Texas Shores

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PHOTO BY RHONDA CUMMINS

Sunrise from Smith Harbor in Port Lavaca looking out on Lavaca Bay.

ON THE COVER: The view north on Trout Street in Port Aransas in early September after Hurricane Harvey. Photo by Tony Reisinger.

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Port Aransas: Debris and flooded materials removed from Cotter Street residences for curbside pickup in the immediate aftermath of Hurricane Harvey.

By Alex Hood

HELPING COMMUNITIES BE MORE RESILIENT:

Harvey Prompts Early Launch of New Collaborative

The impact of Hurricane Harvey on the Texas coast has accelerated the start of a new research- and extension-based coastal community planning program at Texas A&M University.

PHOTO BY TONY REISINGER

helping communities

Through a partnership between Texas Sea Grant and the College of Architecture's Texas Target Communities, the Community Resilience Collaborative (CRC) is designed to help coastal communities create science-based plans for sustainable development, increase their resilience to natural and technological hazards, and enhance or restore their habitats and ecosystems.

"We wanted to partner with the College of Architecture because it has some of the country's leading experts in land use planning, hazard mitigation and disaster recovery," says Heather Wade, Senior Associate Director for Planning and Extension at Texas Sea Grant. "Our collaborative was born out of the idea that our two groups could combine our resources to help low-capacity and vulnerable communities become more resilient to hazards and disasters."

The program, which is co-directed by Wade, started last fall, only a few weeks after Hurricane Harvey — a time when Texans from Rockport to Port Arthur were reeling from the impact of what ended up being both the wettest and the costliest tropical cyclone to ever hit the United States, and a time when disaster preparedness was at the forefront of the minds of people around the state.

According to Kate de Gennaro, the CRC's Planning Research Associate, that timing is no coincidence. "We were planning to launch the CRC in January or February, but because of Hurricane Harvey, we were able to get rapid response funding to begin now, when the need is greatest."

De Gennaro, who was brought aboard with the National Oceanic and Atmospheric Administration rapid response funding, has begun meeting with planners and officials in coastal counties to determine how the CRC can best assist them. "Most of the communities that I've talked with are still making assessments, so as they move forward in their recovery process, we'll learn more about how we can contribute to support them."

Disaster recovery and preparation are just some of the things the CRC plans to address through coastal planning. The collaborative will also work to manage critical land use and environmental issues and hazard mitigation, particularly in the places that need them most. The program also emphasizes providing this planning assistance to low-capacity, low-resource and underrepresented communities.

"We want to help communities that don't have the capacity to do this on their own, whether it's due to time, talent or treasure," says Jaimie Masterson, the Associate Director of Texas Target Communities and the other co-director of the CRC. Masterson says the new collaborative can help communities that don't have a planner on staff and don't have the financial capability to hire one.

"Typically that means it's going to be a rural community with less than 15,000 in population, but not always," she says. "We've also worked in neighborhoods in Houston that really aren't being served. It just depends on the community and its needs and lack of access to resources."

This is also the goal that Dr. Pamela T. Plotkin, Director of Texas Sea Grant, is most excited about. She says that one of the greatest benefits of the CRC is that the assistance to these areas will be offered free to the communities. "There are hundreds of Texas communities that cannot afford to hire their own city planner, nor can they afford to contract with professional planners to outsource their community plans. The CRC now gives these communities access to a no-cost resource, and it links them to the researchers at Texas A&M University who have the best available science."

While the CRC is headquartered at Texas A&M's main campus in College Station, it also is building a team of extension-based coastal planners in the field in three regions of the Texas coast: the Upper Coast, Coastal Bend and Rio Grande Valley. Walter Peacock has been a Planning Specialist with Texas Sea Grant for more than a year and is located on the Upper Coast in Houston; two additional planners, Steven Washington and Ashley Bennis, joined the team early this year. The CRC won't be working just with counties on the coast, however; it will also be assisting communities in the next two counties inland due to the far-reaching impacts inland development and land use can have on the coast.

Another goal of the CRC is to educate and train local officials and staff on the basics of coastal planning, including best practices, resources and tools. This will give them the foundational knowledge they need to better plan their community's path forward, Wade says.

PHOTO BY HEATHER WADE

PHOTO BY DR. PAMELA T. PLOTKIN

Electrical crews converge on Port Aransas to restore power after Hurricane Harvey.

"Just educating them on the disaster recovery process would be a good example," she says. "What we're finding after Harvey is that some community officials have never experienced a large-scale disaster before and don't know a lot about the recovery process or how it works or impacts them, so we're talking about doing a webinar series on disaster recovery and land use planning to make it as easy to understand as possible."

In addition to helping coastal counties with planning, the CRC funds small grants for community resilience research and provides related learning opportunities for university students. These opportunities are aimed at students in Texas A&M's colleges of Architecture, Geosciences, Engineering, Agriculture and Life Sciences, and Liberal Arts; the schools of Public Health and Law; the Bush School of Government and Public Service; and Texas A&M University at Galveston.

This is one of the benefits that Texas Target Communities, which has a strong, established service learning component, will bring to the collaborative. Masterson says that the experience it provides to students is invaluable. "They're getting real-life examples of what they've learned that will give them a sense of how things aren't just one dimensional," she says. "They learn that there's a full range of complexity in how communities work, and by working with Texas Sea Grant, we're able to connect students to real-life issues in coastal communities in a targeted and meaningful way."

According to Dr. Debbie Thomas, the Interim Dean of the College of Geosciences at Texas A&M, these opportunities are important in cementing into place the knowledge that students acquire in class by allowing them to actually practice what they've learned and then see the result of their efforts. She says this type of first-person experience can ignite students' passion for what they do. "Everything becomes so real and so tangible when students see the immediate and long-term impact of their work," she says. "They then become the most important advocates for

Texas Sea Grant Research Associate Kate de Gennaro (far left) takes notes while surveying storm damage in Port Aransas with the FEMA Mitigation Assessment Team in November. The more elevated houses on the left stayed above the storm surge, which inflicted extensive damage to the ground-level houses on the right, as demonstrated by the waterline still visible on the yellow house (right).

TEXAS SEA GRANT PHOTO

TEXAS SEA GRANT PHOTO

Garage doors are often the first part of a house to suffer wind damage, as seen on the Key Allegro home on the left. On the right, Texas Sea Grant Senior Associate Director for Planning and Extension and CRC Co-Director Heather Wade photographs a much sturdier one at a house near Salt Lake during the FEMA Mitigation Assessment Team's damage survey.

inspiring the next generation to learn and serve."

Despite only having launched the CRC a few months ago, the program's staff have been busy in the field helping to assess the damage Harvey left in its wake and determining the best ways to help communities proceed. Wade and de Gennaro joined FEMA's Texas Mitigation Assessment Team (MAT) in Port Aransas and Rockport in November to help evaluate residential damage in the two Coastal Bend communities. The MAT was there to study how different structures were affected by each facet of the storm.

"We looked at damaged and undamaged houses, and houses that weren't finished being built yet, to see how bad the damages were and what caused them," de Gennaro says. "The team is writing a report of recommendations for what they think would make for better engineering standards for the area to adopt."

These kinds of experiences are learning opportunities for the CRC, de Gennaro says. "We're doing a mixture of resilience, mitigation, assessment and education efforts, so what we learn from this experience will be built into our outreach materials."

In November, Wade attended regional meetings across the state that were organized by the Governor's Commission to Rebuild Texas to engage recovery experts and local officials in a discussion about improving disaster preparedness after Harvey. Her presentation, co-created by several CRC team members, focused on the various ways the collaborative is supporting local communities in their land use planning and coastal development efforts. "I was asked to present as a subject matter expert on flood control, mitigation and land development," she says. "We used our presentation to introduce attendees to the CRC and let them know about this free service that they can use if they lack resources or capacity and they need help."

Based in part on her work with the CRC, Wade was also recently asked to join the advisory council for the National Association of Counties' new Strengthening Coastal Counties' Resilience program, which is aimed at helping coastal managers educate elected officials about coastal hazards, helping them work together to address the hazards, and connecting them to coastal management resources. This will provide Wade with an opportunity to not only share what she has learned, but learn from the experiences of other planning experts from around the country and use their knowledge to bolster the collaborative's work at home.

According to de Gennaro, the wide reach necessary to accomplish the CRC's numerous goals is only made possible because of the existing relationships with

For more information about the **Community Resilience Collaborative,** go to http://texasseagrant.org/programs/community-resilience-collaborative or contact Heather Wade at hwade@tamu.edu or Jaimie Masterson at jmasterson@arch.tamu.edu.

Community Resilience COLLABORATIVE

Texas communities that both Texas Sea Grant and Texas Target Communities are bringing to the collaborative. "We're going to share our resources and share our connections so both organizations can help those communities."

One such connection is to Rockport, where Hurricane Harvey made its initial landfall. Texas Sea Grant has worked with the city for several years to increase its resilience to natural hazards, according to Rockport Community Planner Amanda Torres, just as the program is now helping the city to recover through the CRC.

"Texas Sea Grant has been a partner in building community resilience in Rockport and Aransas County for many years," Torres says. "The organization helped fund the county's first multi-jurisdictional Floodplain Management Plan and continues to provide technical assistance and support to city and county staff."

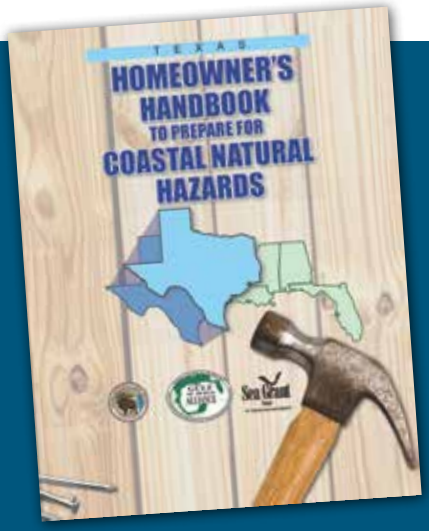
Using these kinds of regional ties to connect the resources of both programs to communities they can help is the fundamental mission of the collaborative, says Dr. Jorge Vanegas, Dean of the College of Architecture. "The ultimate goal is to make the CRC both a portal providing access and a bridge providing connection to the diverse resource base of Texas Target Communities and Texas Sea Grant specifically, and of Texas A&M University and The Texas A&M University System in general." He adds that the considerable overlap in the missions of the two programs individually makes them an ideal match to work together toward this objective.

TEXAS SEA GRANT PHOTO

Exactly what the FEMA Mitigation Assessment Team is looking for: A house in Key Allegro demonstrates the difference newer building codes can make, emerging from the storm with its older, rear section all but destroyed and newer front relatively unscathed.

The accelerated launch of the CRC in response to Hurricane Harvey's destruction will allow the collaborative to make a greater impact than if it had remained on its original schedule, according to Dr. Shannon Van Zandt, the Interim Department Head of the Department of Landscape Architecture and Urban Planning and a faculty affiliate of the CRC. Van Zandt participated in a November panel discussion on Capitol Hill organized by the Sea Grant Association to discuss how science and outreach can help coastal areas improve their disaster preparedness, and she described how the collaborative is beginning to do just that in Texas by helping communities rebuild to be more resilient literally from the ground up.

"The CRC is being formed at a time when Texas' coastal communities are just beginning their recovery from Hurricane Harvey," Van Zandt says. "Recovery is a critical phase because it's an opportunity to make some big changes in the communities, and I'm excited to see what we can do in terms of building a resilient future into their recovery plans."



Texas Sea Grant staff members delivered about 8,000 of its *Texas Homeowner's Handbook to Prepare for Coastal Natural Hazards* for distribution at 30 FEMA Disaster Recovery Centers, seven Texas A&M AgriLife Extension county offices around the state and the FEMA Joint Field Office in Austin. Produced in partnership with the Texas General Land Office, the *Homeowner's Handbook* includes sections on roof stability, keeping water out, power issues, retrofitting an existing home, and insurance. It is available online for download at **http://texasseagrant.org/assets/uploads/resources/13-401_HomeownersHandbook_Engl.pdf,** or request a copy by emailing **seagrant@tamu.edu**. A Spanish version is available at **http://texasseagrant.org/assets/uploads/resources/HomeownersHandbook-Tx_web-ES.pdf.** You may also request a paper copy while supplies last by calling **979-458-8442** or emailing **seagrant@tamu.edu**.

Researchers survey public's perceptions of coastal resilience after Harvey

By Alex Hood

A team of Texas A&M University researchers is studying Hurricane Harvey's effect on how coastal Texans perceive their communities' disaster resilience.

Dr. Kirby Goidel, professor in the Department of Communication and the Public Policy Research Institute, is leading the group, which also includes Dr. Jennifer Horney, Interim Head of and associate professor in the Department of Epidemiology and Biostatistics, and Dr. Paul Kellstedt, professor in the Department of Political Science. For more than a year they have been working on a project funded by Texas Sea Grant to survey coastal residents about how resilient they believe their communities to be, but when Harvey struck the Texas coast in late August, it gave the researchers an opportunity to conduct follow-up surveys to test those perceptions with additional rapid response funding from Texas Sea Grant.

PHOTO © JIM ZIETZ, LSU UNIVERSITY RELATIONS 2010)

Dr. Kirby Goidel

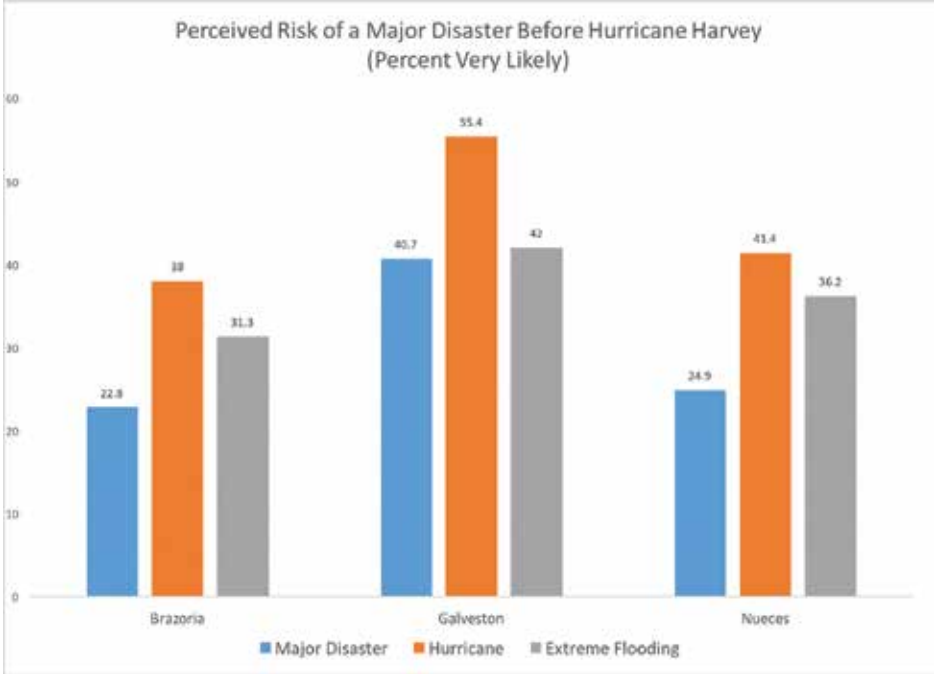


Chart courtesy Dr. Kirby Goidel

"What we wanted to do was go back into the counties that were really affected, like Brazoria, Galveston and Nueces, and re-interview some of the people who had been affected," Goidel says. "If we can go back in and survey directly, we can try to get a sense of how people thought about it beforehand and how they were actually affected."

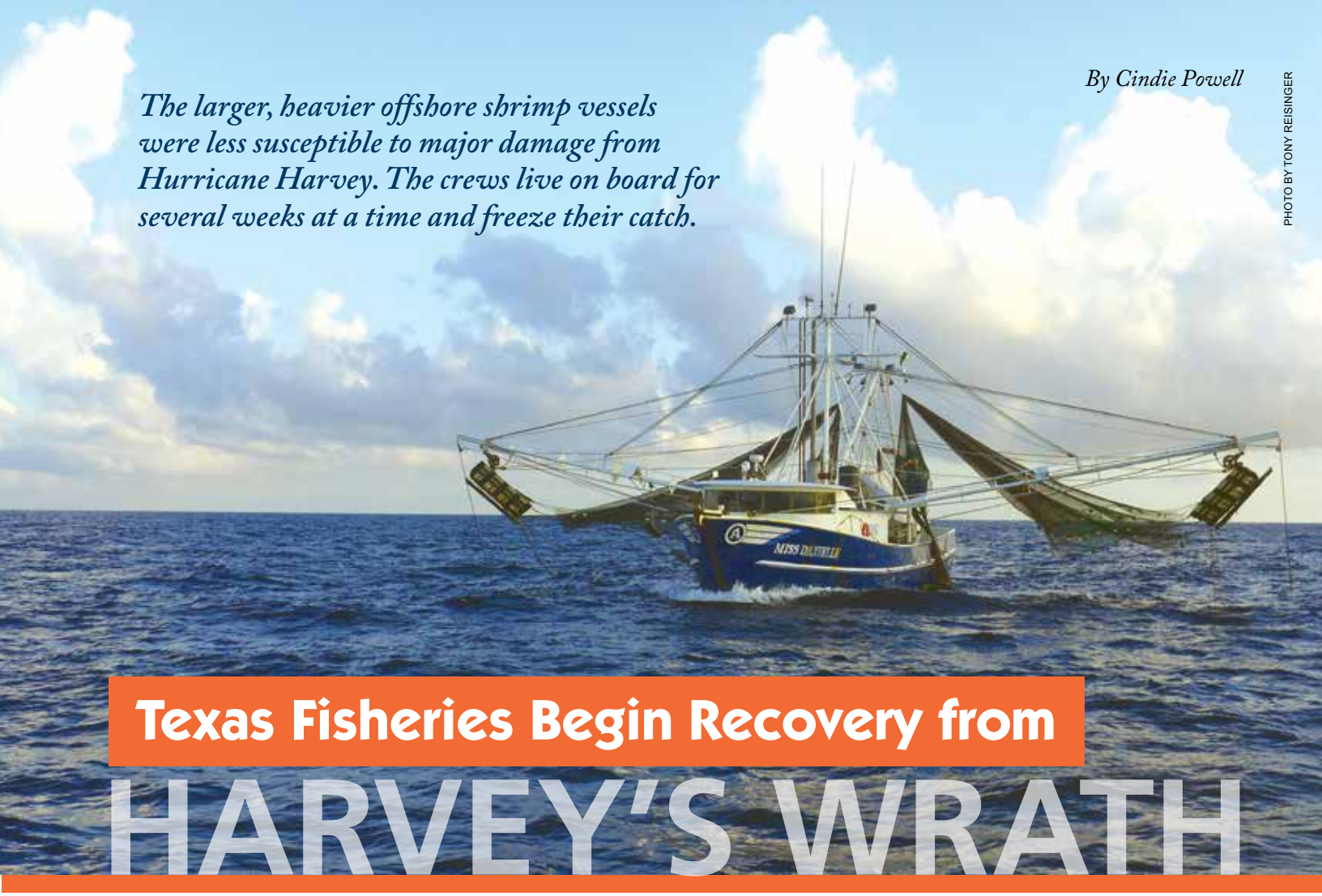
The team is using address-based sampling, which involves using postal service records to find respondents, to survey people in these counties. Goidel says that address-based sampling is the best method for making sure a survey sample mirrors the population. The downside, he says, is that the best contact information is not always available through postal records, so the team will be calling respondents with an available phone number and mailing surveys to those without one, after sending everyone an initial letter explaining what the project is about.

The post-Harvey phase of the study began in fall 2017, and Goidel stresses that the results thus far are preliminary, but some interesting correlations had already begun to appear in the data collected before the storm. "One of the really fascinating things to me is that if you look at the perceptions of how prepared the community was, it tends to be less connected to perceptions of risk, like what the danger is of a major disaster hitting the area, and more about perceptions of how aware people are of disaster-based resources … or how long it would take the community to recover from a disaster."

According to Goidel, studying public perception can help identify gaps in a community's disaster preparedness that can't be fixed until the public is aware of the issue. "A lot of times policy makers will say, 'Here's what we would love to do, but the public won't support it,' " he says. "And the response is that we need to do an education campaign and let people know their perceptions are wrong."

Goidel says the goal of their study has always been to share the findings with policy makers to help them communicate with the public, but the post-hurricane surveying they can now do because of the rapid response funding will give the project a new level of importance.

"With the ability to go in and collect another wave of data, we can actually find out some things that I hope will really matter in terms of how people think about community resilience," he says.



The larger, heavier offshore shrimp vessels were less susceptible to major damage from Hurricane Harvey. The crews live on board for several weeks at a time and freeze their catch.

PHOTO BY TONY REISINGER

By Cindie Powell

Texas Fisheries Begin Recovery from HARVEY'S WRATH

Late on the evening of Aug. 25, as Hurricane Harvey approached the Texas coast, Captain Richard Aguilar's Brownsville-based *R&R*, a 65-foot, 94-ton offshore shrimp vessel, sought refuge in the closest port — Conn Brown Harbor in Aransas Pass, only 15 miles from what would be the storm's first Texas landfall in Rockport in the pre-dawn hours of Aug. 26.

"I talked to the captain. He had three crew members and himself on board, and they had a harrowing night," says Tony Reisinger, Texas Sea Grant's Coastal and Marine Resources Agent for Cameron County. "They had 10,000 pounds of shrimp on board that they couldn't unload. The wind increased violently, and it just capsized the boat. They climbed out of the water and up on the hull, and rode out the height of the storm clinging to the hull. The captain said you couldn't see your hand in front of your face because it was raining and blowing so hard."

The *R&R* was tied up to the dock near the *Dragon's Den*, a shrimp vessel registered in Louisiana, and when the cleats broke from the hurricane-force winds, the two boats broke away from the concrete sea wall and sank.

The *R&R* was the only Texas offshore shrimp trawler lost in Hurricane Harvey, but hundreds of other, smaller recreational and commercial boats sank, including fishing vessels used by crabbers, oystermen, and the bay and bait shrimp fishermen.

"When you talk about the shrimp fishery, it's important to understand that it's not generic — there are several shrimp fisheries in the state, offshore and inshore, and when you break it down from that, it becomes even more complex," says Gary Graham, Texas Sea Grant's Marine Fisheries Specialist. "When we look at the results of the hurricane, the inshore fishermen were impacted significantly more than those offshore."

PHOTO BY TONY REISINGER

Two offshore shrimp vessels sank in Aransas Pass' Conn Brown Harbor near the Redfish Bay Boat House dry boat storage facility, the R&R *out of Brownsville and the* Dragon's Den *from Louisiana.*

PHOTO BY SETH PATTERSON

Bay and bait shrimp boats are smaller, and their crews go out in the morning and return to the dock at night.

"The inshore shrimp fisheries focus on table shrimp and bait and are confined to the bays," he says. "The vessels are relatively small, and there were many more of them in the vicinity of heavy winds from Harvey, in the areas from Corpus Christi to Seadrift." The offshore or Gulf shrimp fishery consists of much larger vessels that target white shrimp, which are harvested nearshore out to 15 fathoms, and brown shrimp, which are found in deeper waters out to 50 fathoms. According to Texas Parks and Wildlife Department (TPWD) data, the Texas offshore shrimp fishery regularly lands more than 90 percent of the overall shrimp catch by weight and value, compared to about 10 percent by the inshore fishery.

While only one Texas offshore shrimp vessel sank during Harvey, other factors affected the industry's ability to harvest shrimp in the days and weeks following the storm. These additional economic damages are being included in surveys to determine the economic impacts of the hurricane, but they are more difficult to calculate immediately after a storm, Graham notes.

"If you look at impacts and damage, there is physical damage and then economic damage that might not be physical," Graham says. "Boats that are sunk are physical damage, and that is easy to put a finger on. But when bays go fresh and the shrimp are washed out, that is economic damage that is more ambiguous. If your boat is floating but there are no shrimp to catch, that will hurt you, and that type of economic damage can be more difficult to assess."

Harvey's impact on the different sectors of the shrimp fishery was influenced by the timing of the storm compared to the life cycles of brown shrimp (*Farfantepenaeus aztecus*) and white shrimp (*Litopenaeus setiferus*). Texas bays are nursery grounds for both species, which drift into the bays through the passes as larvae. Young brown shrimp stay in the estuaries during late winter and then move into the deeper offshore waters of the Gulf starting in the late spring and continuing through early summer. White shrimp leave the bays later in the year, staying in the estuaries from early summer to fall, moving out of the bays to spawn in response to seasonally lower temperatures; as adults they tend to remain in the relatively shallower waters of the Gulf that are closer to the shoreline.

Graham does not expect the numbers of offshore brown shrimp to be affected by Hurricane Harvey. "The 2017 crop of brown shrimp had already emigrated from the nursery areas in the bay systems to offshore waters," he says. "Production should not be affected."

When the storm struck in late August, however, the white shrimp were still in the estuaries and had not yet emigrated into the Gulf. "Shrimp will have been flushed from the bays and estuaries into the Gulf of Mexico," Graham says. "The white shrimp normally leave the bay systems after undergoing considerable growth, when cold fronts occur later in the year. The floods will have forced these shrimp out earlier than normal." He says the nearshore Gulf shrimp fishery may be harvesting white shrimp at a smaller, less valuable size because they entered the Gulf so early.

He says the sector of the shrimp fishery he expects to be hurt the worst by the flooding is the inshore fishermen in Texas from Corpus Christi to the Bolivar Peninsula, who in addition to facing

localized damage to their smaller trawlers from Harvey's winds and floods are also likely to have their catch severely impacted from the flooding that has pushed the young white shrimp out of the bays. "I think their vessels will be out of business for the rest of the year. The fishermen may be forced to wait until new crops of shrimp appear in 2018."

Shrimp is Texas' most valuable commercial fishery. According to the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) annual commercial landings statistics for 2016 — a year in which landings were slightly above average but dockside prices were slightly below average — Texas fishermen brought in 38.3 million pounds of brown shrimp worth $96.4 million and 23.5 million pounds of white shrimp worth $54.3 million. They also landed 1.4 million pounds of other types of shrimp — pink, rock and seabob — valued at roughly $5 million. Texas waters and the federal waters off the Texas coast are typically closed to shrimp fishing from mid-May to mid-July to allow the shrimp to grow to a larger and more valuable size before harvest.

Andrea Hance, Executive Director of the Texas Shrimp Association, says the economic impact of the storm will also be related to the timing of the fishing season. "That time of year is peak season, and our boats all along the coast were forced to come in and tie up for a week. That cost us about $4,800 a night in lost production.

"For the most part, that's how we were affected. There were also a couple of processing facilities completely destroyed, and I haven't heard if they're going to be rebuilt."

Hance points to information released in October by the Southern Shrimp Alliance that shows Texas landings by weight for September 2017, immediately after the storm, at 3.2 million pounds — a 45.8 percent reduction compared to historical averages from the previous 15 years for September. Landings can vary widely from year to year; for total landings over the first nine months of the year, Texas' 25.23 million pounds is an 11.2 percent decrease from the historical average since 2002 but is higher than the same time period last year, when landings totaled 21.8 million pounds.

Soon after the hurricane, Graham traveled to the Upper Coast with Reisinger, who has worked closely with the shrimp industry throughout the Gulf of Mexico alongside Graham and was interested in helping fishermen in other parts of the state. On his way back to the Rio Grande Valley, which was unaffected by the storm, Reisinger visited Aransas Pass and Port Aransas, near where Harvey made landfall, to interview fishermen and owners of businesses that support the industry. He collected firsthand accounts of damages and the costs of repairs to fishery-related infrastructure like docks and fish houses, where vessels unload their catch. He provided these accounts to Texas Sea Grant's Marine Economics Specialist Dr. Andrew Ropicki, who also shared the damage estimates with NMFS to help with its assessment of the impacts of Harvey on the state's commercial fisheries.

Reisinger says that while the offshore fleet saw minimal damages to vessels themselves — lost antennas, radar equipment or outriggers on tied-up boats — impacts to the industry also included damage to commercial infrastructure and manpower losses because of damage to crew members' homes. "There wasn't really any damage to the boats per se, but some people in Port Arthur had to live on their boats just to recover from the flooding, to have a place to stay while their homes dried out," Reisinger says. "That's a secondary impact that you don't expect to see." One fleet of 13 vessels on the Upper

SHRIMP

Texas' most valuable commercial fishery

38.3 million pounds
BROWN SHRIMP
$96.4 million

23.5 million pounds
WHITE SHRIMP
$54.3 million

1.4 million pounds
PINK, ROCK & SEABOB SHRIMP
$5 million

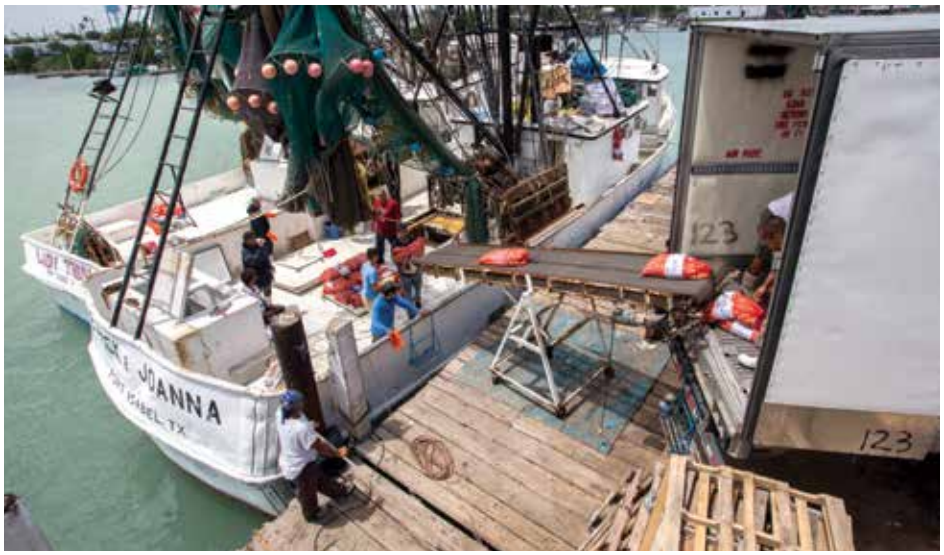


PHOTO BY SETH PATTERSON

An offshore shrimp trawler unloads at the dock in Port Isabel.

PHOTO BY RHONDA CUMMINS

Oyster season on the public reefs in Texas opened on Nov. 1, though some areas were closed by the Texas Parks and Wildlife Department because too many oysters were undersized. In Lavaca Bay, at least 60 boats were out working at dawn, including one small skiff near Point Comfort.

Coast had five tied up at the docks, either being used as temporary shelter by crew members or because crew members dealing with damages to their homes were not available to go out fishing.

Texas' second most valuable fishery is the eastern oyster (*Crassostrea virginica*). In 2016, Texas oyster fishermen harvested 2.5 million pounds of oyster meat (minus the shell) valued at $13.7 million. In good years, harvests have been more than 6 million pounds.

The situation for the industry looked extremely dire in the days following Hurricane Harvey, but later assessments were more hopeful. The oyster reefs in Galveston Bay took a direct hit from Harvey's rains as the storm settled over the Houston area, with trillions of gallons of freshwater flowing into the bay system from flooded rivers. Early speculation about the impact of the storm included the possibility that this winter's oyster crop in Galveston Bay would be a total loss.

"We conducted sampling throughout Galveston, and we were pleasantly surprised in some respects," says Lance Robinson, Deputy Director/Management Resources Manager for TPWD's Coastal Fisheries Division. "We expected a high mortality rate throughout the Galveston Bay System, but the oysters in the lower reaches have come through pretty well.

"There are some areas that sustained a pretty significant loss of the resource — mortality that resulted directly from all the freshwater that inundated that system — running from 50 to 100 percent in east Galveston Bay," he says. "But as you get closer to the Houston Ship Channel at the lower end of the bay, mortalities were much lower because of the proximity of the reefs to the pass. Saltwater is heavier than freshwater, and as the rain came in, being closer to the pass may have created a little higher salinity wedge at the bottom to allow the oysters to persist and survive."

Parts of every Texas bay system were open when the oyster season started on Nov. 1. Some oyster areas were closed by TPWD because of a low abundance of legal-size oysters — 3 inches, which requires 18 to 24 months of growth from when they first settle on a reef — but Robinson says that is a result of harvest pressure and not Hurricane Harvey.

The past decade has seen a series of hits to the state's oyster industry, starting in 2008 when Hurricane Ike's storm surge buried Galeston Bay oyster reefs under several inches of silt. "Hurricane Ike changed the oyster fishery and consequently the oyster resources in the entire state of Texas," Robinson says. Prior to Hurricane Ike, Galveston Bay produced 70 to 80 percent of the oysters in Texas. "We lost half that production overnight from the siltation from that storm."

To continue to meet the demand, fishing pressure increased on the less productive bays in other parts of the state. This only intensified after the Deepwater Horizon oil spill in 2010, when Texas was the only source of eastern oysters from the Gulf of Mexico not affected by the spill. Then record drought in Texas from 2011 to 2014 increased salinities on the coast to levels not documented for 40 to 50 years. High salinities do not negatively affect the oysters themselves, but they create a welcoming environment for predators and parasites that kill the oysters.

On the heels of the drought were two particularly ill-timed floods: in 2015, coastwide flooding flushed the free-swimming larvae out of the bays before

PHOTO BY SETH PATTERSON

Oyster reefs at low tide.

they could attach to reefs, and in 2016, flooding in Galveston Bay killed the juvenile oysters there. And Hurricane Ike's legacy continues: only about 1,400 acres of the 8,000 acres of reefs in Galveston Bay that were silted over by Ike have been restored.

In spite of these setbacks, Robinson remains positive about the recovery of the oyster industry in Texas. "I am cautiously optimistic that with the industry's support, it will turn around. It may be five or 10 years before we see significant improvements, but it is coming."

One reason he cites for his optimism is new regulations instituted this year to reduce the amount of dead shell collected by fishermen to preserve the substrate for young oysters to attach; another is how oyster reefs typically rebound from major floods. "Even though this flood was unprecedented in the amount of water that came into the bays, there are historical examples of flooding events hitting an area where we've seen a corresponding significant increase in oyster production about two to three years later," he says.

Dr. Sammy Ray, the late Professor Emeritus of Marine Biology at Texas A&M University at Galveston and the recognized authority on the eastern oyster, contended that regular deluges were good for oysters. "People look at floods as disasters, but in my opinion, if I could control things, I'd have a good flood every eight to 10 years to clean out the parasites," Ray said in an interview in 2012.

Robinson says he thinks another reason oysters rebound after a flood is that it creates a more hospitable environment for young oysters to settle. "Floods clean out the other organisms like sponges that grow on oyster shells and limit the space that young oysters have to settle, and that also compete for food with the oysters. After a flood, we have a clean substrate, and the oysters colonize first in high numbers and outcompete the other organisms."

Another commercial fishing sector that was impacted by Hurricane Harvey, crabbing, uses smaller boats like the inshore shrimp fishermen and oyster fishermen to access the shallower bays and estuaries. According to NMFS data, the crab industry last year landed almost 5 million pounds of crab valued at $6.4 million. Crabbers had boats damaged or destroyed, lost crab traps, and lost a resource in the bays that was vulnerable to extreme flooding. "Some of the smaller, undersized crabs seem to have remained in the inshore waters of the Upper Coast, but apparently the larger, legal-size crabs have left the bay system," Graham says.

In the recreational fishing sector, for-hire fishing guides and charter boats and

PHOTO BY CHRIS HALE

Some bait shops suffered major damage from Harvey, but even those that survived intact lost their supplies of baitfish and shrimp due to power outages.

the supporting businesses like bait houses and docks also took a hit from the storm. Some charter boats lost their docks and in a few cases the boats were damaged or deposited high and dry on the banks from the storm surge. Several bait camps and fish markets were damaged or destroyed near the eye of the storm on the central coast, and many that survived the storm intact lost their supply of baitfish and shrimp from electrical power failures.

Even for businesses whose vessels were unaffected by the storm, a major issue is the loss of charter income. Bill Balboa, the Coastal and Marine Resources Agent for Matagorda County, was one of several county agents asked by their county officials to collect information about impacts to local fisheries. He says his surveys and interviews with the bait camps included many who were concerned that, because so much of their clientele came from the Houston area, which suffered wide-scale damage, it might be December before business began to return to normal.

NMFS conducted a broader assessment of the damages to fisheries-related businesses in Texas from Nueces to Jefferson counties and in Harris County. The agency had conducted a rapid assessment of damages to fisheries-related businesses on the East Coast after Hurricane Sandy in 2012, and offered its expertise to TPWD and the Florida Fish and Wildlife Conservation Commission after Hurricanes Harvey and Irma to conduct similar surveys of the affected industries.

Dr. Michael Jepson, an Anthropologist with the Fisheries Social Science Branch of NMFS's Southeast Regional Office, says his agency conducted person-to-person interviews, used an online survey, and followed up with telephone interviews with businesses and vessel owners starting in early and mid-October. "We had people in the field and surveyed all along the coast from Nueces County to Jefferson County and in Harris County, and we targeted bait and tackle shops, wholesale and retail dealers, processors, marinas, retail marine supply shops, and for-hire and commercial vessel owners."

Jepson gives Texas Sea Grant staff, including Marine Economist Ropicki, Calhoun County Marine Agent Rhonda Cummins and several other coastal county agents credit for helping NMFS surveyors reach the people in the industry. "They gave us a great deal of information on where to go, who to contact, and which areas were hit the hardest, and they were very key in helping us with the field work." More than 800 businesses and fishermen participated in the rapid appraisal, and as of early January, NMFS was still analyzing the collected data.

Meanwhile, Texas' fisheries, like the rest of the state, continue along the road to recovery from Hurricane Harvey, though some will return to normal more quickly than others. About a month after it sank in Aransas Pass, the *R&R* was lifted out of the water by the Texas General Land Office (GLO). The GLO targeted almost 200 recreational and commercial boats for removal along the Texas coast. The *R&R* was one of the luckier ones — dive teams had to cut away the masts and rigging of the *R&R* and the *Dragon's Den* before the boats could be raised, but after being pumped out, the *R&R* was afloat and was soon back in Brownsville, awaiting repairs.

The R&R, *sunk in Aransas Pass by Hurricane Harvey, was refloated by Global Diving and Salvage under contract from the Texas General Land Office and the U.S. Coast Guard, and returned to the Port of Brownsville for repairs.*

PHOTOS BY TONY REISINGER

PHOTO BY RHONDA CUMMINS

EXTENSION PROVIDES SUPPORT in Harvey's aftermath

Texas Sea Grant's extension team worked to help fishermen and other residents along the coast recover after Hurricane Harvey. Several staff members are part of their counties' emergency management team and responded in the immediate aftermath of the storm, while all supported the state's recovery efforts.

PHOTO BY DOREEN BADEAUX

PHOTO BY RHONDA CUMMINS

Galveston County's Julie Massey, Brazoria County's John O'Connell and Matagorda County's Bill Balboa assisted communities with identifying priority projects for the Governor's Commission to Rebuild Texas, and Balboa, Calhoun County's Rhonda Cummins and Texas Sea Grant's Marine Economist Andrew Ropicki participated in training to help communities with FEMA requirements and paperwork.

Marine Fisheries Specialist Gary Graham and Cameron County's Tony Reisinger (left image, with Tommy Bui of Tommy Docks in Port Arthur) conducted preliminary damage assessments for fisheries, and Cummins arranged for a local chemical company, Formosa, to donate funds to Our Lady of the Gulf Catholic School that made it possible for Bay Ltd., a crane company, to hoist sunk fishing boats out of the Harbor of Refuge in Port Lavaca, including the *Capt. Steven* (top image) and three sunken oyster skiffs, and to refloat another fishing vessel that had been stranded ashore. Rusty Gaudé (right image), an extension agent from Louisiana Sea Grant, lent a hand on temporary, long-term detail in Texas to provide additional assistance.

Planning Specialist Walter Peacock assisted with the Texas FEMA Mitigation Assessment Team in Houston, and Dr. Stuart Carlton, Healthy Coastal Ecosystems Specialist, led a Galveston Bay post-Harvey task force in partnership with the Galveston Bay Estuary Program to coordinate efforts to track changes in Galveston Bay ecosystems caused by the hurricane and avoid duplication of efforts.

A dolphin spotted after Hurricane Harvey during one of the Galveston Bay Dolphin Research and Conservation Program's monthly surveys shows multiple signs of ill health, including skin lesions and a post-nuchal depression behind its blowhole.

By Alex Hood

Galveston Bay Foundation receives rapid response funding to study Harvey's effect on bay's dolphins

The Galveston Bay Dolphin Research and Conservation Program (GDRCP) is ramping up its dolphin surveys with the help of rapid response funding from Texas Sea Grant, through the Gulf of Mexico Alliance (GOMA). Researchers with the program requested the funds when they noticed a change in the Galveston Bay dolphin population after Hurricane Harvey.

The GDRCP, a partnership between the Galveston Bay Foundation (GBF) and the Environmental Institute of Houston (EIH), has conducted regular monthly dolphin surveys to monitor Galveston Bay's bottlenose dolphin (*Tursiops truncatus*) population since the program's inception in 2014. During the days following Hurricane Harvey, however, the researchers immediately noticed something amiss.

"We started seeing skin lesions on the dolphins," says Kristi Fazioli, the EIH Research Associate who conducts the field work for the project. "And when we went out after Harvey, we actually found very few dolphins up here, which is not typical for the time of year."

Fazioli says that many of the dolphins weren't exhibiting normal behavior and appeared malnourished — they were skinny, and several had something called a post-nuchal depression, an indentation behind the blowhole that is typically an indication of poor health. The researchers also noticed a lack of mother and calf pairs, again unusual for the time of year. Fazioli speculates that the dolphins fled the upper portion of the bay in search of saltier water because Harvey caused an influx of freshwater that drastically lowered parts of the bay's salinity.

It is not known for certain what caused the skin lesions seen by the Galveston Bay Dolphin Research and Conservation Program's team, but the researchers think it may be related to the bay's reduced salinity after Harvey's deluge.

There is some debate on the issue, the researchers say, but they think the drop in salinity may also be what caused the animals' sores.

"These skin lesions are kind of a hot topic right now throughout the Gulf Coast because other programs are seeing these in dolphins whenever there are big rain events," GBF Research and Conservation Fellow Dr. Vanessa Mintzer says. "Often we do see that the skin lesions improve after salinity goes back up … but we just don't know the long-term effects and how that affects their health overall."

The severity of Hurricane Harvey put the researchers at the GDRCP in a unique position to study these symptoms. Because Harvey was the wettest storm on record in the United States, the researchers anticipated an incredibly large pulse of freshwater into Galveston Bay. But their previous long-term surveying had been for only two consecutive days each month along a standardized route. If the researchers had continued on that schedule, they say, they would have missed valuable post-Harvey data, which is why receiving the extra funding so quickly was important. "When you're talking about a storm like this, where the effects can be fairly immediate, the more information we have right after the storm, the better," Fazioli says.

Mintzer adds that the funds will allow them to gather more information over the short term. "What we're changing, and where the GOMA funding is playing a very important part, is adding one extra day per month where Kristi can go out and look for dolphins instead of having to follow a standardized survey route," she says. "We want to pick between five and 10 dolphins that have had these skin lesions and follow them individually."

The researchers say they'll spend the next few months continuing to track the animals' behavior and health, and quantifying the early data they've already collected. Though this is a long-term study, they hope to be ready to report some of their findings on the short-term effects of the storm in early 2018.

sea science

By Jessica Scarfuto

Pigfish Project Shows Aquaculture Potential

A research project supported by Texas Sea Grant may ultimately reduce the number of pigfish taken from the wild while leading to new business opportunities for Texas aquaculture.

Anglers who use live bait to catch popular game fishes such as spotted seatrout, red drum and red snapper stock up on pigfish (*Orthopristis chrysoptera*), also known as piggy perch, every year from June through August at bait stands in Texas. Fingerling pigfish, which are about 6 months old and 4 inches long when they are sold as bait, are highly sought after during the summer months, but their popularity might be putting them at risk for overfishing. In the Port Aransas area alone, the local major bait stands collectively sell about 400,000 pigfish per year — all of which are wild caught, says Dr. Lee Fuiman, Director of the Fisheries and Mariculture Laboratory and the Perry R. Bass Chair in Fisheries and Mariculture at the University of Texas Marine Science Institute in Port Aransas.

"It became clear to us that there's an underappreciated ecological impact from the current practice of harvesting almost a half a million pigfish from the bays in this area every year," Fuiman says. If the fish could be cultured, the same demand could be met while lessening the ecological impact of harvesting them from the wild.

Farmed fish are usually food fish such as shrimp, tilapia and salmon, but Fuiman thought piggy perch might be amenable to aquaculture — and could also provide economic benefits to the Gulf of Mexico region. He first conceived of the project about five years ago, primarily for economic reasons. "Jobs were a huge problem in the United States at that time, and there was really no baitfish aquaculture going on," he says. "We thought if we could develop a new industry, we could create jobs for people along the coast at a time when jobs were desperately needed."

Fuiman says he also recognized great sales potential in cultured pigfish. The fish are currently available only for about three months a year, and bait stands in his area often report selling out before 10 a.m. each day. Additionally, pigfish sell for a decent price — $5 to $7 per dozen — compared to other farmed fish. "Normally in aquaculture you get pennies per fish, so even if you estimate that the wholesale price would be about half of that, that's still a very high price for aquaculture fish." Given the large demand, short seasonal availability and decent sale price of the fish, Fuiman believed pigfish could be a good candidate for commercial aquaculture.

After conducting some preliminary research with pigfish that showed the species would spawn in captivity, Fuiman and his team — Research Associates Cynthia Faulk and Jeff Kaiser, Research Assistants Kathryn Thompson and Rene Lopez, and Graduate Research Assistants Zhenxin Hou and Corinne Burns — received support in 2014 from the National Oceanic and Atmospheric Administration and Texas Sea Grant to investigate whether pigfish might be a good candidate for year-round aquaculture. The laboratory studies had four major objectives: to show that pigfish would breed and spawn out of season, to determine their ability to thrive on an aquaculture diet instead of wild feed, to determine their adaptability to aquaculture pond temperatures and salinities, and to find the optimal densities of fish in the ponds.

Fuiman believed there might be significant economic gain — and that fishermen might like it, too — if they could extend the seasonal availability of pigfish by even a month or two, if not year-round. To get pigfish to spawn out of season, the researchers used a process called photothermal manipulation, through which they adjust the water temperature and lighting to mimic an accelerated seasonal cycle. This essentially tricks the fish into thinking the seasons are passing faster than they actually are and makes them

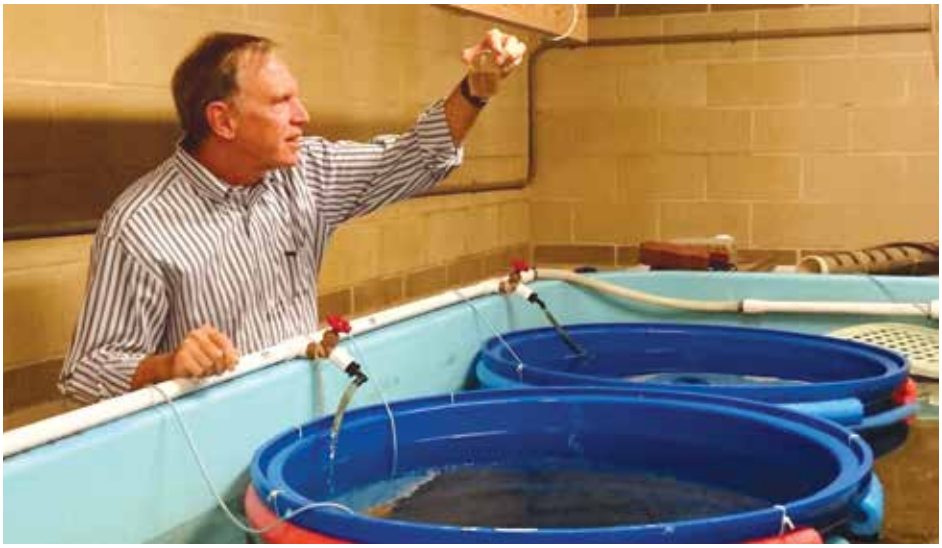


PHOTO BY JEFF KAISER

Dr. Lee Fuiman examines pigfish larvae in grow tanks in the CCA Laboratory for Marine Larviculture at The University of Texas at Austin Marine Science Institute's Fisheries and Mariculture Laboratory.

PHOTO COURTESY SALLY PALMER/UTMSI

Doctoral student Zhenxin Hou measures a piggy perch before its transfer to Kubecka Aquaculture in Palacios.

spawn earlier. In 2016 and 2017, the pigfish spawned on their usual cycle in January, February and March, but the researchers were able to manipulate some of them into also spawning in July and August. In addition to doing this with wild-caught pigfish, the researchers were successful with fish they had reared from eggs to adulthood, thereby completing the life cycle of the captive fish. "Over the course of this project, we've had a total of 337 spawns from three tanks of fish, so that's worked out really quite well," Fuiman says.

The earliest stages of the pigfish life cycle — larvae — only eat live, microscopic animals, and raising large quantities of these zooplankton is very labor intensive. Consequently, it is ideal to switch larvae to a dry diet as early as possible in their rearing, so the researchers' second objective was to determine when pigfish larvae could be weaned from live feed to a dry diet. Unfortunately, pigfish are born with a very simple digestive system — essentially a straight tube with limited digestive enzyme activity. To determine when they could be weaned, Fuiman's team had to determine at what age or size the larvae develop the necessary enzymes to digest dry food.

"We did some biochemical studies of the digestive system and the development of these larvae, and we figured out that the enzymes necessary for a prepared diet appear around 30 days after hatching," Fuiman says. Weaning trials followed, and the researchers found that the larvae would accept a dry diet between 28 and 30 days after hatching with no detrimental effects on their growth or survival, another indication that pigfish could be a good candidate for commercial aquaculture.

The third objective was to determine if pigfish could withstand the variations in temperature and salinity that are common in aquaculture, where fish are typically kept in outdoor ponds subject to weather changes like cold fronts and rainfall. Fuiman's team took the pigfish out of the warm, salty rearing tanks in the laboratory and transferred them directly into environments with lower salinities and lower temperatures. "We found that they were basically very tolerant of all the salinities we threw at them. They were a little bit sensitive to temperature, but not very much," Fuiman says, adding that the pigfish did not handle an immediate transfer to the lowest temperature tested, 12° C (about 53° F). However, they did very well when transferred to an intermediate temperature for a day before being put in the 12° C water. "That's a practical solution when the temperatures are quite cold."

The project's final goal focused on determining the optimal densities of pigfish in outdoor ponds. "In aquaculture, you're going to want to put as many fish as you can in the pond to get as much product as possible to sell at a single time," Fuiman says. This has to be balanced against possible overcrowding, which can lead to problems with water quality, competition for food, mortality and reduced growth. To test the fish's adaptability to different population densities, the team took about 3,000 pigfish to Kubecka Aquaculture, a commercial operation in Palacios. The fish reacted well to five densities, ranging from 100 fish per cubic meter to 1,000 fish per cubic meter. "We had between 85 percent to 95 percent survival at all of these densities," Fuiman says of the results, though he adds that growth was slightly diminished at the higher densities. "All of this information points to the species being a really good candidate for commercial aquaculture."

With results that point to the biological feasibility of farming pigfish commercially, the next step is assessing the economic feasibility of large-scale commercial production. Dr. Andrew Ropicki, Texas Sea Grant's Marine Economics Extension Specialist, is now assessing the viability of adapting Fuiman's research to commercial

PHOTO BY DR. LEE FUIMAN

The pigfish were placed in ponds at Kubecka Aquaculture to determine the ideal densities for rearing them in a commercial setting.

PHOTO © BRYAN FRAZIER, TEXAS PARKS AND WILDLIFE

Pigfish, also known as piggy perch, are a popular baitfish.

production under a subgrant from NOAA's National Marine Fisheries Service.

"We know what it costs to raise these in a laboratory, so now we're going to take that information and say, 'If you were going to build a commercial facility, what would that look like?' " Ropicki says. To assess the economics of commercial production, the first step is determining whether pigfish can be produced at a price point where they can compete with wild caught fish.

One piece of the puzzle in favor of cultured pigfish is a U.S. study that gave farmed baitfish to bait stands and found that fishermen liked it and came back for more. "It seemed to serve as better bait because there was less handling of the fish — the stock was more lively," Ropicki says. If aquaculture turns out a better product, he says, then it is possible that bait stands could charge more for farmed pigfish than they do for wild caught, which would help cover the high start-up costs associated with a new commercial aquaculture operation.

The second part of Ropicki's role is to assess the market size, which he plans to do by surveying bait shops in the region to see whether they would be interested in using farmed baitfish as an alternative to wild-caught baitfish. "We're going to ask them about how interchangeable they think the baitfish are," Ropicki says. "If they have someone coming in for croaker and they don't have croaker, will the customer buy piggy perch instead?" He will also ask them what attributes are the most important to them and their customers: Is it all about the price? Is it really important that the fish survive a long time in the livewell? How important is the fish's appearance? "All of this is geared toward determining what the potential market size will be," he says. This stage of the project was unfortunately delayed by Hurricane Harvey both in the storm's direct impact on bait shops and in diverting Ropicki's time to support state and federal efforts to determine Harvey's economic impacts on Texas' marine-dependent industries, but he hopes to return to the market size assessment soon.

Ropicki says one of the things that drew him to the project was not having to worry about international competition for the live bait market. Many domestic seafood aquaculture ventures have failed because they cannot compete with the lower-priced imported products due to lower labor costs in Asia and South America, but those products are shipped frozen to the United States. "No one is going to grow baitfish in China and then ship it over here live — it would just be too difficult and expensive. It makes this an appealing market for the United States, especially if it were expanded to include other species of live bait."

Fuiman is excited about where his project might lead. Reducing the dependence on wild-caught bait could also strengthen the local food web, in addition to its economic benefits. "I'm very optimistic that we may have started something that can catch on and make people money, save the environment, and give people more fishing opportunities."

Research facilities impacted by Harvey

The University of Texas Marine Science Institute's Fisheries and Mariculture Laboratory (FAML), on the north end of Port Aransas, was among the facilities damaged by Hurricane Harvey when the storm made landfall less than 20 miles to the north in Rockport.

FAML Director Dr. Lee Fuiman says that among the major losses at his facility were fish being used in at least three laboratory experiments, including a fourth replication of an experiment in the pigfish aquaculture assessment and adult fish that were spawning out of season. "We lost our entire broodstock of pigfish," he says. "We were halfway through an experiment, which takes many weeks to do. But we knew they wouldn't survive the storm, so we had to euthanize them."

Fuiman and other researchers were back in the facility three weeks after the hurricane, although operations are still not fully back to normal. Damage assessments led to a redesign of the seawater intake and distribution system to decrease its likelihood of failure in future storms. His group was also scheduled to collect new pigfish broodstock in January and early February to complete the interrupted experiment.

PHOTO BY DR. RUSS MIGET

By Alex Hood

Piggy Perch in the Park:

Harvey delays launch of kids' fishing program in Freeport

The Texas coast is still rebuilding in the wake of Hurricane Harvey, but thanks to the efforts of a few dedicated people, a community fishing project for kids was saved within weeks.

The project, called Kids Fishing for Fun, was designed to teach local children fishing techniques and the importance of catch and release. It was born out of a collaboration between Dr. Lee Fuiman of the University of Texas Marine Science Institute (UTMSI), the Texas Parks and Wildlife Department's (TPWD's) Marine Development Center, the Brazoria County Parks Department (BCPD) and Dr. Russ Miget, Texas Sea Grant's Environmental Quality Specialist.

Fuiman and his research team, with support from Texas Sea Grant, were studying the mariculture of the pigfish (*Orthopristis chrysoptera*), also called piggy perch and a baitfish that is very popular with Texas anglers. Miget says he saw the research project as an opportunity to do something for the community.

"My thought was that it would be a really novel idea to have an area where kids could come and catch fish that had been stocked in saltwater at high density so that you'd almost be guaranteed to catch something," he says. "You can teach kids early on that they don't have to keep everything they catch."

PHOTO BY DR. RUSS MIGET

Delbert Gatlin IV, a fisheries biologist with Texas Parks and Wildlife Department, releases pigfish into their new home in a pond at the San Luis Pass County Park in Freeport.

The team at UTMSI supplied fertilized pigfish eggs, TPWD gave them a place to grow at its Marine Development Center in Corpus Christi, and BCPD prepared a pond for them in San Luis Pass County Park. By the first week of August, the fish had grown to 4 inches, and roughly 10,000 of them were transported to their new pond. The fish were allowed to settle in, and the first Kids Fishing for Fun tournament was scheduled for early September.

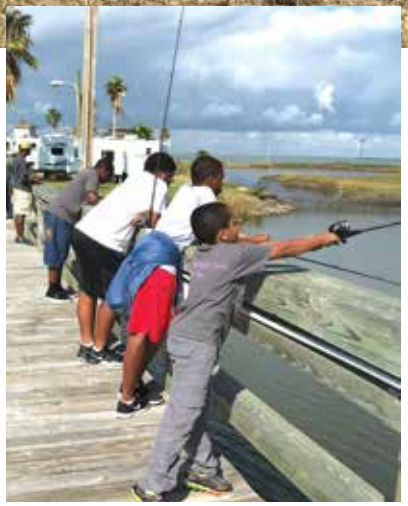


PHOTO BY DR. RUSS MIGET

Kids enjoy the first Kids Fishing for Fun event at San Luis Pass County Park on Nov. 4.

When Harvey made landfall in late August, Brazoria County issued a mandatory evacuation for its coastal areas, and storm surge flooded the park. By the time the first tournament was supposed to take place, no one knew if the fish were still there.

"They still had high water and weren't sure if it had risen above the fencing or whether any of the fish had swum out or stayed," Miget says, adding that even after floodwaters had receded, there was no way to know how many fish remained in the pond.

It was the effectiveness of Fuiman's mariculture techniques and TPWD's skill in applying them that saved Kids Fishing for Fun. The TPWD facility had been so successful in raising the pigfish that it still had thousands more that hadn't fit in the hauling tank used to stock the pond in August. Miget immediately contacted the facility about the remaining 4,000 fish, and TPWD agreed to have the pond restocked by mid-October.

The first Kids Fishing for Fun tournament in the park on the morning of Saturday, Nov. 4, was a hit. Parents from around Freeport brought their children to learn fishing techniques from the experienced anglers at BCPD. BCPD will continue to host regular fishing tournaments and events at the pond, and plans to make future announcements on its Facebook page.

Harvey was one of the most devastating hurricanes to ever strike Texas, and recovery will continue to be a daily reality for coastal Texans for a long time to come. But thanks to the successful practical application of a research project and some quick work, kids in one of the counties impacted by Hurricane Harvey enjoyed a fun day at the park catching some fish.

Texas Gulf shrimp is a Lone Star treasure. It's wildly popular with consumers and professional chefs alike. And who can blame them? With miles of clean, sustainable coastline framing the Gulf of Mexico, there is no reason to buy, serve or eat shrimp from anywhere else. Texas Gulf shrimp is better by a nautical mile. For more information about wild caught shrimp, visit **gotexan.org.**

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By Rhonda Cummins and Cindie Powell

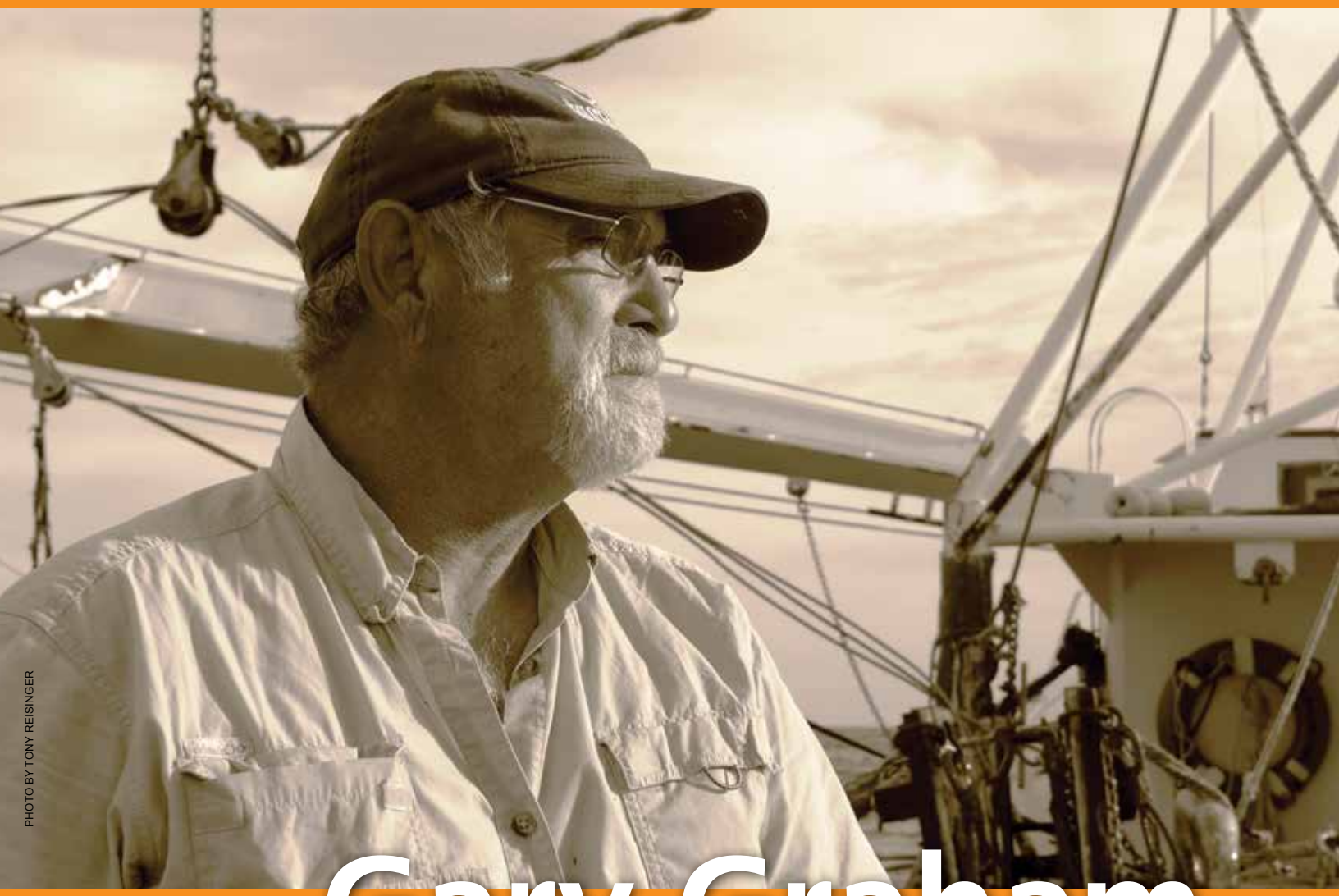


PHOTO BY TONY REISINGER

Gary Graham

Being in the Right Place at the Right Time Takes More than Luck

"I almost didn't take this job," Gary Graham told an audience in Port Lavaca in 2016. His "Cooking with Seafood" shrimp stew demonstration had been hijacked and turned into an informal roast in his honor, one of several events celebrating the 50th anniversary of the National Sea Grant College Program Act and also a way for Texas Sea Grant to honor one of their own.

They were not the words you would expect to hear from a man who has supported the shrimping industry for almost 50 years, most of that time with Texas Sea Grant. "He has made a tremendous, positive impact on our industry in every facet," says Andrea Hance, Executive Director of the Texas Shrimp Association. "With each set of industry challenges, Gary led a team that researched, developed and implemented gear modifications, specifically bycatch reduction, trawl net exclusion, and cataloging of bottom obstructions, just to name a few. Through his hard work and dedication, the commercial shrimping industry is now considered to be one of the most sustainable fisheries in the world."

Graham always has been a part of the fisheries community. As a youth he fished for fun, and as a young adult he fished over the summers to help pay his way through Texas A&M University. The money was good, really good, back in the late 1960s and early 1970s, and Graham says he considered fishing as a career, but his mentor and employer, Captain Jim McMurrey, discouraged him. "He was a unique individual," Graham says. "He had attended Princeton, and he had done a tremendous amount of work for the government. He had what at the time was the largest shrimp vessel in the Gulf of Mexico."

After receiving his degree from Texas A&M University, Graham was hired to work on a research project involving shrimp — but not fishing. In 1968, what was then the Texas Agricultural Extension Service (now the Texas A&M AgriLife Extension Service) launched its shrimp mariculture program. Starting in 1970, Graham worked alongside Dr. Jack Parker, who with Dr. Wallace Klussmann and Hoyt Holcomb built and operated a series of aquaculture ponds in Brazoria County. From a project funded by the extension service and Texas Sea Grant, the researchers learned more about the life cycles of Gulf shrimp and found that white shrimp were better suited to pond culture than brown shrimp. "I broke the code on finding and producing gravid white shrimp for seed stock, among other things," Graham says.

Meanwhile, Graham's close friend, David Harrington, had taken a position as Georgia Sea Grant's Marine Extension Fisheries Specialist. He suggested that Graham consider taking a position with Texas Sea Grant, and in 1972, Graham was hired as an assistant fisheries specialist with the Texas Sea Grant Marine Advisory Service, bridging the gap between academics and the fishing community by conducting research and outreach, supporting the fishermen with workshops and one-on-one education, and truly becoming a trusted consultant for the industry. As Graham's longtime friend, hunting buddy and professor emeritus of marine biology at Texas A&M University at Galveston, the late Dr. Sammy Ray, said in a 2004 interview, "Gary is a highly respected fisheries specialist based on actual experience — his knowledge of the fishery and his knowledge of the culture of the fisherman — and he has done all of this by learning it through being immersed in the industry and not through academic training. He learned it the hard way."

Perhaps the hardest times were the tumultuous years that followed the adoption of turtle excluder devices (TEDs). By the mid-1980s, the incidental take of sea turtles in the Gulf of Mexico and southeastern Atlantic shrimp fisheries had environmental groups gearing up to sue and shut them down. To manage the competing interests, the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) mandated that shrimp fishermen utilize a TED design that was cumbersome to use and that some in the field referred to as a "widow maker." They were difficult times for the shrimp industry.

The Gulf and South Atlantic Fisheries Foundation (GSAFF), a private nonprofit organization serving the commercial fishery since the passage of the Magnusson-Stevens Act, put together some large research and outreach projects to financially support TED development and outreach. GSAFF funded the efforts of a small cadre of extension specialists and agents who knew about trawl gear and had a good relationship with the fishing industry; Graham was their leader in the Gulf. The goal was to help fishermen determine the best designs for TEDs and have those designs tested and accepted by the federal regulators. Tom Murray was the GSAFF Executive Director at the time. "I think our (Sea Grant) extension people performed a

TEXAS SEA GRANT PHOTO

Graham has been part of the shrimp fishery in Texas, as a fisherman or with Texas Sea Grant, for more than 50 years. His many projects over those years included one with bay shrimp fisherman Jim Warren of Aransas Pass in the mid-1970s.

singularly valuable service, to the country but certainly to the industry, to make solutions in a time of great acrimony, and nobody is more responsible for that than Gary Graham," Murray says.

While some of the politicians and firebrands in the fishing industry were ready to go to court and fight the environmental groups, it would have been hard to fight the Endangered Species Act — and a closure would have cost the shrimping industry hundreds of millions of dollars. Murray says the more visionary members of the industry saw the inevitability of what was coming. "Gary was working hand in hand with the industry at that time: the Texas Shrimp Association, Louisiana Shrimp Association, southeast fisheries, South Carolina shrimpers, Georgia shrimpers, etc. It was really a large collaboration. He spent a lot of time going from Key West to Morehead City, N.C., back to Texas and up to Dulac (La.). He was a traveling man. He and Dave Harrington at Georgia Sea Grant Extension were the keys, knowing about the gear. Shrimpers trusted them without exception. They were able to lead the regional effort and do an awful lot."

PHOTO BY CHRIS HALE

Graham fills out a checklist during a TED inspection in Brownsville.

Graham and Harrington worked alongside the first county marine agents and helped convince shrimp fishermen that Sea Grant extension staff were not "government men" or game wardens. The two friends and work partners tested modified gear with shrimp fishermen and conducted outreach to the Gulf and southeastern Atlantic shrimp fleet, including the first adoptions of TEDs and, later, federally mandated bycatch reduction devices (BRDs), and they worked together on those efforts until Harrington's death in 2003.

One of Graham's first projects in fisheries extension was suggested by his mentor, McMurrey — collecting information from shrimp fishermen about "hangs," locations where seafloor obstructions can snag shrimp nets and cause thousands of dollars in damage, and compiling the information into a catalog. Fishermen kept careful records of these obstructions but kept them as secret as their favorite fishing spots. Graham spent hundreds of hours copying down each captain's coordinates for hangs and sharing the ones he had collected from other fishermen. The collection was published by Texas Sea Grant as a two-book set of 12,000 coordinates, *Hangs and Bottom Obstructions of the Texas/Louisiana Coast*. In addition to providing an invaluable service to the fishery, the project also opened doors in the fleet that would be crucial to Graham's ability to assist them with TEDs several years later.

Graham, Harrington and the rest of

PHOTO BY RHONDA CUMMINS

Graham helps a shrimp fisherman in Port O'Connor check his turtle excluder device.

a small cadre working hand in hand with fisheries leadership brought the shrimping industry into a more environmentally friendly future. Murray credits the TED projects as the greatest example of successful and meaningful outreach that the Sea Grant program has done nationally. "[They] took an impossible situation and through extension education were able to bring people together, create solutions and transfer the technology to stabilize an entire industry. That to me is what extension is all about, and Gary manifests that. He was in fact the leader of this, and I frankly consider it to be the single greatest success of Sea Grant Extension."

As new needs in the fishery arose, additional projects followed. Soaring diesel fuel prices beginning in the early 2000s led Patrick Riley, at the time the general manager of Western Seafood in Freeport, to seek trawl gear that was more fuel efficient. In 2005, he enlisted Graham to participate in proof-of-concept sea trials comparing the fuel efficiency of curved, vented, steel trawl doors to that of the flat, rectangular, wooden doors in use by the industry for decades. "It was one of those 'Eureka!' moments," Riley says of the results of their tests. Graham began to spread the word to other fishermen, and the first vessel outside of Riley's company to try the new doors was one owned by Charles Burnell of Brownsville. "It wasn't very long after that that Gary started applying for grants from NMFS to get these things out there through technology transfer. We've been to South Carolina, Alabama, Louisiana, pretty much all around the coast."

During the 2006 shrimp seasons, Graham went back out with the new gear to conduct comparative analysis to record the fuel savings and to make sure that the new doors didn't decrease the size of the shrimp catch. "They were able to show that it wasn't losing shrimp, which was a big cause for concern [for fishermen]," Riley says. "He published the results in a paper he and [Texas Sea Grant Marine Economist Dr. Michael] Haby put out, and that went a long way in what they were asking people to do. Without their help, I don't think it would have been disseminated as quickly — not as many boats would have adopted it as they did." Haby conducted a detailed analysis of the costs of the new doors against their fuel savings and longer life to show the economic benefits over the life of the doors. Meanwhile, Graham took the lead in transferring the technology to the shrimp fleet. Since 2008, when technology transfer of the new gear began, the Gulf and southeastern U.S. shrimp fleet has saved more than 17.7 million gallons of fuel, worth $51 million.

Although Graham semi-retired in 2011, it did not seem to slow the pace of his work for fishermen. In 2013, Graham and Tony Reisinger, Texas Sea Grant's Coastal and Marine Resources Agent for Cameron County, who works extensively with the Brownsville/Port Isabel shrimp fleet, spent a cumulative 50 days over two trips aboard Anchor Seafood's *Miss Madeline* in the Gulf to test five new designs of BRDs. Federal regulations require the use of BRDs to reduce the capture of other species, known as bycatch, but they also allow shrimp to escape the nets. Some models currently in use can reduce the shrimp catch by 10 percent or more, and shrimp lost from the net equals money lost for the fisherman. Modified BRD designs or new models that would reduce shrimp losses or are easier or less expensive to install must go through lengthy and expensive federal testing before being approved for use. The goal of Graham and Reisinger's research, which was funded by NMFS, was to pinpoint those that are most likely to meet the stringent testing protocols at the federal level. Since then, one BRD has been subjected to formal federal certification trials by the Gulf and South Atlantic Fisheries Foundation, and the North Carolina Wildlife Resources Commission and the North Carolina Sea Grant Program have conducted additional BRD testing based on the models originally tested by Graham and Reisinger.

Another grant, this time from the National Fish and Wildlife Foundation, has had Graham and Reisinger traveling around Texas, Mississippi, Alabama and Florida since 2014, going from dock to dock and vessel to vessel, checking TEDs and instructing crews in their proper installation, operation and maintenance. The inspections are voluntary, and Graham and Reisinger can make on-the-spot adjustments to correct any areas where

PHOTO BY TONY REISINGER

In addition to his contributions to the shrimp industry, Graham is also well-known for his sense of humor, seen here in a lighter moment on a dock in Louisiana bayou country, where he and Tony Reisinger were conducting voluntary TED compliance inspections on shrimp vessels.

TEDs are out of compliance. Issues can include TED construction, net angle, escape opening size, flotation and flap construction. Graham says most of the problems they find are minor, and some problems they find don't represent a danger to sea turtles but can cost fishermen some of their catch. Vessels that are in full compliance receive an inspection form they can use to help certify that their catch is "turtle safe."

In 2016, Graham was named to an international committee to improve fishing techniques in the Gulf of California in Mexico to protect the vaquita, the world's smallest porpoise and the most endangered marine mammal in the world. Some experts believe there may be as few as 60 vaquita left in the world, all in a small area of the upper Gulf of California. Graham says the future of the vaquita is hanging by a thread. "It is going to be a tremendous challenge to stop their further decline and potential extinction."

Hurricane Harvey also increased the demands on Graham's time, both personally and professionally. Even as he was dealing with the flooding of his West Columbia home from the storm, he traveled to the Port Arthur area with Reisinger to help assess the damage to vessels and docks there. "A lot of the fishermen were impacted by flooding and are living on their boats, but by Gary's coming, he helped us determine that except for one crabber, there were no boats lost," says Fr. Sinclair Oubre, Director of the Apostleship of the Sea of the Diocese of Beaumont. "The rest of us were [too busy] trying to take care of our houses, or taking care of other people's houses, to be able to get a good read on what was going on, and his being able to do that was a big help.

"As we traveled together, he shared his own situation, and we were truly impressed that he made his way up to the coast to check out our guys at the same time that he was struggling with his own home," Oubre says. "He is a model of what it means to be a professional fisherman who is out there doing the work because he loves doing it and then doing everything he can to become better at it — more environmentally friendly, more efficient — and then sharing that knowledge with other fishermen so they can be better fishermen also."

Graham is fond of saying, "I'm one of these people who was always in the right place at the right time." A less modest man might describe it as having the vision to see a need, the compassion to want to help, and the will to do something about it. Or as Murray puts it, "When the help was needed, he was right there."

Graham maintains that the most effective way to get things done is to be on the waterfront or aboard a vessel, working one-on-one with fishermen to help them adopt the newest gear, comply with the most recent regulations or navigate the latest contentious issue. That caring,

committed service to the industry has been widely recognized by several organizations. The Southern Shrimp Alliance honored him with a Lifetime Achievement Award in 2016 in recognition of outstanding dedication, vision and amazing lifetime accomplishments in and for the United States domestic shrimp industry. The Sea Grant Extension Assembly also recognized Graham with the William Q. Wick Visionary Career Leadership Award at its 2015 meeting. The award celebrates outstanding career achievement, leadership, vision and contributions to Sea Grant Extension through programming or administration by a Sea Grant extension professional.

Other recent awards in his long, distinguished career include the Gene Raffield Humanitarian Award from the Southeastern Fisheries Association in 2014 for his devotion to educating commercial fishermen, demonstration of leadership and support of fishing communities. Graham and other members of the Texas Sea Grant extension team also won the 2013 Superior Service Award from Texas A&M AgriLife Extension for their efforts in providing training and helping Texas commercial shrimp fishermen qualify for Trade Adjustment Assistance from the U.S. Department of Agriculture. And in 2009, Graham received the David L. Harrington Award, named for his longtime friend and partner, from the Southeastern Fisheries Association.

"It's been a heck of a career for me," Graham says. "I'm not supposed to have done all of this. It wasn't supposed to happen. I believe there was a power much bigger than me that directed all this stuff. I am not that smart. For me to come up with the hang book and the gear, it was just something that was put there for me. It wasn't me, it was something much higher."

He says that the relationships he has built are his greatest accomplishment. Those relationships, made by working with individual fishermen throughout the Gulf of Mexico and supporting his colleagues in Texas, were evident in the comments shared during 2016's surprise roast in Port Lavaca as members of his Sea Grant family gave praise and shared stories from their years together.

PHOTO BY TONY REISINGER

Graham and his long-time partner, Candy Graham, visited Santiago, Cuba, in 2016.

"Gary was a mentor to all of us, a brother to all of us. I cannot think of a time during my 30-something years with the Texas Sea Grant program when Gary wasn't there when you called him," said Willie Younger, the program's retired education specialist. "Gary was one of the most professional men that you ever wanted to be around, both as clients and as compadres in Sea Grant." Younger spoke for many of his colleagues, both in the room and across the Gulf, when he told Graham, "It was an honor to have you as a working companion."

In recent years, Graham has begun making time for personal travel and other well-deserved retirement activities. He and his long-time partner, Candy Graham, have hiked the Machu Picchu Inca Trail, visited Cuba and hiked in Switzerland, among other destinations. "We've done some pretty good trips. We're starting to work a little play into this." He has started reducing his hours with Texas Sea Grant, and the program is conducting a search for a new Marine Fisheries Specialist to train alongside Graham.

At the end of the roast in Port Lavaca, Graham reflected on a recent trip with Reisinger checking TEDs on boats in Louisiana. In the earliest days of TED adoption, he said, there were about 700 nesting female Kemp's ridley sea turtles — the most endangered sea turtle in the world. "A lot of the shrimpers said they didn't catch them, and they didn't. The reason they didn't catch them is because there weren't many left."

The species rebounded to 22,000 nests by 2009, but the numbers dipped again to 13,000 after the Deepwater Horizon oil spill, so hopes of changing the listing of the species from endangered to threatened would have to wait. But Graham expressed great satisfaction in the efforts by shrimp fishermen to protect the species by having TEDs that were properly installed and used, including the vessels he visited on that recent trip to Louisiana. "They have good gear. We went on a lot of boats, and people are trying to do the right thing. That makes me feel good. I think I can walk away from this job holding my head up... It's been a blessing to me, and it's been a wonderful ride."

Upper Coast Marine Agent Terrie Looney retires

BEAUMONT — After 19 years as the Coastal and Marine Resources Agent for Jefferson and Chambers counties, Terrie Looney hung up her hip waders and retired from her dual Texas Sea Grant/ Texas A&M AgriLife Extension Service position at the end of August 2017.

Looney joined Texas Sea Grant after 10 years as a certified teacher, experience that she used to enhance her education and outreach efforts. Through Neches River Adventures, operated by the Big Thicket Association, she provided educational outings on the Neches River for school groups. She also was one of the coordinators of Camp SeaPort, a Port Arthur-based summer day camp that since its inception in 2008 has educated local high school students about maritime career opportunities.

Statewide, Looney served as the regional coordinator for the two Texas competitions of the National Ocean Sciences Bowl (NOSB) — the Dolphin Challenge in northern Texas and the Loggerhead Challenge in the southern part of the state. NOSB is a quiz bowl-style competition designed to teach high school students about the oceans and raise the visibility of our nation's investment in ocean-related research. The only regional coordinator in the nation charged with the management of two competitions, Looney traveled with the winning regional teams to the national competitions each year.

She also supported the local shrimp industry, including sitting on the Port Arthur Shrimp Association board and acting as a commercial fishery representative to the U.S. Coast Guard's Southeast Texas Waterway Advisory Committee. That body is a public forum on a wide range of issues relevant to the Sabine and Neches rivers and the ports of Beaumont, Orange and Port Arthur. She also provided professional development education directly to shrimp fishermen, including safety training, updates on regulatory changes, and information and updates from the Coast Guard, Texas Parks and Wildlife Department and National Marine Fisheries Service.

TEXAS SEA GRANT PHOTO

Dr. Terrie Looney, who retired as the Coastal and Marine Resources Agent for Jefferson and Chambers counties in August, was honored by the Jefferson County Commissioners Court with a proclamation honoring her dedicated service to the county, Texas A&M AgriLife Extension Service and Texas Sea Grant. The proclamation was presented by Jefferson County Judge Jeff Branick.

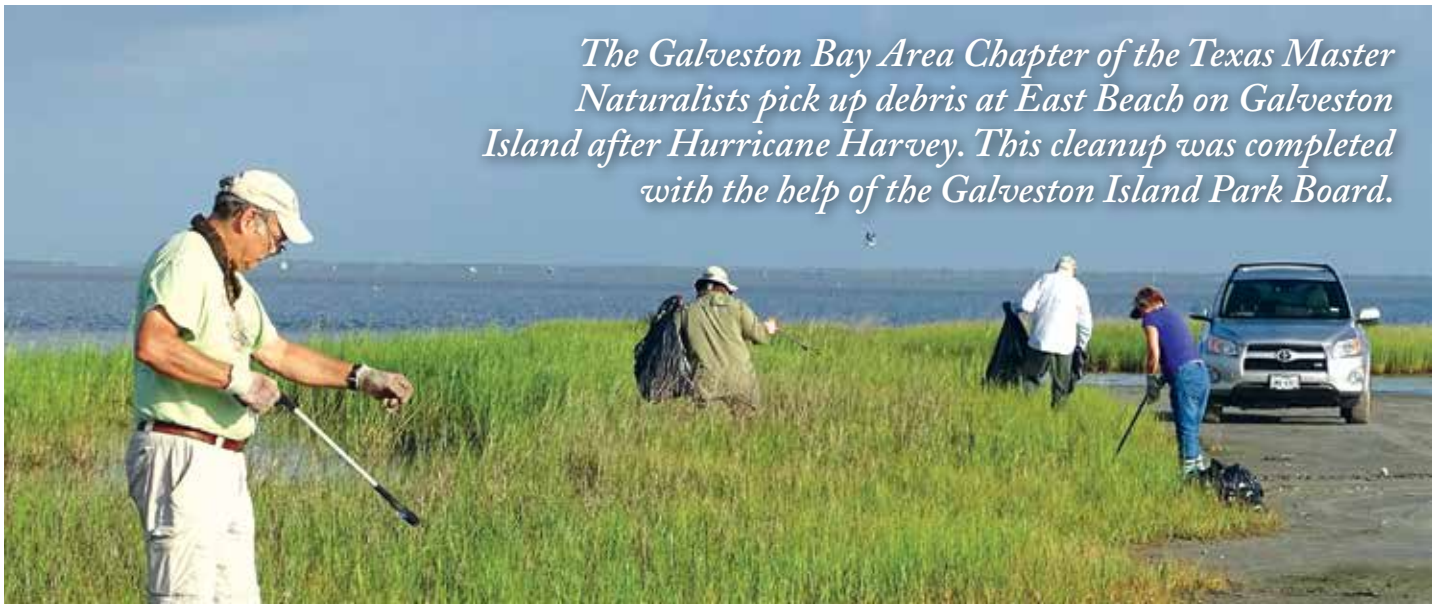
A graduate of Lamar University in Beaumont with bachelor of science and master of science degrees in biology, she completed a doctorate in educational leadership from Northcentral University while working full-time as a county agent.

In 2015, Looney received a Superior Service Award in the county agent category from Texas A&M AgriLife Extension. She also was among the Texas Sea Grant staff members whose work with the Shrimp Trade Adjustment Assistance Program for the Gulf and Atlantic shrimp industry was recognized with a Texas A&M AgriLife Superior Service Team Award in 2013, and she was honored with an Assembly of Sea Grant Program Leaders' Superior Outreach Programming Award in 2010 with three other Texas Sea Grant staff members for their Hurricane Ike recovery efforts.

The Jefferson County Commissioners' Court presented Looney with a proclamation at its August meeting: "Dr. Looney is recognized for her unselfish devotion to the common good and welfare of the citizens of Jefferson County and will be missed by her friends and co-workers. Therefore, let it be resolved that the Jefferson County Commissioners' Court does hereby honor and commend Dr. Looney for her dedicated service as a valuable employee of Jefferson County, Texas A&M AgriLife Extension Service and Texas Sea Grant program, and wish her all the best in her retirement."

— Cindie Powell

Gulf Guardian Awards honor two projects for conservation efforts



The Galveston Bay Area Chapter of the Texas Master Naturalists pick up debris at East Beach on Galveston Island after Hurricane Harvey. This cleanup was completed with the help of the Galveston Island Park Board.

PHOTO COURTESY JULIE MASSEY

Two Texas Sea Grant-related projects were honored with 2017 Gulf Guardian Awards from the U.S. Environmental Protection Agency for their work to conserve and restore the natural resources of the Gulf of Mexico.

The Galveston Bay Area Chapter (GBAC) of the Texas Master Naturalist program, a partnership between the Texas Parks and Wildlife Department, Texas A&M AgriLife Extension Service and Texas Sea Grant, won first place in the civic/non-profit category for its Plastic Prevention Partnership (P3). GBAC is a 222-member cadre of trained volunteers that uses outreach, education and conservation to protect Galveston Bay area ecosystems. During its work on the coast, the group observed a destructive trend.

"The volunteers were monitoring nesting sea turtles and shorebirds for many years, and they began to notice increasing numbers that were being harmed due to plastic litter," says GBAC Advisor Julie Massey, Texas Sea Grant's Coastal and Marine Resources Agent for Galveston County. "They decided they wanted to not only promote the proper disposal of plastic, but also to reduce its use."

The group created P3, an outreach and cleanup partnership with Galveston Bay area stakeholders that resulted in more than 3,500 pounds of plastic being removed from the environment and 178 litter-education events that reached 3,250 people.

Massey says the award is a great honor for the Master Naturalists and she is excited about the recognition it will bring to the volunteers' accomplishments. "The Gulf Guardian Award is a huge honor," she says. "The competition is open to organizations across the whole Gulf of Mexico. The Galveston Bay Area Master Naturalists are extremely excited and proud, and I am too!"

Also recognized was the Wetland Restoration Team (WRT) of the Texas Community Watershed Partners (TCWP), formerly the Texas Coastal Watershed Program, which was a partnership of Texas A&M AgriLife Extension Service and Texas Sea Grant. The WRT, a group of about a dozen volunteers coordinated by TCWP, won third place in the partnerships category for its restoration project at Sheldon Lake State Park in Houston.

"We've been working at Sheldon Lake for over 14 years, and we've been doing different phases of restoration," says TCWP Extension Program Specialist and WRT leader Marissa Llosa. "It's a very long-term project."

Progress at Sheldon Lake State Park is ongoing, so the team is receiving the Gulf Guardian Award for their years of effort. To date, the volunteers have restored more than 375 acres of the park's marshes and coastal prairies and logged more than 10,500 hours there since 2003. The project recently received funding to restore an additional 62 acres, which will complete the fifth phase of its restoration work.

TEXAS SEA GRANT PHOTO

Wetland Restoration Team Leader Marissa Llosa (right) at Sheldon Lake State Park in 2016.

"The work these volunteers do is so critical, and the award is a perfect reflection of their effort and their dedication," Llosa says.

— Alex Hood

Two oceanography grad students are latest Rayburn Scholarship recipients

Luz Zarate Jimenez

Xiaoqing Liu

Two Texas A&M University oceanography graduate students are the recipients of the Ralph Rayburn Texas Sea Grant Scholarship for the 2017-18 academic year.

Xiaoqing Liu and Luz Zarate Jimenez each received $500 from the fund established to honor the Texas Sea Grant College Program's late Associate Director and Extension Program Leader, who died in 2008. The scholarship is administered by the university's Department of Oceanography in the College of Geosciences and is awarded to outstanding graduate students within the department.

"I am honored to receive the Rayburn Scholarship," Liu says. A Ph.D. student studying paleoceanography, paleoclimatology and marine geochemistry, she has a master's degree in marine geology from Tongji University in China and a bachelor's degree in marine science from the China University of Geosciences. Her current research focuses on reconstructing the sea surface temperatures of the Western Pacific Warm Pool starting from approximately 20 million years ago.

Zarate, a master's degree student studying the use of oceanographic instrumentation to improve the understanding of ocean circulation along the Texas coast, has a bachelor's degree in geophysical engineering from the National Autonomous University of Mexico. She has been on five research cruises totaling 90 days at sea in the Gulf of Mexico and South Pacific, including a 45-day-long oceanographic cruise from Tahiti to Chile from August to October 2017. Her responsibilities have included operating, deploying and recovering oceanographic instruments; collecting samples; and acquiring, processing and analyzing data.

"As part of my master's thesis, I am analyzing data from the first high-frequency radar system installed on the Texas coast," Zarate says. "A better understanding of ocean circulation will contribute to the enhancement of oceanographic models to benefit coastal hazard mitigation, fisheries, the oil industry and marine navigation."

Rayburn, a graduate of Texas A&M University, first joined Texas Sea Grant in 1978 as a marine agent for Aransas and San Patricio counties. After several years as Executive Director of the Texas Shrimp Association and in a number of roles at the Texas Parks and Wildlife Department, he returned to Texas Sea Grant in 1999. Through his association with these three organizations, he worked tirelessly for the protection of Texas' marine resources, but he is also remembered for his integrity, professionalism, work ethic and outgoing personality.

Eight graduate students have received the Ralph Rayburn Scholarship since it was first awarded in 2011. Their research projects have included using numerical modeling to learn more about hypoxic "dead zones" in the Gulf of Mexico and studying the ocean's past for clues about how climate change may affect its future.

—Jessica Scarfuto

Ralph Rayburn

Doctoral student tagging bull sharks in Galveston Bay

A Texas A&M University at Galveston doctoral student is studying the movement and habitat patterns of bull sharks *(Carcharhinus leucas)* in Galveston Bay with support from Texas Sea Grant's Grants-in-Aid of Graduate Research Program.

Thomas TinHan is tagging juvenile bull sharks to learn more about their habitat preferences through long- and short-term movement tracking. Texas estuaries are essential nursery habitats for the sharks, but these areas vary greatly in habitat type and regularly experience drastic changes in environmental conditions like temperature and salinity. By tagging the sharks and then observing where they go over time, TinHan hopes to learn more about how they respond to these changes.

"I've always had an interest in studying the behavior of apex predators," he says. "They typically play very important roles in marine ecosystems."

By studying one of the top predators in Galveston Bay, TinHan says that more can be learned about the food chain as a whole, which can then be used to inform management and fishing practices in Texas bays.

"Some ecosystems are very tightly linked," he says. "If you adjust the population of one species, it could affect several other species, or it might not. But it's important we understand how much influence that might have, and the first step of getting at that is understanding the first link in the chain."

There is a reason TinHan is interested specifically in bull sharks. They are infamous for their ability to do something that very few other sharks can do: regularly travel deep into freshwater systems with no apparent ill effects. They have been found all over the world in rivers and lakes that are connected to oceans, but the extent to which they do this in Texas isn't well known.

"Texas Parks and Wildlife has a survey monitoring program that's been going on for about 30 years, but they don't sample into fresh water systems," TinHan says. "We know that bull sharks move into low salinity areas near river mouths, but we don't know how far they're actually moving into them."

He adds that it's not rare for bull sharks to be found in bodies of fresh water in Texas, but how often it happens is hard to quantify. "A lot of fishermen who are attempting to catch other species in rivers will catch bull sharks occasionally, but it's hard to tell how often it happens because they're typically not fishing for an animal that large, so bite-offs are common."

TinHan hopes that observing the sharks' movement patterns over the course of a year will shed some light on that mystery. He began tagging sharks in summer 2017 with the aid of Texas Sea Grant's funding, but his project was interrupted by Hurricane Harvey. However, tagging has since resumed, and he says they'll be monitoring the sharks' movements for a full year after the last tag is deployed.

PHOTO BY TRAVIS RICHARDS

Texas A&M University at Galveston doctoral student Thomas TinHan releases a freshly tagged juvenile bull shark back into east Galveston Bay. The shark was fitted with an external tag containing return information should it be captured by an angler and an internal acoustic tag to track its movements across the bay.

Texas Sea Grant's Grants-in-Aid of Graduate Research Program is a competitive program that provides small grants to graduate students enrolled at Texas A&M University, Texas A&M University at Galveston and Texas A&M University-Corpus Christi whose research projects are both relevant to Texas and marine related. The program is designed to promote scientific research by supporting students in their early academic careers.

— Alex Hood

Two Texas grad students serving yearlong marine policy fellowships

Emily K. Cira *Andria Kay Salas*

Two Texas doctoral students began a prestigious Sea Grant marine policy fellowship in Washington, D.C., in February.

Emily K. Cira and Andria Kay Salas will spend a year as 2018 John A. Knauss Marine Policy Fellows, Cira with the U.S. Environmental Protection Agency National Nutrient Criteria Program and Salas in the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service Restoration Center. The Knauss Fellowship, established in 1979, pairs highly qualified graduate students who have an interest in ocean, coastal and Great Lakes resources and in the national policy decisions affecting those resources with host offices in the legislative and executive branches of government. This provides a unique educational opportunity for students to learn about how national policy decisions affect these natural resources.

A Ph.D. student in coastal and marine science at Texas A&M University-Corpus Christi, Cira is studying how environmental factors such as temperature and salinity and human factors such as nutrient loading influence water quality in Baffin Bay in South Texas. "Baffin Bay has been showing signs of water quality degradation," she says. "I hope that the results of my research can help the local efforts to address these concerns."

Cira says she is looking forward to learning how research like hers is applied to policy and management decisions. "I have spent years conducting research on coastal water quality with the intent that my results would be used to guide management decisions. The Knauss Fellowship will give me hands-on exposure to marine and coastal policy, and allow me to have a much more active role in the process."

Salas is a Ph.D. candidate in ecology, evolution, and behavior at the University of Texas at Austin. Her research focuses on how sounds generated by the activity of animals living on coral reefs may serve as cues to indicate the quality of a reef for larval fishes that use reefs to transition to the next stage of life.

She says she is excited to participate in the Knauss Fellowship because she is passionate about the research process and has a deep appreciation for the world's oceans. "I want to gain knowledge and insight about what type of science is needed and how this science is used by policy makers so that I can better guide my own research to positively contribute to how our ocean resources are managed and protected."

The Knauss Fellowship program is open to interested students who are enrolled in a degree in a graduate or professional program; they are required to apply through the nearest state Sea Grant program. The fellowship is named in honor of one of Sea Grant's founders, former NOAA Administrator John A. Knauss.

Matthew Dzaugis

Texas' 2017 Knauss Fellow, Matthew Dzaugis, worked at the U.S. Global Change Research Program (USGCRP), which is an interagency program that helps coordinate all of the climate change research done from 13 different government agencies and is mandated by Congress to produce the National Climate Assessment no less than every four years.

"There is always a lot going on at USGCRP, so I have the opportunity to participate in or at least sit in on a huge number of different interagency working groups or other cross-agency programs," he says. "I have mostly been involved with the coordination and production of the National Climate Assessment. As a coordinator, I helped to manage and facilitate the writing of some of the chapters by the climate change experts who volunteered to be authors."

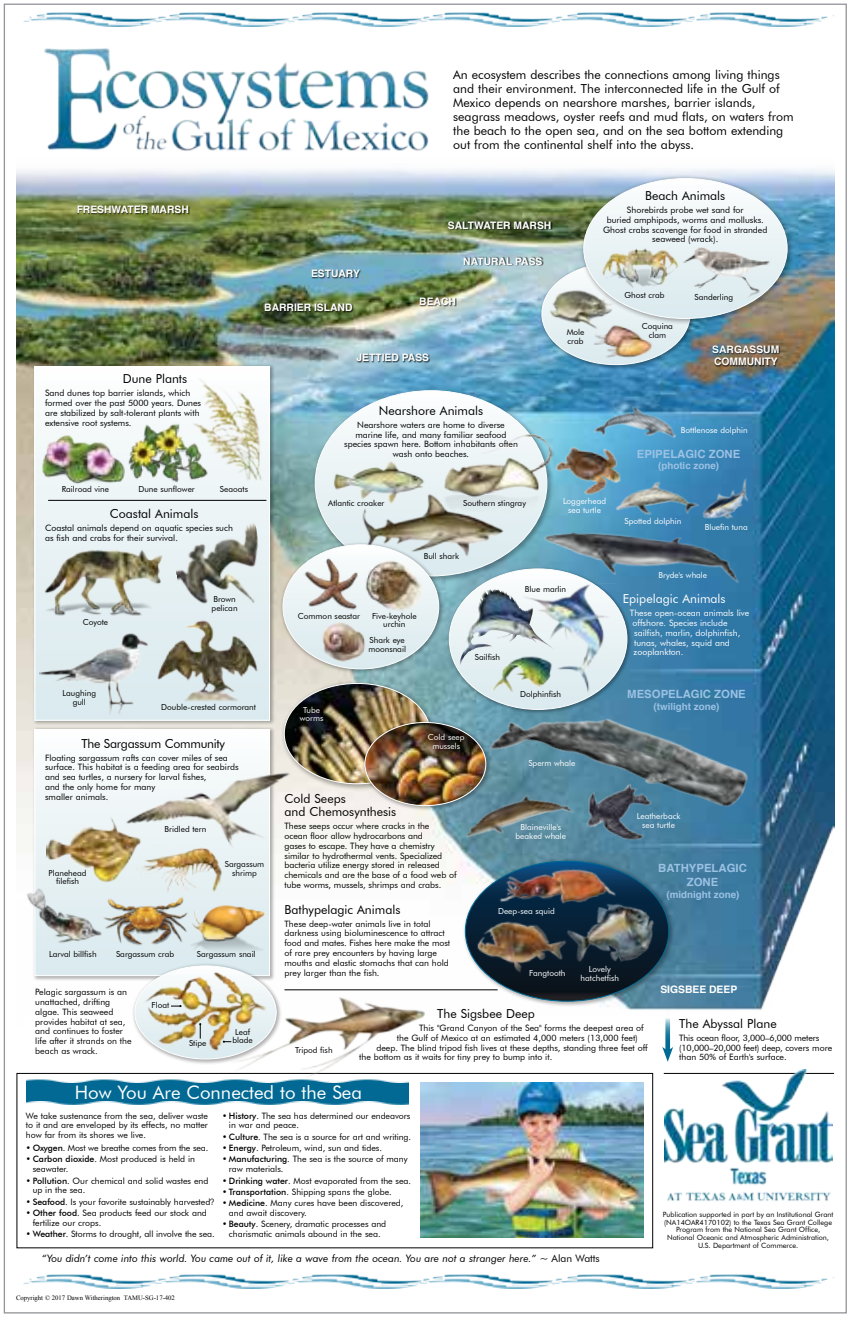
Dzaugis served as the lead author of the Frequently Asked Questions chapter. "Not only was I writing the answers to the most prevalent climate change questions, but also communicating with a large list of technical experts who helped verify and fact-check my answers. Overall it has been a huge privilege to be involved with this project."

— Jessica Scarfuto

Gulf ecosystem display for Sargent fishing pier available as posters from Texas Sea Grant

Four panels of an educational display about Gulf habitats and sea life soon to be installed at the Sargent fishing pier in Matagorda County are now available from Texas Sea Grant as a set of full-color posters.

The new pier at Sargent Beach has been in the making for the better part of a decade, and once it started to come together, Matagorda County approached Texas Sea Grant's Environmental Quality Specialist, Dr. Russ Miget, who also has a background in youth education, about designing an educational component for it.



Miget says he wanted the focus to be on increasing visitors' knowledge about coastal ecosystems and Gulf of Mexico wildlife. "I think it's important to inform fishers about the life cycle of fish in the Gulf of Mexico because it helps them better understand why fishing regulations are set up the way they are," he says. "Forty years ago, people considered the ocean an inexhaustible resource, and now we know that only around 1 percent of fish eggs ever make it to adulthood. I suggested placing educational posters in this centrally located kiosk."

A few ideas for topics were discussed, Miget says, but the final decision was to do four posters about sea life in the Gulf of Mexico: "Ecosystems of the Gulf of Mexico," "Gulf of Mexico Food Webs," "Ocean Animals" and "Estuaries of the Gulf of Mexico." The posters include information and full-color illustrations, define scientific terms, show species from tiny plankton to sperm whales in their habitats, and highlight visitors' connection to the sea.

Dawn Witherington of Drawn by Dawn Illustration and Design created the detailed illustrations and designed the posters, while Miget provided the concepts to be covered, scientific information and text. Witherington had previously completed a series of illustrated posters of endangered sea turtles, including a drawing of the Kemp's ridley sea turtle, the state sea turtle of Texas, that Texas Sea Grant used on an informational card.

Dredging on Sargent Beach after Hurricane Harvey delayed the installation of the educational display on the pier, but Texas Sea Grant has already begun distributing the poster versions around the state and region to teachers and others interested in Gulf Coast ecosystems.

The posters can be downloaded as PDF files from the Texas Sea Grant website at TexasSeaGrant.org/publications/category/2017-publications, or free copies can be requested from Texas Sea Grant, while supplies are available, by emailing seagrant@tamu.edu or calling 979-458-8442.

— Alex Hood

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