or other funding sources.

- Plans for the February 2010-January 2012 funding cycle were developed in late 2008. In January 2009, some of the administrative staff from Texas Sea Grant visited with prospective principal investigators in College Station, Galveston and Corpus Christi to discuss the priority research areas for the program and the pre-proposal and proposal process for both the Texas Sea Grant research funds and those that will be available from the regional research program.

Marine and Aquatic Science Literacy

- Texas Sea Grant hosted the northern Texas regional National Ocean Sciences Bowl (NOSB) competition in February 2008. This was the third year that Texas Sea Grant had been the host for the Dolphin Challenge competition. The winning high school went on to compete in the national NOSB competition in Seward, Alaska, in April.

Extension Program

The plan of work for the Texas Sea Grant Extension Program during the funding cycle February 1, 2008, through January 31, 2010, was:

Objectives:
1. To achieve sustainable, ecologically responsible aquaculture operations in Texas and waters adjacent to Texas.
2. To achieve healthy ecosystems in the coastal and marine areas of Texas.
3. To achieve sustainable and economically viable fishery-related industries and enterprises.
4. To achieve an economically viable and informed marine business community.
5. To achieve a populace knowledgeable on the issues related to the coastal and marine environment, resources and enterprises.
6. To achieve an economically viable and sustainable seafood industry that produces, processes and markets safe, high-quality seafood products.
7. To achieve balanced and effective coastal and marine policies through education and coordination with international, national, regional, state and local decision makers.
8. To assist coastal communities in efforts to protect their environmental amenities, strengthen their economies and improve their quality of life.
9. To promote responsible management of port and harbor resources through closer interaction between Sea Grant and major stakeholders in the marine transportation system.

Methodology: The objectives will be undertaken and achieved through the network of county coastal and marine resources extension agents and extension marine specialists under the programmatic leadership of the Texas Sea Grant Extension Program. The staff will utilize both standard and innovative tools to educate coastal residents and enhance coastal communities and industries involved in coastal issues. Education and outreach tools will include workshops, classroom instruction, symposia, colloquia, summits, publications, public meetings, result demonstrations, individual contacts, discovery cruises aboard the Marine Education Vessel *Karma*, field trips, computer enhanced educational resources and electronic newsletters or websites. The National Sea Grant Office, Texas Legislature, Texas A&M University System, county commissioners' courts and various other granting and funding entities, both continuing and to be awarded, will provide resources to support the activities of the Sea Grant Extension Program.

Rationale: The objectives in this project have evolved to support issues identified by interest groups, local advisory committees, community leaders, the Sea Grant Extension Advisory Board, the Sea Grant Advisory Committee, the Texas Legislature, the National Sea Grant Office and the U.S. Congress. Furthermore, these objectives are embedded in the program's strategic plan.

The Texas Sea Grant Extension Program, including its six county agents and seven extension specialists, reported the following accomplishments during the 2009 Annual

Report period, February 1, 2008, through January 31, 2009. They are organized by National Sea Grant Strategic Plan focus area:

Healthy Coastal Ecosystems

Volunteer Efforts

- Through their joint appointments with Texas AgriLife Extension, four of Texas Sea Grant's county-based coastal and marine resources agents are active in organizing and providing volunteer training for the Texas Master Naturalist Program (TMN). During the reporting period, the four agents trained 46 new Naturalists. Also during the same time period, the full cadre of Naturalists – 408 – accounted for 31,334 educational contacts. The Texas Master Naturalist (TMN) Program is operated jointly by Texas AgriLife Extension and the Texas Parks and Wildlife Department (TPWD). Texas Sea Grant/AgriLife Extension staff also assist Master Naturalists in finding suitable activities required to subsequently fulfill their required annual 40 hours (minimum) of volunteer work, though many donate many, many more. Additionally, several of the agents have provided advanced training to TMN volunteers. The estimated economic impact of these four chapters' volunteers' work is shown below:

Chapter	Volunteer Hours	Value ($20.25/hr.)
Cradle of Texas (Tillman)	11,040	$223,560
Galveston Bay Area (Massey)	20,683	$418,830
Mid-Coast Chapter (O'Connell)	3,223	$65,266
Rio Grande Valley (Reisinger)	9,744	$197,316

- Texas Sea Grant county extension agents for coastal and marine resources also have been actively involved in the Texas Master Gardener (TMG) program, a highly successful Texas AgriLife Extension program that was the forerunner to the TMN program. Sea Grant agents emphasize aspects of gardening that impact the watersheds of the coastal environment such as xeriscape landscaping and rainwater harvesting in drought-prone Texas, emphasizing the need for freshwater inflows into bays (via water conservation), and the effects of lawn and garden runoff on bay water quality on the Texas coast during rain events. The Texas Sea Grant agent most actively involved in the TMG program documented 9,567 volunteer hours with a value of service of $193,742 for his county alone. The volunteers conducted 34 programs (meetings, seminars, workshops, training sessions, etc.) that resulted in 2,030 contact hours promoting the idea that utilizing Earth Kind™ residential landscaping practices, which promote the use of native and adaptive plants, proper lawn care techniques and precise irrigation practices can reduce water usage, reduce pesticides and save money, while at the same time reducing the amount of runoff pollution reaching the bays and estuaries.

- During the reporting period, Texas Sea Grant's Galveston County coastal and marine resources extension agent and her Master Naturalist volunteers partnered with the Houston-Galveston Area Council and conducted two Texas Stream Team trainings. Fifteen new water quality monitor volunteers completed the intensive training and conducted routine stream monitoring in Galveston County.

- During the reporting period, the coastal and marine resources agent for Matagorda County oversaw the Monofilament Recovery and Recycling program. The agent's volunteers collected 141.9 pounds of monofilament line and sent it to be recycled. The program also aims to increase public awareness of the impacts to wildlife and property by improper disposal of monofilament fishing line into the environment. A total of 440.9 pounds have been collected since records began to be kept in 2004.

Marinas and Recreational Boaters

- More than 50,000 copies of Clean Texas Marina Program and Clean Texas Boater Program publications were printed for distribution to marina personnel and members of the public to enhance the audience's understanding of best environmental practices. Through cooperative environmental education programs with Texas Parks and Wildlife Department, the Boat U.S. Foundation, Marine Environmental Education Foundation, MAT and the Clean Texas Marina Program, Texas Sea Grant was able to make the printing costs of the publications supporting clean marina and clean boater practices sustainable over the long term and less reliant on federal or state budgets.

- The Clean Texas Marina Program, coordinated by the Texas Sea Grant business specialist, signed up five new pledged marinas and five new certified marinas during the reporting period.

- The Clean Texas Boater Program, also coordinated by the business specialist, signed up 462 boaters who pledged to follow clean boating practices to help keep Texas waterways clean.

- The business specialist, in his role as coordinator of the Clean Texas Marina Program, continued to work with the marina industry and Marina Association of Texas (MAT) to recognize outstanding marina industry operators by conducting an awards program on behalf of MAT. He coordinates the effort of a panel of industry leaders who inspect and review marinas for Outstanding Marina of the Year and Clean Marina awards annually. The Clean Texas Marina Program also presented an award to the Texas marina that signed up the most Clean Boater pledges.

- The business specialist, partnering with the Galveston Bay Foundation and Marina Association of Texas, began providing information regarding proposed legislation, SB 2445, and revisions it would make to the Texas Water Code to

various user groups and stakeholders. SB 2445 provides the Texas Commission on Environmental Quality (TCEQ) and Texas Parks and Wildlife Department (TPWD) more enforcement authority over all surface waters in the state, and allows greater local involvement in marine sanitation device inspections and certification of sewage disposal devices. The bill was approved in May 2009 and went into effect September 1, 2009.

Sustainable Coastal Development

Note: Additional Extension-related accomplishments in the area of Sustainable Coastal Development are listed under Coastal Communities Development, which is a separately funded project.

- The coastal and marine resources agent for Matagorda County surveyed 264 county residents and weekend visitors, tourists and Winter Texans to determine their opinions and perceptions regarding current and projected growth in the county. Results of his survey were shared with local leaders and elected officials, chambers of commerce and the city and county.

- Texas Sea Grant's marine business specialist organized and coordinated the 32nd Annual International Marine/Offshore Industry Outlook Conference, held April 8, 2008, in Houston, Texas. Co-sponsored by the Texas Sea Grant College Program and the National Ocean Industries Association, more than 110 industry participants were provided with information on the 2008-2010 outlook for marine construction, offshore drilling, transportation and service operations from marine/offshore industry leaders.

- The business specialist collected data through an annual survey of Texas marinas and published the information in the 23rd Annual (2008-2009) Texas Marina Facilities and Services Directory, a comprehensive guide to the state's marinas grouped by body of water. It includes location and contact information for the marinas and lists the facilities and services that each provides. The publication is referenced by marina planners, developers and those who provide some type of marina services. It also helps identify areas of growth in the Texas boating industry.

- During the reporting period, the coastal and marine resources agent for Calhoun County revitalized an existing kayak paddling trail with new markers and signage and explored the possibility of developing an audio guide for the trail. She also replaced monofilament recycling bins at along the kayak trail and boat ramps throughout the county.

Safe and Sustainable Seafood Supply

Fisheries

- During the reporting period, the Texas Sea Grant fisheries specialist, seafood specialist and Cameron County agent traveled to Louisiana, Mississippi and Alabama as part of an energy conservation program and conferred with shrimp industry cooperators. During the trip, the fisheries specialist picked up 152 Bycatch Reduction Devices (BRDs) from NMFS in Pascagoula, which were distributed to the industry members. The Cameron County agent was given 80 of these BRDs, which he distributed to his clientele in South Texas. On a subsequent trip, the fisheries specialist acquired an additional 138 BRDs from Pascagoula and distributed them to industry members.

- During the reporting period, the Texas Sea Grant fisheries specialist planned and coordinated the Sea Grant Regional Fisheries Extension meeting, which was held in conjunction with the Gulf States Marine Fisheries Commission meeting in Galveston. The specialist met with the commissioners, who voted that the regional Sea Grant meeting would become a formal advisory panel to the commission.

- The fisheries specialist delivered several presentations during the reporting period on cambered trawl doors for shrimp boats and related fuel savings and on the newly mandated BRDs to numerous audiences. During a trip to Louisiana, he coordinated with two different Louisiana Sea Grant agents to conduct BRD technology transfer efforts in their parishes.

- The seafood specialist, fisheries specialist and two cooperating shrimp fishermen from Texas conducted six workshops in North Carolina that addressed the new trawl doors and the Sapphire webbing that combine to reduce fuel consumption by about 29 percent (the reported median value thus far). About 90 participants attended the workshops, which were held in communities from the town of Supply, on the South Carolina border, to Wanchese, about 60 miles south of the Virginia line.

- The environmental quality specialist participated in the Gulf Fishery Management Council Texas Habitat Committee annual meeting in Houston. The majority of the meeting dealt with the impact of Hurricane Ike on Galveston Bay itself. Roughly 50 percent of the oyster reefs, more than 8,000 acres, were destroyed and will cost an estimated $320 million to restore.

- The Texas Sea Grant Extension Program facilitated the appearance of Mr. Patrick Riley, General Manager of Western Seafood in Freeport, to testify on behalf of Sea Grant at a Sea Grant Program reauthorization hearing held in Washington, D.C., in April 2008.

- In June, the Sea Grant Extension Program team conducted a “Shrimp School” on South Padre Island for Texas Department of Agriculture (TDA) marketing and promotions staff headquartered across Texas. The seafood specialist highlighted the environmentally friendly aspects of shrimping, dispelling several myths about the industry, while the fisheries specialist described his work with new fishing gear that increases fuel efficiency and leaves a smaller “footprint” on benthic sediments and habitat. The environmental quality specialist discussed unique flavor attributes of wild vs. pond-raised shrimp. Nearly 40 TDA staff were in attendance. TDA has cultivated a cadre of “food leaders” from high-end retailers and chefs, and often conducts targeted promotions of selected food products. Given the domestic wild caught shrimp market share is less than 10 percent, generic promotional work that focuses only on “using more shrimp” does little to boost the revenue streams of local producers. On the other hand, if TDA marketing specialists can target their efforts towards the high-end of the retail sector and show how wild Texas shrimp fits into the larger picture of a sustainable harvest caught in the most environmentally friendly way possible, it is believed a higher price premium can be generated.

- During the reporting period, three Texas Sea Grant specialists met with industry and national conservation group representatives and created a video "story" about the newly mandated by-catch reduction gear and what it means to offshore shrimp producers. A three-minute video clip was produced and launched on their website at http://www.oceanconservancy.org/site/PageServer?pagename=ftf_retailers_ roundtable. Since that time, the video has also been posted to YouTube at http://www.youtube.com/watch?v=E-2V1qe7pnY.

- Texas Sea Grant specialists and a county coastal and marine resources agent were able to bring together two groups that had historically not worked together harmoniously. Viewed as a non-biased, research-based entity by both the commercial shrimp fishery and environmentalists, Texas Sea Grant was able to identify both elite fishermen with a track record of testing and refining innovative gear to reduce their ecological impacts and members of the Ocean Conservancy who wanted to see a greater and more widespread technology transfer of experimental gear being tested by Texas Sea Grant. These identified individuals formed the Sustainable Fisheries Partnership (SFP) to explore innovative ways to move the fishery toward greater sustainability. Members of the SFP include the Ocean Conservancy, Gulf shrimp fishermen, seafood buyers and other fishery experts. The inaugural meeting of SFP was held on November 21, 2008. It was moderated by Texas Sea Grant’s Cameron County coastal and marine resources agent and included among its attendees the Texas Sea Grant seafood specialist and fisheries specialist. SFP promotes having the tropical shrimp industry or a portion of it (actually determined by interest among producers and processors) obtain environmental certification similar to that offered by the Marine Stewardship Council, thus opening larger markets and yielding higher dockside prices for the fishermen. From the SFP, a “Gulf of Mexico Shrimp Fishery

Improvement Roundtable" that included Texas Sea Grant personnel was held to identify measures that might further improve the fishery.

Seafood Safety

- In November at the Gulf States Marine Fisheries Commission meeting in Key Largo, Florida, the coastal and marine resources agent for Cameron County presented research findings from his ongoing study of mercury content in local fish species. Acknowledging work performed by Harriet Perry, Gulf Coast Research Laboratory and also the Mississippi/Alabama Sea Grant Programs, and cautioning his audience that many of the 812 fish he sampled were landed during fishing tournaments and thus were larger and had a potential for greater levels of bioaccumulation, he revealed that he had found high mercury levels in samples of bonita, cobia, certain shark species, king mackerel, amberjack, blackfin tuna and yellowfin tuna, though samples obtained from dolphin (dorado fish) were low. He noted that his findings of elevated mercury levels would place some of these fish on cautionary lists, especially for pregnant women and children.

- Seafood Hazard Analysis and Critical Control Point (HACCP) activities conducted during the reporting period centered around intensive technical assistance to one firm that produced a smoked, dried catfish product oriented to the ethnic African market in Houston. In particular, this firm was having difficulty with the regulatory community in demonstrating that their HACCP plan was capable of producing a safe product. The environmental quality specialist and seafood specialist performed several functions for this firm, including characterization of the entire process (from cutting to a prescribed thickness to ensure consistent heat transfer, to cooking in gas-fired, rotisserie ovens, to smoking/drying in a smoke house, to packaging), performing additional validation by having the final product sent to an outside laboratory for analysis that measured water activity across the entire slate of locations where fish was cooked and then smoked/dried, and specifying a variety of data collection equipment necessary to verify that their HACCP plan was operated as prescribed.

Aquaculture

- During the reporting period, the Texas Sea Grant aquaculture specialist provided technical assistance to Cruz de Lereta, a local Mexican fishing cooperative, to oversee the stocking of 10 million hatchery-raised postlarval shrimp. Stocked in a 640-acre netted section of a 750-acre estuary for growout, more than 248,000 pounds (112,800 g) of head-on shrimp were harvested. Feeding, harvesting and processing the shrimp produced steady employment for an additional 50 fishing families.

- The aquaculture specialist oversaw the management and operation of the Texas Aquaculture Association's (TAA) website (http://www.texasaquaculture.org)

during the reporting period. The website recorded more than 300,000 hits and 200,000 files downloaded during the reporting period.

- The aquaculture specialist updated, compiled and posted a detailed report, titled, "Texas Aquaculture Industry – 2008," which contained the most up-to-date and reliable data about the industry. The 400-page document was the file most frequently downloaded from the TAA website.

- The aquaculture specialist served as a member of the TAA's Board of Directors and on three TAA committees during the reporting period. He also helped to plan and conduct the 38th annual TAA Conference and Trade Show. This industry conference, held January 21-23, 2009, in Bay City, Texas, brought together vendors, producers, regulators and researchers. Researchers delivered informal presentations on their research and discussed how their results could affect farm production practices. TAA is a not-for-profit 501(c)3 organization.

Hazard Resilience in Coastal Communities

Hurricane Ike Recovery

- Texas Sea Grant county coastal and marine resources extension agents worked to better direct federal, state and local resources and assistance to immigrants without the means to acquire them in the aftermath of Hurricane Ike. The agents collaborated with a local church in the largely Vietnamese-American community of Oak Island to secure interpreters and transportation to FEMA centers for registration and assistance and to the Texas Workforce Commission in Beaumont for these rural fishing community residents, allowing them to seek disaster unemployment assistance.

- Two Texas Sea Grant county agents located, photo-documented, marked and recorded the GPS locations of derelict recreational vessels after Hurricane Ike. In all, some 80 vessels were located and recorded. State registration numbers were compiled from the lost vessels and cross-referencing with Texas Parks and Wildlife Department records. Once identified, the boat owners were contacted. By locating lost vessels (some deposited in open pastures miles from the water), the insurance reimbursement process was greatly speeded.

- Three weeks after Hurricane Ike made landfall in September 2008, Texas Sea Grant staff assessed damages sustained by the fishing industry. Several industry-specific surveys were developed and distributed to targeted, impacted groups across the Galveston Bay System, including those who hold leases within the bay system for the cultivation of oysters, oyster processors and distributors, commercial fishermen, seafood dealers and processors, and fishing guides licensed to carry six passengers. In addition, commercial fishermen and fishing guides from the Sabine-Neches area were also queried about their respective,

storm-related damage. All surveys of seafood-linked enterprises sought similar information about physical damage, the estimated cost to repair or replace assets damaged or destroyed by the storm, and the expected time required to return damaged or destroyed assets to full operation. Economic and ecological impact reports based on these surveys were expected to be released during the next annual report period and would include recommendations for rebuilding and recovery. These reports will be made available to stakeholders, local leaders, elected officials, industry and trade groups as well as governmental and non-governmental organizations. The environmental quality specialist contacted both state and federal officials and requested assistance for Galveston Bay commercial fisheries and recreational fishing guide businesses. While no funds were promised, each person contacted indicated that the economic information Texas Sea Grant is gathering in the surveys will be crucial to any future assistance to the industry.

- The environmental quality specialist participated in the Gulf Fishery Management Council Texas Habitat Committee annual meeting in Houston. The majority of the meeting dealt with the impact of Hurricane Ike on Galveston Bay itself. Roughly 50 percent of the oyster reefs, more than 8,000 acres, were destroyed and will cost an estimated $320 million to restore.

Hurricane Preparedness

- In April 2008, the Brazoria County coastal and marine resources agent chaired a local emergency planning committee that developed a hurricane awareness seminar. The day-long annual event, titled "The Perfect Storm," shows continued growth, and during the reporting period was held on consecutive Saturdays in May and June at two locations. Fifteen local organizations co-sponsored the program, and approximately 400 people attended.

- The coastal and marine resources agent for Matagorda County coordinated the third annual Community Hurricane Awareness Conference held in Bay City, which trained residents in hurricane planning and preparations. Approximately 350 people attended.

Safety at Sea

- In 2008, the nine-hour Commercial Fishing Vessel Drill Conductor Program, administered by the Texas Sea Grant Program, reached a new milestone with contractors having trained more than 3,000 people since the program began in April 1994. Texas is second only to Alaska in the number of programs and personnel trained under this type of “train the trainer” program. During the reporting period, the program conducted nearly 50 sessions, with more than 500 participants from Maine and Michigan. The safety and survival training program for commercial fishermen is certified by the U.S. Coast Guard (USCG), and the Commercial Fishing Vessel Drill Conductor Program provides all the USCG-

required training and materials to each fisherman taking the course. The Drill Guide Manual used in the course was updated and reprinted in 2008 with funds from registrations. Drill conductor programs like the Commercial Fishing Vessel Drill Conductor Program have reduced both injuries and fatalities in the commercial fishing industry, as reported by the USCG.

Additional Activities

Additional projects that do not easily fall under one of the National Strategic Plan's four focus areas are also important priorities for Texas Sea Grant. Accomplishments in these areas during the reporting period include:

Marine and Aquatic Science Literacy

- During the reporting period, Texas Sea Grant's Floating Classroom Program (FPC) conducted 63 student and youth group cruises and public cruises, serving 21,264 students and members of the public and providing 4,400 instructional contact hours. Established in 2001 and administered by the marine education specialist, the FCP utilizes the *Karma*, a 57-foot converted shrimp vessel. Established in 2001, the program's ongoing mission is to conduct an educational program that includes a hands-on investigative cruise supplemented by shoreside science demonstrations and experiments, either from its homeport at that time in Matagorda, Texas, or in other locations along the coast as demand and financial support warrant.

- Through their joint appointments with Texas AgriLife Extension, four of Texas Sea Grant's county-based coastal and marine resources agents are active in organizing and providing volunteer training for the Texas Master Naturalist Program (TMN). During the reporting period, the four agents trained 46 new Naturalists. Also during the same time period, the full cadre of Naturalists – 408 – accounted for 31,334 educational contacts. The Texas Master Naturalist (TMN) Program is operated jointly by Texas AgriLife Extension and the Texas Parks and Wildlife Department (TPWD). Texas Sea Grant/AgriLife Extension staff also assist Master Naturalists in finding suitable activities required to subsequently fulfill their required annual minimum 40 hours of volunteer work, though many donate more. Additionally, several of the agents have provided advanced training to TMN volunteers. The estimated economic impact of these four chapters' volunteers' work is shown below:

Chapter	Volunteer Hours	Value ($20.25/hr.)
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Rio Grande Valley (Reisinger)	9,744	$197,316

- Texas Sea Grant county extension agents for coastal and marine resources have been actively involved in the Texas Master Gardener (TMG) program, a highly successful Texas AgriLife Extension program that was the forerunner to the TMN program. Sea Grant agents emphasize aspects of gardening that impact the watersheds of the coastal environment such as xeriscape landscaping and rainwater harvesting in drought-prone Texas, emphasizing the need for freshwater inflows into bays (via water conservation), and the effects of lawn and garden runoff on bay water quality on the Texas coast during rain events. The Texas Sea Grant agent most actively involved in the TMG program documented 9,567 volunteer hours with a value of service of $193,742 for his county. The volunteers conducted 34 programs (meetings, seminars, workshops, training sessions, etc.) that resulted in 2,030 contact hours promoting the idea that utilizing Earth Kind™ residential landscaping practices, which promote the use of native and adaptive plants, proper lawn care techniques and precise irrigation practices can reduce water usage, reduce pesticides and save money, while at the same time reducing the amount of runoff pollution reaching the bays and estuaries.

- The coastal and marine resource agent for Jefferson and Chambers Counties led numerous hands-on discovery learning field trips for students and teachers during the reporting period. Topics included, but were not limited to, water quality, invasive species, water nutrition, and marine and freshwater ecosystems and habitats. In all, more than 650 youth and 14 teachers attended.

- The Jefferson and Chambers Counties agent conducted 22 field laboratory experiences for 619 adults and youth during the reporting period as part of the Waterborne Education Center (WEC). An additional 30 trips carrying 634 passengers were facilitated by personnel she trained. The trips were aboard the WEC vessels on the Trinity River out of Anahuac, Texas. Funding came from various sources, primarily grants procured by WEC.

- During the reporting period, Texas Sea Grant's Galveston County coastal and marine resources extension agent and her Master Naturalist volunteers partnered with the Houston-Galveston Area Council and conducted two Texas Stream Team trainings. Fifteen new water quality monitor volunteers completed the intensive training and conducted routine stream monitoring in Galveston County.

International Collaborations

- In October 2008, the coastal and marine resources agent for Cameron County traveled to the El Cielo Biosphere Reserve in the Sierra Madre Orientale of Mexico and served as an instructor for nature printing workshops for three local *ejidos* or cooperatives. This project involved personnel from Texas Sea Grant, Texas AgriLife Extension, the Gorgas Science Foundation, Pro Biosfere and the University of Texas at Brownsville. The project was intended to provide an

alternate source of income (besides logging) for these *ejidos* by teaching participants to carry out plant printing, emphasizing native plants, using non-toxic water-based ink on unique long-fiber paper. This art form was originally taught by the county agent using Gulf of Mexico fish species. The project was highly praised by local dignitaries, who asked the staff to return for additional workshops in other locations.

Coastal Community Development

Coastal Community Development is a separately funded unit within the Texas Sea Grant Extension Program. The plan of work for the Coastal Community Development Specialist and his staff during the funding cycle February 1, 2008, through January 31, 2010, was:

Objectives: To assist coastal communities in efforts to protect their environmental amenities, strengthen their economies and improve their quality of life.

Methodology: The objective will be achieved through the Texas Sea Grant Extension/Marine Advisory Service Program staff working under the technical guidance of the Coastal Communities Development/Environmental Quality Specialist, the Texas Coastal Watershed Program created by the Coastal Communities Development Specialist, and the program's leadership service on the Coastal Coordination Council. The staff will utilize workshops, training sessions, symposia, colloquia, publications, mass media, field trips and public meetings to accomplish this project.

Rationale: In support of the national initiative in coastal communities development, the Texas Sea Grant Extension Program designated an environmental quality specialist as the Coastal Communities Development Specialist. Utilizing infrastructure support from the Sea Grant Program and the Texas Cooperative Extension, the specialist created the Texas Coastal Watershed Program and extended its affiliation to the Texas Water Resources Institute. In addition, the Texas program's leadership serves on the Texas Coastal Coordination Council, its executive committee and various working groups to implement the state's Coastal Management Program. These attributes make the program well suited to accomplishment of this initiative.

The Coastal Community Development Specialist and his staff reported the following accomplishments during the 2009 Annual Report period, February 1, 2008, through January 31, 2009:

- During the reporting period, the Coastal Community Development Specialist (CCDS) helped lead the way for the organization and development of the Sustainable Coastal Community Development Network (SCCD). Major accomplishments of the specialist and his team include holding a major meeting in Washington, D.C., in conjunction with the New Partners annual meeting. During that meeting, the SCCD group was formally organized and an executive committee and subcommittees were appointed.

- The CCDS secured and managed more than $400,000 in grants to support CCD/Texas Coastal Watershed Program (TCWP) Extension outreach activities. Grantors included the Texas Commission on Environmental Quality (TCEQ), Harris County (Houston), and the Mission-Aransas National Estuarine Research Reserve (MANERR). Using these and other funds, TCWP personnel hosted or co-hosted 15 major workshops for cities (Port Aransas, League City), agencies (TCEQ, Guadalupe Blanco River Authority, NOAA Coastal Services Center), as

well as citizen and volunteer groups (SurfRiders, Coastal Prairie Master Naturalists, Gulf Coast Master Naturalists, Master Urban Ranchers). These workshops were attended by more than 500 people and targeted local leaders, elected officials, regulatory agency personnel, NGOs, master volunteers, policy makers, and concerned citizens. Workshop topics included: "Planning for Walkability and Sustainability," "Growth Management," "Water and Cities," "Growth and Water" and "Density: Neighborhood Friend or Foe?"

- TCWP's WaterSmart Program coordinated the 2008 Lyondell-Basell Global Care Day. The event included the creation of a nature park for the community of Shoreacres, which is situated on the west side Galveston Bay. More than 80 volunteers participated in the five-hour event. Eight of these volunteers were Master Gardeners and Master Naturalists who helped supervise the additional volunteers. The market value of the volunteer effort was $6,232. This park is the only one of its kind on that section of the bay, and it provides citizen access to allow for a fuller appreciation of wildlife habitats.

- The Dickinson Bayou Watershed Planning Roundup and BBQ Bash was held in League City on August 23, 2008, with more than 100 people in attendance. The primary focus of the roundup was the planning process for the future of the Dickinson Bayou Watershed. Attendees were asked to participate in a series of nominal group planning activities, which were arranged by topic. As the participants moved throughout the hall, they learned about the Dickinson Bayou Watershed Partnership and the Watershed Protection Plan, the water quality in Dickinson Bayou, stormwater best management practices (BMPs), Smart Growth, important watershed habitats, wetlands, raingardens, and WaterSmart landscaping. Booths included a variety of activities ranging from participating in written surveys to manipulating "chips" on aerial photographs to depict various scenarios for growth along the watershed. The latter exercise enabled participants to better visualize how the watershed could accommodate new residents under different growth scenarios.

- Two workshops titled "Urban Growth Management: Is It Possible in Your Watershed?" were held in August 2008. Members of the TCWP staff presented information about growth issues in the Houston-Galveston region and ways these could be handled. Topics included regional watershed planning, Smart Growth, stormwater BMPs, stormwater wetlands, rain gardens, and WaterSmart landscapes. Twenty-two individuals from 15 organizations attended these workshops.

- TCWP staff coordinated writing of the Dickinson Bayou Watershed Protection Plan. This document is a comprehensive stakeholder plan that addresses the water quality issues of Dickinson Bayou. It summarizes the current state of the watershed, including the current total maximum daily load studies, and sets goals to improve watershed health and strategies to reach these goals. The plan was completed in spring 2009.

Marine Information Service

The Marine Information Service (MIS) is the communications arm of Texas Sea Grant. The plan of work for the Marine Information Service (MIS) during the funding cycle February 1, 2008, through January 31, 2010, was:

Objectives:

1. To provide information on Texas Sea Grant, coastal issues, marine safety and marine education to stakeholders throughout the state.
2. To continue to preserve Texas Sea Grant's archival publications in digital form.
3. To assist Sea Grant-funded investigators in working with print and electronic media through printed pieces, on-site workshops and on-demand consultation.
4. To provide technical expertise in hosting the Program website as well as those for specialized program components and for Sea Grant's Gulf and Southeast Region program.
5. To provide publication, public information and conference support for the administrative, research and outreach components of the Texas Sea Grant College Program.
6. To cooperate with state and federal agencies and nongovernmental organizations in producing joint publications and programs.
7. To make MIS safety publications available immediately through online access.

Methodology: Key audiences will be reached through ongoing and new projects with emphasis on publications, news releases, media relations and outreach projects. MIS will work with Sea Grant-funded researchers (recent past and present) to help them work with both print and electronic media in an effort to gain wider dissemination of research results.

Rationale: Legislators, government officials and the general public are better equipped to make decisions about the use of Texas' coastal environment when they are fully informed about the issues, opportunities and problems associated with Texas' marine resources. Students, particularly at the K-12 level, need instruction in the importance of marine resources, and informed consumers will make better use of the state's seafood products.

MIS reported the following accomplishments during the 2009 Annual Report period, February 1, 2008, through January 31, 2009. They are organized by National Sea Grant Strategic Plan focus areas:

Healthy Coastal Ecosystems

- Working with the Texas Parks and Wildlife Department and medical supply manufacturer Becton, Dickinson and Company (better known as B-D), MIS staff constructed 10,000 fish venting tools (mandated by federal law for use in federal waters) using 20 ml syringes and 18-gauge needles. Each tool featured a sticker

showing proper venting technique. During the reporting period, MIS distributed 7,000 of these tools to recreational fishermen and charter boat businesses.

- MIS staff continues to work with the Matagorda County agent for coastal and marine resources to develop and implement a marketing plan for the Monofilament Recovery and Recycling Program, an effort aimed at removing discarded monofilament fishing line from Texas' marine ecosystems, where it poses a threat to a variety of coastal and marine animal species. During the reporting period, MIS staff worked to revamp the program's website and also designed and produced 10,000 brochures, most of which were distributed to recreational fishermen in packages containing fish venting tools.

- Research project Principal Investigator Dr. Troy Holcombe produced the latest in a series of highly detailed bathymetric/topographic maps of the Texas and Louisiana coasts out to the continental shelf. MIS arranged for Holcombe to present this map during a poster session at the 2009 State of the Bay Conference in Galveston. MIS also archived the map data for use in future projects.

Hazard Resilience in Coastal Communities

- In the weeks following Hurricane Ike's landfall, Texas Sea Grant's Calhoun County and Jefferson-Chambers County marine agents approached MIS staff about developing easily reproducible fact sheets, based on those created by Louisiana Sea Grant, that would instruct Texas residents on how to successfully navigate the Federal Emergency Management Agency's bureaucracy during hurricane recovery. During the reporting period, the fact sheets were under development, with completion planned before the start of the 2009 hurricane season.

- MIS continued to provide hurricane awareness information in both English and Spanish to Texas residents through the publication *Eye of the Storm*, which includes hurricane preparedness tips and a hurricane tracking chart. About 5,000 copies were distributed during the reporting period.

- As a partner in the national Rip Current Awareness campaign, Texas Sea Grant distributed in coastal communities 2,000 of its bilingual posters and table tents describing how to escape a rip current if swimmers are caught in one.

Additional Activities

- Work began on revising MIS' popular dichotomous fish key, *Saltwater Fishes of Texas*. Two graduate students at TAMU-Corpus Christi, under the direction of Dr. David McKee, are conducting the revision.

- MIS staff continued to work with Texas Sea Grant's Marine Education Specialist to market the Floating Classroom Program (FCP), which offers Texas students a hands-on marine science experience aboard a specially outfitted boat.

- MIS provided publication, planning and logistical support to Texas Sea Grant's National Ocean Sciences Bowl (NOSB) Coordinator in support of the Dolphin Challenge, the annual regional NOSB competition hosted by Texas Sea Grant at TAMU.

- MIS staff continued to preserve Texas Sea Grant's archived publications in digital form on CD-ROM. During the reporting period, 127 publications, primarily books and marine advisory pieces published between 1978-1986, were scanned and saved.

- MIS staff interacted with and distributed publications to many of the 6,000 elementary and secondary education science teachers who participated in the annual Conference for the Advancement and Support of Science Teaching (CAST), held in Fort Worth in November 2008. During the three-day exhibition, MIS staff distributed a total of 12,500 copies of various TXSG publications.

- Not counting publications distributed during the CAST, MIS distributed 33,335 copies of various products during the reporting period.

- During the reporting period, MIS staff designed and produced 20 new products and reprinted and/or produced 12 existing products.

- The MIS webmaster hosted, maintained and updated six different web sites: Texas Sea Grant, Southeast Atlantic and Gulf Sea Grant Region, Monofilament Recovery and Recycling Program and the Dolphin Challenge National Ocean Sciences Bowl regional competition.

- The MIS webmaster continues a leadership role on the TAMU College of Geosciences IT Committee and continues to serve on the National Sea Grant Webmasters Committee.

- Texas Sea Grant's Communications Coordinator continues to serve on the editorial board for the TAMU College of Geosciences' magazine, *GeoConnections*.

Research Projects

Texas Sea Grant-funded researchers listed below reported the following accomplishments for their projects during the 2009 Annual Report period, February 1, 2008, through January 31, 2009. They are organized by National Sea Grant Strategic Plan focus area:

Healthy Coastal Ecosystems

Genetic analysis of nitrogen assimilation in the Texas brown tide *Aureoumbra lagunensis*

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Abstract: The pelagophyte alga *Aureoumbra lagunensis* causes recurrent "brown tide" blooms in Texas, including the longest harmful algal bloom on record from 1989-1997. Brown tides disrupt coastal ecosystems by excluding other algae, harming invertebrates, and reducing light availability, causing death of seagrass beds that are critical nursery habitat for many fish. The cause(s) of brown tides are still unknown, but are thought to involve the ability of *Aureoumbra* to use organic nitrogen, especially at low concentrations. We propose to clone a set of genes encoding proteins involved in nitrogen assimilation in *Aureoumbra* and to use them as molecular markers of nitrogen source use in this organism. These markers will enable us to determine the nitrogen source(s) used for growth in the field and the nutritional status of the populations. This information will improve our understanding of the role of nitrogen in the development and persistence of brown tide blooms, and enhance our abilities to predict when *Aureoumbra* blooms may occur, if they will persist, and when they will end. Knowledge of the factors that contribute to bloom formation and persistence could also help to determine what mitigation measures could be implemented to prevent or ameliorate brown tide blooms.

Accomplishments reported February 1, 2008, through January 31, 2009:

- During the reporting period, the researchers cloned, sequenced and verified the genes encoding the ammonium transporter (AMT) and urease C subunit (UREC) in *Aureoumbra lagunensis*. Attempts to use the same process to clone the nitrite reductase gene sequence were unsuccessful, and attempts to isolate the amine oxidase gene were not yet begun.

- To set up for their study, the researchers cloned, sequenced and verified a partial sequence of the actin gene (ACT). They are using it as standard for the quantitative PCR to enable relative quantification of gene expression differences in their experiments.

- The researchers also conducted preliminary experiments examining the expression of the AMT and UREC genes. This involved testing several methods for extracting mRNA from *A. lagunensis*. They found that plant nucleic acid extraction kits gave the best yield of clean DNA and RNA that amplified well by PCR. They have extracted RNA from ammonium-grown cultures, converted it to cDNA, and amplified the AMT and UREC target genes using PCR (not quantitative PCR) to determine the presence or absence of gene expression in those cultures.

Genetic markers and their assay for critical studies of spotted seatrout (*Cynoscion nebulosus*) in Texas bays

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Texas A&M University, College Station

Abstract: The recreational fisheries for the estuarine-dependent sciaenids *Cynoscion nebulosus* (spotted seatrout) and *Sciaenops ocellatus* (red drum) are a vital resource to economies of coastal communities in Texas. Because of recent declines in abundance, the Texas Parks and Wildlife Department (TPWD) has initiated a program of stock enhancement of spotted seatrout, similar to the successful program for red drum initiated more than 20 years ago. A two-year project to generate and optimize molecular-genetic markers and their multiplex assay for use in much-needed genetic studies of spotted seatrout is proposed. The markers and their cost-effective, multiplex assay will be critical to addressing two major issues regarding both management (assessment and allocation) and stock enhancement of the spotted seatrout resource: structure and geographic boundaries of different stocks of spotted seatrout, should they exist, and assessments of the success of stock enhancement in terms of survival of released fish and optimization of release strategies. The work proposed is to develop and optimize multiplexes for up to 100 nuclear-encoded microsatellites specific to spotted seatrout. The 100 genetic markers will provide the necessary tools to assess multiple chromosomal regions (and chromosomes) for spatially and temporally stable instances of linkage disequilibrium, a novel (for fishes) approach to assessing geographic population structure that includes identification of chromosomal segments that contain genes responding to local adaptive pressure(s). The multiplexes provide the cost-effective approach needed to obtain genotypes at so many genetic markers. Results of the project will facilitate proposed/planned projects on spotted seatrout at two other research units in the state: the Perry R. Bass Marine Fisheries Research Station (TPWD) in Palacios, and the Department of Life Sciences at Texas A&M University at Corpus Christi. Outreach of project deliverables also is proposed.

Accomplishments reported February 1, 2008, through January 31, 2009:

- During the reporting period, researchers extracted genomic DNA from each of 30 spotted seatrout, provided from the Lower Laguna Madre by Texas Parks and Wildlife Department personnel, using a standard phenol-chloroform protocol.

- The researchers tested Polymerase-Chain-Reaction (PCR) primers for a total of 132 nuclear-encoded microsatellites, originally developed from a red drum (*Sciaenops ocellatus*) genomic library, and found them to produce reliable and consistent amplifications in the closely related spotted seatrout. Thirty-three of the primers amplified microsatellites that were monomorphic among a sample of 30 individuals, while the remaining 99 were polymorphic; genotypes at two of the microsatellites did not conform to Hardy-Weinberg expectations.

- The microsatellites characterized in this study will prove highly useful for future genetic studies related to both stock enhancement and the culture of spotted seatrout.

Making bathymetry of Texas/Louisiana coastal and continental shelf/slope Areas compatible with Geographic Information Systems

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Abstract: We propose to enhance usability of the recently completed map/image series "Bathymetry and land topography of the Texas and Louisiana coastal and continental shelf areas" (Holcombe, *et al.*, 2007) by making the images of Louisiana coastal and continental shelf areas fully compatible with GIS (Geographic Information Systems). (Making the images of Texas coastal and continental shelf areas fully compatible with GIS is being accomplished in a coordinated effort supported by the Texas Parks and Wildlife Department). These images are the final product of the recent Sea Grant project "New Bathymetry of the Texas-Louisiana continental shelf: Education, Research, Engineering." In addition, we propose to enter into the GIS framework existing xyz-data and imagery of Northwestern Gulf of Mexico shelf-edge banks and continental slope areas, constructed from multi-beam bathymetry and conventional sounding data, thereby providing complete facility for integrated views of the bathymetry of the entire Northwestern Gulf of Mexico within the arc-GIS domain.

Accomplishments reported February 1, 2008, through January 31, 2009:

- During the reporting period, a Geographic Information Systems version of the bathymetric/topographic map of the Texas and Louisiana coastal areas and continental shelf was completed. It will be made available for download from the

Texas Natural Resources Information System (TNRIS), part of the Texas Water Development Board.

- The Principal Investigator also produced a large (40x72) "bathytopo" map of bathymetry and land topography of the Texas and Louisiana continental shelf and coastal areas and a CD-ROM containing 26 images of detailed bathymetry of the outer shelf banks and the northwestern Gulf of Mexico continental slope, derived from multibeam bathymetry. The maps show features, particularly on the continental slope, that are not visible on past maps purporting to show the topography of the Gulf floor of the two states. The maps have been used by the offshore oil and gas industry to help them plan pipeline routes and in school science classes.

Mapping genetic structure in the seagrass *Halodule wrightii* (shoalgrass) along the Texas Gulf Coast

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Abstract: Seagrass ecosystems are an extremely important habitat for a broad variety of species, including Texas' abundant commercial shrimp and recreational fisheries. Seagrasses around the world face a number of threats from pressures attributed to coastal development. Recent studies have shown genetic variation to be correlated with individual fitness and the ability of populations to resist disturbance. This study's objective is the measurement and mapping of genetic variation among 40 populations of shoalgrass (*Halodule wrightii*) from 10 monitoring sites along the South Texas Gulf Coast. A microsatellite-based DNA marker assay will be used to estimate several measures of genetic variation, including mean number of alleles per locus (A), mean expected heterozygosity (He), mean observed heterozygosity (Ho) and past gene flow within and among sites (pairwise FST). The georeferenced data will be incorporated into a GIS database being developed for use by scientists and managers at state agencies with coastal management responsibilities. Mapping the distribution and abundance of genetic variation will serve both scientific and management goals by laying a foundation for addressing biotic and abiotic influences on variation and as a reference for identifying areas for conservation.

Accomplishments reported February 1, 2008, through January 31, 2009:

- During the reporting period, high resolution mapping data were used to identify sampling locations within each of the 10 sites initially chosen from a set of monitoring locations established in the Texas Seagrass Monitoring Plan.

- Apparatuses for large- and small-scale sampling were built. Each of the 10 locations identified were visited during summer 2008, and between 34-84 samples (rhizome, root and shoot bundles) were collected at each site for a total of 667 samples. The GPS coordinates for each sample were also recorded. All samples were transported back to the TAMUCC campus for long-term storage.

- A method for extracting high-quality DNA from shoalgrass rhizomes was developed during the reporting period. During the reporting period, development was also begun on methods for quantitating DNA using a fluorescence-based spectrophotometric assay.

- During the spring and summer of 2008, DNA was extracted from shoalgrass rhizomes collected in the Upper Laguna Madre and shipped to a private firm, which sequenced hundreds of clones and identified 55 microsatellite sequences. Primer sequences for the microsatellites were designed and delivered along with copies of the *H. wrightii* genomic library.

- During the reporting period, the researchers extracted and quantitated DNA, and conducted control polymerase chain reaction (PCR) assays to test the ability of each sample to amplify, on about 15 percent of the samples collected in the field. (The same procedures were done with the remaining samples in the spring and early summer of 2009.)

- In connection with the project, the PI developed a seagrass training exercise in conjunction with a Harte Research Institute-sponsored "Innovation Academy" for local ninth graders that involved the students collecting, identifying and taking measurements of seagrass samples at TAMUCC's Laguna Madre field station. It also involved an educational program on seagrass biology, genetics and ecology. Approximately 30 students and two high school teachers participated.

- An additional training session in the use of molecular techniques was held on the campus of TAMUCC in August 2008. The three-day course for advanced undergraduates, graduate students and faculty provided a hands-on introduction to molecular methods such as DNA extraction, quantitation, gel electrophoresis, Polymerase Chain Reaction, DNA sequencing and fragment analysis. The course was designed for field scientists who are considering the use of molecular methods in their research.

Influence of nutrient and sediment load on our ability to define beneficial flows for Galveston Bay

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Abstract: Galveston Bay is the largest watershed in Texas, with more than four million people living along its borders, an oyster production that is unsurpassed in the U.S., and a recreational fishery that is worth millions of dollars annually. Given the local population in this area is expected to double by 2020, we need to define the current ecological status of this estuary and determine the impact of future changes in freshwater inflows. In this multi-year study, we will examine the response of the bay to natural perturbations in nutrients and sediment load on the water quality, phytoplankton and zooplankton communities and productivity. This study, when leveraged with other newly funded projects in Galveston Bay, will enable us to capitalize on complementary field work that involves system-wide characterizations of the bay and more focused in-water experiments. Ultimately the data collected will be used in modeling efforts by state agencies to examine the best management approach to regulating freshwater inflows and returned inflows in order to sustain 'beneficial flows' for the Galveston Bay estuary.

Accomplishments reported February 1, 2008, through January 31, 2009:

- The researchers conducted monthly sampling trips in Galveston Bay beginning in April 2008, measuring spatial patterns of water quality using the DATAFLOW flow-through water quality mapping system.

- They analyzed the data through the December 2008 sampling trips for color dissolved organic matter (CDOM), chlorophyll, conductivity, pH, salinity, temperature and transmittance, which shows, for example, that a large pulse of freshwater that entered Galveston Bay from the Trinity River contributed to higher CDOM and turbidity, and at the interface between freshwater and saltwater, higher concentrations of chlorophyll.

- During each sampling trip, the researchers also took samples at six predetermined stations to estimate primary productivity and respiration, and to conduct laboratory analyses of the water samples for nutrients, chlorophyll *a* and phaeophytin *a*, total suspended solids, phytoplankton and zooplankton composition. The researchers completed analysis of primary productivity and respiration rates, chlorophyll *a* and phaeophytin and total suspended solids, and had analyzed some of these nutrient samples from all trips during the reporting period.

- During the reporting period, the researchers conducted resource limitation assays at two stations for a total of 15 weeks over three seasons. The assays were designed to determine if one of three nutrients (N, P or Si) or sediment load is

limiting primary productivity. The large number of samples taken to conduct the assays had begun to be processed. For example, the April 2008 assay showed significantly more cyanobacteria in the northern section of Galveston Bay than in the southern section, but similar amounts of diatoms and dinoflagellates were present throughout the bay. This information, combined with the fact that all treatments had a similar increase in biomass, suggests that phytoplankton were light-limited rather than nutrient-limited. Measurement of phytoplankton productivity in each of the treatments showed low production rates in both sections of the bay, except in treatments where both N and P were added that showed highest productivity levels, indicating that an effort to overcome light limitation may be possible in the presence of both N and P. Continued processing and multifactorial analysis of the results will take place in the project's second year.

- The researchers collected freshwater inflow information from the Trinity River from daily data collection at U.S. Geological Survey (USGS) monitoring stations. Information on the San Jacinto River that was expected to be similarly collected is not available because the station is no longer serviced by USGS. They also analyzed and graphically diagrammed the discharge from the Trinity River based on data from calendar year 2008 and from January 2009.

Field and numerical investigations of tidal vortices for exchange flows through inlets on the Texas coast

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Abstract: This project will evaluate the role of tidal vortices in mixing through an inlet on the Texas coast using field data and numerical analysis. Preliminary inlet characteristics will be collected from Boussinesq-type numerical model simulations, drogue tracer studies, and long-term (many tidal cycles) moorings of two acoustic Doppler current profilers (ADCP). These preliminary results will be analyzed together to design a comprehensive field campaign. During this field campaign, one ADCP will be moored while the other is used to take downward-looking velocity profiles along transects from a ship. At the same time, a flow-through fluorometer on the ship will be used to measure dye concentration of Rhodamine WT injected near one of the inlet boundaries. Drogue tracer studies and a second period of ADCP measurements will complement the field campaign. Collectively, these activities will yield a complete data set for describing the tidal eddies and mixing at the inlet. Once these data are assimilated into the numerical model and the mixing physics adequately represented, the model will be used to evaluate

larval transport and to predict salinity dynamics in flood and drought conditions, with emphasis in both cases on determining the importance of tidal eddies on inlet exchange.

Accomplishments reported February 1, 2008, through January 31, 2009:

- The researchers analyzed predicted tidal data for the Texas coast for 2009 and 2010 to prepare for the model studies. They isolated one week to insert into ADCIRC to determine the necessary boundary condition water levels for the hydrodynamic model, COULWAVE. Using the predicted tidal data, inlets were evaluated based on their likely ability to produce escaping tidal vortices. This information will be used to decide which Texas inlets to assess for likelihood of producing tidal vortices using COULWAVE, and ultimately which one inlet will be the focus of the field study. The ADCIRC simulations were completed and data was being processed to provide movies of velocity and vorticity fields at each Texas inlet.

Sustainable Coastal Development

A Coastal Communities Planning Atlas for decision makers and local residents: Phase II

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Abstract: This project will build on previous work conducted to develop a web-based Coastal Communities Planning Atlas for Texas. The initial phase of research laid the groundwork for providing an easily accessible, web-based tool with which communities can analyze existing socioeconomic and biophysical conditions, and better understand the consequences of development decisions before they take place. The overarching goal of the Planning Atlas system is to create an Internet-driven spatial decision support system that acts as a proactive device to identify, visualize, and predict the impacts of future growth along the coast. Communities along the coast can use this educational tool to help guide future decisions on growth in a sustainable manner such that the need for economic development is balanced with priorities associated with environmental protection and human health, safety, and welfare. In the second phase of Planning Atlas development, we intend to build on the momentum gained from the previous round of funding and make all system components more accessible, functional, visual, and interactive.

Refinements will enhance our delivery of an easily accessible, understandable and graphically represented information system on environmental, hazard, and land use-related issues to local decision makers and residents along the Texas coast.

Accomplishments reported February 1, 2008, through January 31, 2009:

- During the reporting period, the researchers updated 80 layers and added an additional 15 layers, expanding the Atlas to 108 data layers in the main atlas and 56 in the hotspots atlas. The researchers loaded a wide range of socioeconomic, biophysical, development and policy-based layers that users can analyze to better understand the impacts of growth on the Texas coast. Specifically, they added a new suite of layers on the hotspot atlas related to social vulnerability to storms that includes layers such as poverty, childcare needs, housing needs and elderly care, as well as a composite index.

- The researchers added a new atlas component for Galveston County with 2008 parcel-level information, through which users can query more than 300,000 parcels for land use and other property-specific details. They also added geo-coded pictures of damage from Hurricane Ike and developed a click-and-view tool within the Atlas system.

- New backup servers were added at TAMU-Galveston and the TAMU main campus in College Station to ensure the Atlas remains online in case of high volume of use or failure of a server location (which demonstrated its usefulness when the Galveston server was rendered inoperable during Hurricane Ike in September 2008 and operations continued via the College Station servers).

- To accommodate the increased number of data layers, the datasets were moved to ARCSDE geo-database management system. Other software modifications were made to increase speed and response time to the Atlas and ensure multiple users can access and query the system simultaneously.

- The displays of various layers were enhanced, such as replacing opaque displays with semi-transparent displays so multiple layers can be viewed and analyzed on the same map.

- Data download and upload features were fully integrated into the Atlas system with password access.

- Metadata were added to provide information on the creation, accuracy and reliability of most of the layers.

- During the reporting period, the Atlas' creators made presentations to the following groups and at the following conferences:
    - Rice University, SSPEED Conference
    - Spatial Analysis Lab, TAMU

- GIS Day, TAMU Libraries
- NOAA Coastal Services Center
- Texas Sea Grant Researchers Conference
- Texas Coastal Applied Research Review Team
- Annual National Hazards Research and Applications Workshop, Broomfield, Col., by University of Colorado at Boulder Natural Hazards Center
- TAMU-Galveston Seminar Series
- TX Colonias Program, Texas Secretary of State
- Hazard Reduction and Recovery 20th Anniversary Workshop, Texas A&M University
- Galveston State of the Bay Symposium, Galveston
- Geographic Information Systems Day, University Libraries Map and GIS Collections Services, Texas A&M University

- Also during the reporting period, the Atlas was integrated into the curricula for two graduate courses in landscape and urban planning at TAMU.

A comparative study of market and non-market valuations for selected ecosystems services of Galveston Bay

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Abstract: Historically, estuarine ecosystem services have often been taken for granted, resulting in improper management and degradation of natural habitat. Sustainable estuarine ecosystem management and conservation requires proper economic valuations of ecosystems. We propose a comparative study of market and non-market analysis valuations for Galveston Bay. Market analysis valuations will include recreation and estuarine dependent industry, and non-market valuations will focus on vegetation-mediated improvement of water quality. We will conduct a market-based input-output analysis using IMPLAN to assess direct and indirect economic benefits of ecosystem services from selected industries for Galveston County. For the non-market valuation, we will calculate nutrient removal and retention rates by performing an ecological field investigation of morphological and stoichiometric characteristics of plant communities along the reaches of Armand Bayou. Based on the field survey, a replacement cost analysis will quantify the potential monetary and energy savings of using established plant communities to manage nutrient input to the watershed by comparison with a conventional civil engineering method of wastewater treatment (*e.g.*, sand filtration). Comparisons between the market and non-market valuations conducted in this study will

provide a more holistic assessment of ecosystem services and improve methodologies for valuation research.

Accomplishments reported February 1, 2008, through January 31, 2009:

- The researchers partially completed their first task, the literature review of valuation of ecosystem services for the estuarine ecosystem and the geographical background of Galveston Bay. They began updating the annotated bibliography of valuation of ecosystem services in order to review multiple forms of ecosystem services and discuss various valuation methods. The bibliography includes the review of papers published in peer-reviewed journals, books, and articles and papers available on the Internet.

- As part of the field study to examine nutrient assimilation capacity, from May to July 2008 the researchers collected plant, soil, water column, and interstitial water samples along waterways leading away from two sources of anthropogenic nutrients into Armand Bayou, the research site of the study. All samples were processed in the laboratory during the reporting period, and analyses of the nutrient content of each of the sample types will be conducted in the second year of the project.

- The researchers also conducted a series of "bioassay" tests wherein samples of plants with a known biomass were starved of nutrients for several days in the laboratory and then replaced in the waterways for 5-7 days to collect information about the plants' ability to take up nutrients relative to their availability in the water column. The plant samples were collected again for later nutrient content analysis.

- They partially completed the embodied-energy based valuation analysis for water quality improvement by establishing a list of energy intensity values for conventional wastewater treatment plants and components of the natural ecosystem.

Note: Analysis of the samples collected in the field was delayed because of the unavailability of Galveston laboratory facilities for a number of months after Hurricane Ike.

Safe and Sustainable Seafood Supply

Utilization of seafood processing wastes in aquaculture through integrated nutritional and feed manufacturing technologies

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Abstract: An interdisciplinary project is proposed to increase the efficiency and efficacy of Texas-based aquaculture through development of nutritious, cost-effective alternatives to traditional marine protein feedstuffs. This will entail development of protein concentrates and complete diets from seafood processing wastes and biofuel co-products such as soybean meal and distillers dried grains with solubles by applying dry extrusion technology. The most promising products and/or diets will be evaluated for nutrient digestibility and production potential based on assessment of growth performance and metabolic capacity (marginal metabolic scope) via trials conducted under controlled laboratory conditions with red drum at the Texas A&M University Aquacultural Research and Teaching Facility and with penaeid shrimp at the Shrimp Mariculture Project in Port Aransas using well-established, standardized protocols. The developed technologies (manufacturing techniques and feedstuff products) will be subjected to economic analysis and extended to various user groups including seafood processors, feed manufacturers and aquaculturists through established networks. Thus, the developed products from this project will make more efficient use of seafood processing wastes and other co-products from biofuels production to replace fish meal and other costly components of aquaculture diets, increasing the cost-effectiveness of aquacultural production while limiting the expense and logistical constraints associated with disposal of seafood processing wastes.

Accomplishments reported February 1, 2008, through January 31, 2009:

- During the reporting period, the researchers made arrangements with their industry cooperators and obtained seafood processing wastes, prepared the byproducts for incorporation into the experimental diets, and began laboratory experiments to evaluate the nutritional and bioenergetic values of the byproducts in diets for red drum and marine shrimp.

- Preliminary results indicate that high levels of substitution (50 percent of dietary protein) of fishmeal with byproducts generated by seafood industry processing is feasible without detrimental effects on all performance indicators analyzed thus far. Further feeding trials with byproduct meals substituting higher levels of fishmeal in diets for juvenile red drum appear warranted.

Viral-pathogen-free *Farfantepenaeus duorarum* broodstock production for sustainable live bait-shrimp farming in Texas

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Abstract: High demand, inconsistent supply, and high prices have attracted investors/farmers interested in farm-raised bait-shrimp as an alternate source. Screenings of wild shrimp populations from the Gulf of Mexico have repeatedly demonstrated presence of White Spot Syndrome virus. Recent WSSV outbreak in crawfish ponds in Louisiana further stresses the need for development of viral-pathogen-free (VPF) broodstock populations of native species to provide VPF postlarvae (PL). The study's objectives are to: 1. Produce VFP F3 and F4 populations of *Farfantepenaeus duorarum* and provide shrimp farmers/researchers in Texas, South Carolina, Florida, Mississippi, and Alabama with VPF PL and broodstock, 2. transfer sustainable limited discharge, live bait-shrimp production technology to Texas farmers, 3. teach live bait dealers how to increase shrimp survival in their shops, and 4. establish the economic viability of a live bait-shrimp production system, including investment cost, operating costs and returns. F3 and F4 generations will be produced at the Texas Agricultural Experiment Station (TAES) facility. Live bait-shrimp production trials will be conducted at TAES-Corpus Christi, in other commercial facilities in Texas and in other states. The VPF live bait-shrimp industry holds promise for being a profitable business which reduces fishing pressure, minimizes the spread of viral diseases and provides the basis for future stock enhancement programs.

Accomplishments reported February 1, 2008, through January 31, 2009:

- A captive F2 viral-pathogen-free breeding population was produced and was being reared to reach maturity in the spring to produce the F3 VPF population needed for the study. However, based on the poor performance of the F1 and F2 populations of the Atlantic pink shrimp in their facility and in the growout ponds in other locations, the researchers requested and received permission from Texas Sea Grant Administration to focus research efforts on another species, *Litopenaeus setiferus*, the Atlantic white shrimp. As a result, beginning in November 2008, research efforts shifted to the new species and the production of an F4 generation.

Hazard Resilience in Coastal Communities

Quantification of hurricane flooding reduction by vegetation along the Texas coast

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Abstract: Flooding by hurricanes is the primary natural threat to communities along the Texas coast, and fully understanding the risk of coastal flooding is paramount for sustaining these communities and economies. This project addresses a critical need to quantify the benefit of coastal vegetation in coastal storm protection along the Texas coast, to not only better define flooding risk, but also to demonstrate the value of these rich coastal habitats. A two-tiered plan for determining the benefit of coastal vegetation on flooding reduction is proposed. First, the impact of vegetation on wave setup (increased water level by wave breaking) will be quantified in the laboratory because this process dominates initial flooding inundation and is not yet fully understood. Second, a methodology for determining flooding reduction, by both wave setup and wind surge, as a function of vegetation characteristics will be developed by synthesizing laboratory results with existing theories governing steady flow through vegetation.

Accomplishments reported February 1, 2008, through January 31, 2009:

- Laboratory experiments, planned in summer and fall 2008, were conducted in October 2008 in the 3D shallow water basin at Texas A&M University to investigate vegetated wave dynamics through plant fields.

- To determine actual plant geometries for the laboratory testing, a site visit to Galveston Bay was conducted in August 2008, during which a number of one-meter-square plots in areas of healthy and unhealthy marsh were sampled, and plant stem spacing, diameter and elasticity were quantified. Natural channels through the marsh were also observed.

- A synthetic plant field was constructed for use in the laboratory experiments consisting of random arrays of wooden dowels representing plants inset in plywood sheets. Hydrodynamic conditions tested were primarily regular gravity waves, but some tests of solitary waves were also conducted.

- During the reporting period, the researchers began to analyze data from the laboratory experiments. Preliminary results from visual observation, however, show that when waves first reached the “vegetated” area, wave-crest turbulence

and a rapid reduction in wave height were observed, and the effect appeared to be more significant when the plant stems were partially above the surface of the water versus fully submerged. Also, the data indicate a change in wave speed in the presence of vegetation, with higher density plant fields causing a more pronounced change.

- The researchers also observed differences in the behavior of the flow as illuminated by dye injection in the mixing and dispersion process within plant fields in the presence of waves. The dye plume after injection into the vegetated flumes was quickly dispersed and spread throughout the vegetation as the waves propagated, while in the control flumes the dye plume remained relatively together. At the interface between the control channel and vegetation, the dye plumes in some cases moved into the control channel and in other cases moved entirely into the vegetation and dispersed.

Program Development/Rapid Response Grants

Texas Sea Grant sometimes has funding available to sponsor small, short-term projects that may not have been foreseen during the approval process for the two-year grants. These "mini-grants" allow the program to respond quickly to problems or opportunities in which a small amount of funding can leverage significant results, including larger research studies in the future.

Detection of non-indigenous marine invertebrates in Galveston Bay, TX by DNA barcoding (Anja Schulze)

Accomplishments:

- The researchers obtained biweekly zooplankton samples from the fishing pier at Seawolf Park in Galveston in addition to monthly boat-based samples from six stations in different salinity regimes and different distances from the Houston Ship Channel. (The shore-based sampling at Seawolf Park was added when the boat-based sampling was interrupted due to Hurricane Ike.)

- During the reporting period, the researchers also sorted each plankton sample by major taxonomic group and approximately 15 individuals in each group were preserved for DNA extraction.

- DNA extraction and amplification of the cytochrome *c* subunit I gene was largely successful for the shore-based plankton samples and more than 30 sequences were generated. The researchers began analysis of the obtained DNA sequences.

Four other projects were approved to receive Rapid Response Grants during the reporting period but had not received funds in time to have significant progress by January 31, 2009. Their progress will be reported in the 2010 Annual Report. The other funded projects are:

Prevalence of the blue crab parasite (*Hematodinum perezi*) in the Aransas and Corpus Christi Bay systems (Kim Withers)

The utility of salt marsh vegetation as an indicator of climate change at short and long time scales (David Cairns)

A nanoscale microfluidic sampler: Applications in environmental/agricultural sampling of *E. coli* (Tom Bianchi)

Recuration of Marine Fishes (Lee Fitzgerald)

Impacts

Texas Sea Grant reported impacts for the period from February 1, 2008, through January 31, 2009, under the following National Sea Grant Themes:

Ecosystems and Habitats

- *Texas Sea Grant personnel participate in oversight of Texas' Coastal Management Plan.* Since 2001, the Director of Texas Sea Grant has served on the state's Coastal Coordination Council (CCC). The council, which oversees the state's Coastal Management Plan, has representatives from the state's four natural resource agencies, other regulatory agencies and four public members. The Texas Sea Grant Director has helped shape the research agenda for the Coastal Management Plan by arranging for presentations to the council about research activities in the council's interest by researchers from universities across the state. Having cutting edge research that deals with coastal management issues brought before the CCC has helped the members understand the relevance of the studies to coastal management in the state.

- *Texas Sea Grant personnel help coordination of research efforts in Galveston Bay estuary*. The Texas Sea Grant director serves on the Research Advisory Committee for the Galveston Bay Estuary Program (GBEP). That committee is instrumental in designing the biennial research programs that GBEP supports. The committee meets at least once quarterly, listens to results of ongoing research, looks at the Galveston Bay Plan and modifies the objectives laid out in the plan. The committee also provides advice on which areas within the Galveston Bay Plan need the most emphasis in the biennial research programs. This is an ongoing activity, including during the reporting period. A major benefit from having participation from Texas Sea Grant on the Research Committee is that it helps ensure that GBEP and Sea Grant funded research, while it may be complementary, will not be duplicative, thereby helping obtain the best possible value for funds expended on Galveston Bay issues. It also facilitates apprising GBEP of related research in Texas funded by Sea Grant that may be of interest to not only GBEP, but also to other members of the committee from state agencies, NGOs, universities and other organizations.

- *Texas Sea Grant-trained volunteers detect harmful marine organism.* Texas Sea Grant's Cameron County coastal and marine resources extension agent was one of the trainers for the Red Tide Rangers, a group of 32 volunteers organized out of the Rio Grande Valley Master Naturalist Chapter to monitor and collect samples in support of the Phytoplankton Monitoring Network, a national monitoring program that serves as an early detection program for hazardous algal blooms. During the reporting period, Red Tide Rangers volunteers detected large numbers of Dynophysis, a single-cell organism responsible for causing diarrheic shellfish poisoning related to shellfish consumption. The Texas Department of State Health Services closed shellfish waters in Texas to avert consumption of shellfish contaminated with this organism.

- *Texas Sea Grant trains volunteers to monitor for harmful algal bloom.* The Texas Sea Grant-trained Red Tide Rangers volunteer group regularly monitor the waters of the Lower Laguna Madre for *Karenia brevis* and other possibly harmful organisms. Periodic sampling and information for hazardous algal blooms helps avert unnecessary economic losses from tourists avoiding the area as a result of hazardous algal bloom "hysteria." A red tide scare in the 1990s coincided with a 10 percent drop in hotel/motel tax revenues on South Padre Island. In addition to supporting the Hazardous Algal Bloom Workgroup in Texas, the samples and information collected by the volunteers in 2005 is also being used in two UT Brownsville studies on the impact of the brevetoxin aerosol on inshore animals and brevetoxin's effects on cellular synapses. The Red Tide Rangers project is being studied as a model for a statewide initiative.

- *Texas Sea Grant promotes clean marinas.* In just its second year as an industry-managed model, under the direction of Texas Sea Grant's marine business specialist, the Clean Texas Marina Program continues to reduce its dependence on federal and state funding, while at the same time increasing marina participation. By being non-regulatory, Texas Sea Grant has taken a successful statewide program and increased the number of marinas and boaters who adhere to best environmental practices. Through January, there were 72 certified marinas with another 44 pledged and in the certification process, which represents 26,300 boat slips and a third of all marinas in Texas.

- *Texas Sea Grant promotes public participation in environmental protection programs.* As an adjunct to the Clean Texas Marina Program and also administered by the Texas Sea Grant marine business specialist, the Clean Texas Boater Program continued to promote environmentally sound practices to individual boaters in Texas. The program solicited an additional 1,000 recreational boaters pledging to support clean water in Texas during the reporting period, bringing the total membership up to 3,500. The program has been adopted by several other clean marina programs in the country, including Maryland, Virginia and Mississippi/Alabama.

- *Texas Sea Grant mobilizes volunteers to expand environmental education and habitat restoration.* Six county-based coastal and marine resource agents identified, recruited and trained 86 interns through the Texas Master Naturalist (TMN) program. The TMN program's mission is to develop a corps of well-informed volunteers to provide education, outreach, and service dedicated to the beneficial management of natural resources and natural areas within their communities. Upon certification, these 86 interns joined a cadre of 508 master volunteers overseen by the county agents, contributed more than 54,000 hours of volunteer service, the equivalent of 26 full-time employees, whose time is valued at more than $1.1 million (independent sector). These Master Naturalists accounted for 36,334 educational contacts to students and teachers through in-school and after-school projects and trainings, and the general public through

workshops on EarthKind Landscaping and rainwater harvesting. They also assisted in habitat restoration projects ranging from staking 7,000 recycled Christmas trees on the beach to help rebuild sand dunes, to planting more than 2,500 native marsh, wetland and prairie plants in wildlife refuges. Other projects included repairing state parks damaged by Hurricane Ike and conducting sea turtle patrols in order to locate and mark the nests of these endangered species. Advanced training for some included a "Keys to Successful Presentations," which taught the basics of public speaking to large audiences. Six of six (100 percent) reported they "probably will or definitely will" deliver public seminars as a result of the training.

- *Texas Sea Grant removes monofilament line from the environment.* Volunteers in the ongoing Monofilament Recovery and Recycling Program continued to collect monofilament fishing line from recycling bins and send it in to be recycled. The program strives to increase public awareness of the impact to wildlife and property by improper disposal of monofilament fishing line into the environment. A total of 141.9 pounds of monofilament line was collected and sent to be recycled during the reporting period — an increase of 20 percent over 2007. Estimating line strength at 12 pound test (common for coastal Texas), this 141.9 pounds corresponds to a distance between 225.7 and 378.9 miles (roughly the distance between Houston and New Orleans). This brings the total amount collected since 2004 (the first year of records) to 440.9 pounds.

- *Texas Sea Grant increases number of water quality monitors.* Texas Sea Grant's Galveston County coastal and marine resources extension agent and her Master Naturalists partnered with the Houston-Galveston Area Council to conduct two Texas Stream Team trainings. Fifteen new water quality monitor volunteers completed the intensive training and will begin conducting routine stream monitoring in Galveston County.

- *Texas Sea Grant educates volunteers about wise landscape management for water conservation and reduced pollution.* After a series of community-wide workshops on Earth Kind Landscaping, composting and irrigation, rainwater harvesting and Master Gardener Intern Training, under the umbrella of the Texas Master Gardener program, participants showed a significant increase in their ratings of their understanding and knowledge of the subject matter between pre- and post-course surveys. Ninety-five percent of respondents indicated that they planned to take actions or make changes based on the information they received and 70 percent of respondents anticipate benefitting economically as a direct result of what they learned from these activities.

- *Texas Sea Grant trains teams to conduct wetland restoration.* The Wetland Program, along with the Wetland Restoration Team, conducted annual continuing education training for team members. In addition, 46 workdays were held throughout the year, recording 1,656 volunteer hours worth $33,500. Workdays included the propagation of wetland plants for the Dickinson Landowner project,

as well as the Buffalo Bend Park project and the annual plant identification classes for mentors (four classes, 25 people/class). All the team training focused on increasing the trained mentor's ability to work with the public in an effective manner, providing necessary knowledge and experience about wetlands.

- *Texas Sea Grant monitors wetland project at Brays Bayou for stormwater treatment.* Wetland Restoration Team efforts continued on the award-winning Brays Bayou stormwater treatment wetland project. This wetland project has received much local attention after winning a Gulf Guardian Award for partnership in 2006 and being featured on local news programs regularly since its completion. The Wetland Restoration Team continued to collect monthly water quality monitoring data (temperature, water clarity, conductivity, dissolved oxygen levels, *E. coli* presence and quantity) to evaluate the success of the wetland. Collected data suggests this wetland system successfully treats bacteria and other pollutants from runoff.

Coastal Natural Hazards

- *Texas Sea Grant helps communities after Hurricane Ike.* Two Texas Sea Grant county agents worked with a local church in the largely Vietnamese-American fishing community of Oak Island to secure interpreters and transportation to get local residents to FEMA centers for registration and assistance and to the Texas Workforce Commission in Beaumont to seek disaster unemployment assistance.

- *Texas Sea Grant reunites boat owners with missing craft after Hurricane Ike.* Two Texas Sea Grant county agents located, photo-documented, marked and recorded GPS locations for about 80 derelict recreational vessels after Hurricane Ike. State registration numbers were compiled from the lost vessels and cross-referenced with Texas Parks and Wildlife Department records, and boat owners were contacted by postcard. By locating lost vessels, some deposited in open pastures miles from the water, the insurance reimbursement process was greatly speeded.

- *Texas Sea Grant promotes safety training for fishermen.* Texas Sea Grant's marine business specialist has been involved in various commercial fishing safety programs since the late 1970s. The nine-hour Commercial Fishing Vessel Drill Conductor Program, administered by Texas Sea Grant, has trained more than 2,960 people since the program started in 1994, including nearly 50 sessions attended by more than 500 people during the reporting period. This total is second only to Alaska in number of programs and personnel trained. The safety and survival training program for commercial fishermen is certified by the U.S. Coast Guard (USCG), and the Commercial Fishing Vessel Drill Conductor Program provides all the USCG required training and materials to each fisherman taking the course. The Drill Guide Manual used in the course was updated and reprinted in 2008. Drill conductor programs like the Commercial Fishing Vessel Drill Conductor Program have reduced both injuries and fatalities in the commercial fishing industry.

Coastal Communities and Economies

- *Coastal communities are using the Texas Sea Grant-funded Coastal Communities Planning Atlas to help guide their development decisions*. The developers of the Coastal Communities Planning Atlas have made several presentations to local governments in coastal areas, federal agencies, and nonprofit organizations and business interests about the Atlas, which is an online, spatial decision support system that can be used proactively to identify, visualize and predict the impacts of future growth and development in coastal Texas. As a result of the presentations, 30 communities have begun to utilize the Atlas in their planning processes during the reporting period.

- *Texas Sea Grant supports marine business.* Texas Sea Grant's marine business specialist organized and coordinated the 32nd Annual International Marine/Offshore Industry Outlook Conference, held April 8, 2008, in Houston, Texas. Co-sponsored by the Texas Sea Grant College Program and the National Ocean Industries Association, more than 110 industry participants were provided with information on the 2008-2010 outlook for marine construction, offshore drilling, transportation and service operations from marine/offshore industry leaders.

- *Texas Sea Grant conducts research and makes available information about the marina industry.* Texas Sea Grant, through the Clean Texas Marina Program, is a co-sponsor of the 23rd Annual (2008) Texas Marina Facilities and Services Directory, a comprehensive guide to the state's marinas, grouped by body of water and based on survey data collected by the marine business specialist. The directory provides an index of growth areas in the Texas marina industry, and shows boating access by body of water so developers and water-related services can be targeted to actual users. More than 200 copies of the 2008 edition were distributed via direct mail, while numerous other copies were accessed via the Texas Sea Grant website during the reporting period.

- *Texas Sea Grant reduces fuel consumption by the Gulf and South Atlantic shrimp fishery, saves jobs.* Texas Sea Grant facilitated testing of new, fuel-efficient trawl gear by a cadre of 15 cooperating, elite producers throughout the Gulf and South Atlantic states. Thus far, reported fuel savings range from 20 to 39 percent. For the median trawler, expected annual fuel savings amount to roughly 19,000 gallons per season. Assuming $3.50 per gallon for industrial diesel, the average for the first five months of 2008, this experimental trawl gear saves the vessel owner about $67,000. In Brownsville, where more than 85 percent of the vessels have adopted the experimental gear, fuel savings were estimated 2.5 million gallons valued at $8.75 million last year alone. An estimated 200 jobs were saved because without the fuel savings, many of the boats would have remained tied up during the 2008 season.

- *Texas Sea Grant transfers new bycatch reduction device technology to Texas shrimp fleet.* NOAA Fisheries announced radical changes to the current regulations related to finfish bycatch reduction device (BRD) placement in shrimp trawls, requiring it to be relocated on the nets, which will result in a documented 10 percent loss of shrimp. NOAA Fisheries has established regulatory provisions for three other choices of BRDs. These newly certified BRDs, which document lower shrimp losses, are much more sophisticated in design and thus more intimidating to fishermen. Partnering with elite fishermen, result demonstration projects are being conducted to effectively transition the fleet to the adoption of the new gears. During this reporting period, 19 formal workshops were conducted, 16 net shops received training on the construction and installation of these new BRDs, and individual contacts with fishermen regarding the new gear occurred in 27 ports. Furthermore, working with NOAA Fisheries, more than 600 of the new devices were distributed to the shrimp industry.

- *Texas Sea Grant helps the creation of a sustainable seafood partnership.* Texas Sea Grant assisted in the formation of the Sustainable Fisheries Partnership (SFP), a collaboration of fishery representatives, seafood industry and the Ocean Conservancy. The group's inaugural meeting in November 2008 was moderated by the Texas Sea Grant Cameron County agent and participants included two Texas Sea Grant specialists. From the SFP, a "Gulf of Mexico Shrimp Fishery Improvement Roundtable" was held to identify innovative measures that might improve the fishery. Among the issues being focused on by the SFP are credentials to certify that seafood products are produced or harvested in a sustainable way, are from healthy stock, use good resource management practices and are having a minimal impact on the ecosystem. A video (at http://www.oceanconservancy.org/site/PageServer?pagename=ftf_retailers_roundtable) "story" by the Ocean Conservancy about the newly mandated by-catch reduction gear and what it means to offshore shrimp producers featured Texas Sea Grant staff.

Marine and Aquatic Science Literacy

- *Texas Sea Grant provides an incentive for high school students to learn about coastal and marine science.* Texas Sea Grant hosted the northern Texas Regional National Ocean Sciences Bowl. This college bowl-style competition pits teams of four high school students and one alternate against each other to answer questions from all disciplines of marine science. Fifteen teams, including several from schools that had never before participated, competed on the Texas A&M University campus on February 23, 2008. Seventy-five high school students, many of them from areas hundreds of miles inland from the coast, including the Dallas/Fort Worth metroplex, studied coastal and marine science to prepare for the competition. As the competition is held annually, a similar number of students, many of them new to the competition, will prepare to participate each year.

- *Texas Sea Grant brings marine education to schoolchildren.* During the reporting period, Texas Sea Grant's Floating Classroom Program (FPC) conducted 63 student and youth group cruises and public cruises aboard the Karma, providing an opportunity for 21,264 students and members of the public to learn about marine and coastal science and sociological issues through 4,400 instructional contact hours.

Aquaculture

- *Texas Sea Grant aids environmentally sustainable aquaculture in Mexico.* The Texas Sea Grant aquaculture specialist provided technical assistance to Cruz de Lereta, a local Mexican fishing co-op, to oversee the stocking of 10 million hatchery-raised postlarval shrimp. Stocked in a 640-acre netted section of a 750-acre estuary for growout, more than 248,000 pounds (112,800 kg) of head-on shrimp were harvested. Feeding, harvesting and processing the shrimp produced steady employment for an additional 50 fishing families.

Awards and Honors

Texas Sea Grant personnel reported the following awards and honors during the reporting period, February 1, 2008, through January 31, 2009:

- Tony Reisinger, Coastal and Marine Resource agent, initiated a new Rio Grande Valley Chapter of Texas Master Naturalists, and, along with other partners in the Bahia Grande Restoration Project, represented Texas Sea Grant in receiving the Texas Environmental Excellent Award, the Texas Commission on Environmental Quality's most prestigious award.

- John O'Connell was appointed by the county judge to represent Matagorda County on the Houston-Galveston Area Council's Natural Resources Advisory Committee.

- The 2008 Keep Houston Beautiful Mayor's Proud Partner Award was given to the Westbury Community's WaterSmart Habitat Highways (HH) initiative. The WaterSmart HH training series was recognized as the catalyst for the Westbury esplanade project.

- Aquaculture Specialist Granvil Treece was awarded a certificate of appreciation from the Texas Aquaculture Association for his ongoing support of Texas aquaculture.

- Cooperators Patrick Riley (Western Seafood) and Captains Manuel Calderon and Louis Stephenson were awarded the National Marine Fisheries Service's Sustainable Fisheries Leadership Award for their ongoing demonstration work testing new shrimp fishery gear. Submitted by Texas Sea Grant's Fisheries Specialist Gary Graham and Seafood Specialist Mike Haby, this is the first time anyone from the Gulf and South Atlantic shrimp industry has ever received this award.

- Rhonda Cummins, Calhoun County Extension Agent-Coastal and Marine Resources, was appointed to the Texas board of the American Shore and Beach Preservation Association.