

Texas Shores



SPRING 2020

TEXAS SEA GRANT COLLEGE PROGRAM

VOL. 45

THE COAST IS YOUR OYSTER

Opportunities arise for
oyster mariculture, coastal
communities, and more

Oyster reefs provide ecological services to humans and wildlife alike. They house many fish species, which become prey for other wildlife and support recreational fisheries.



FROM THE DIRECTOR

Reviewing our Successes



Next year Texas Sea Grant will celebrate its 50th anniversary, and we are looking back in time now to review our past successes and prepare for a big Texas-sized celebration in 2021. One thing we have done consistently since we became an official Sea Grant College Program in 1971 is support Texas fisheries.

We have supported the entire supply chain from the people who fish Texas waters and beyond to the consumers who love to eat their catch. We developed seafood recipes and a cookbook; we trained fishermen how to fish sustainably, increase their catch, and reduce their fuel use to decrease their operating costs; we funded vital research on commercially important species that are of economic importance of our recreational fisheries; and we taught multiple generations of kids how to fish. This issue of *Texas Shores* takes a look at some of the work we are doing today to help keep Texas seafood on the menu. Coming soon, the most exciting addition to the menu is Texas' own brand of oyster on the half-shell. New state regulations passed in 2019 will take effect in 2020, making oyster mariculture legal in Texas. This opportunity will revitalize the oyster industry in Texas and enhance the economies of our coastal communities.

We look forward to assisting oyster mariculture efforts in Texas to ensure this new industry is safe, profitable, and successful. Like so many other things in Texas, I am confident our oysters will be bigger, better, and will bring the flavor!

Warm Regards,

A handwritten signature in cursive script that reads "Pamela Plotkin".

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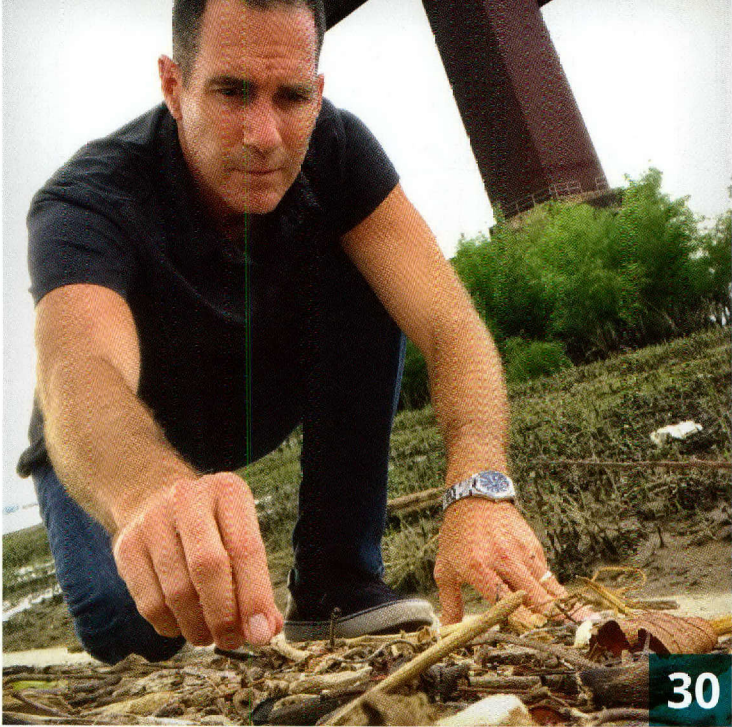
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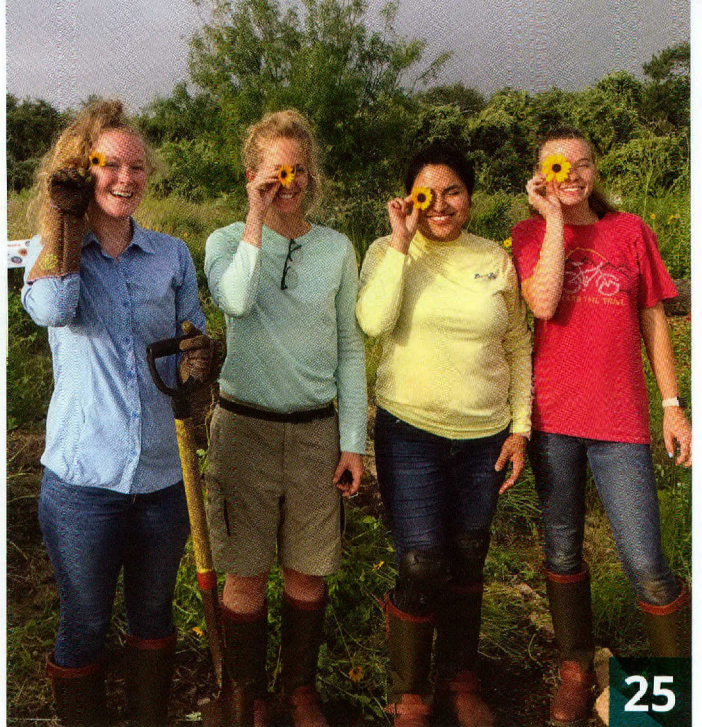
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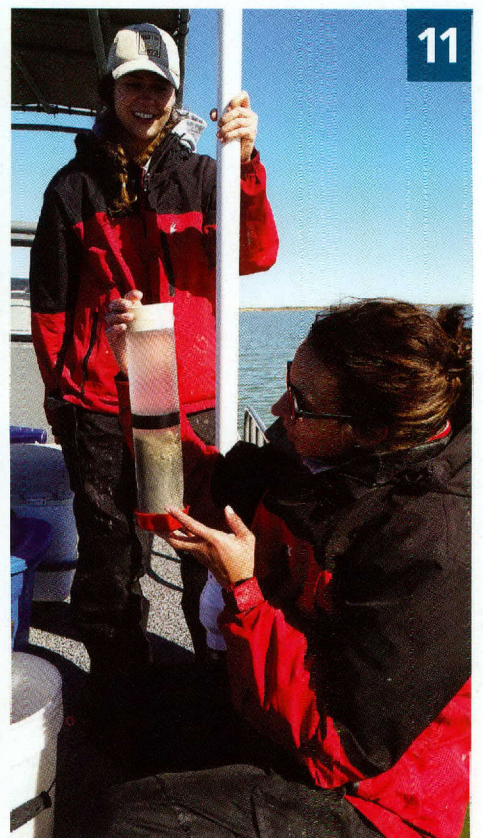
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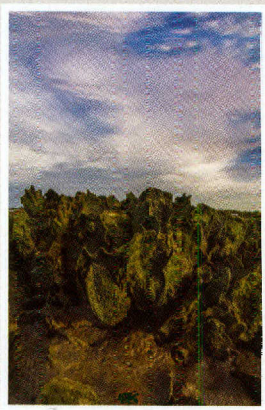
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Cover image:

As oysters mature and form their own shells, they fuse together with other oyster shells to form rock-like structures known as reefs.



SETH PATTERSON

A SIMPLE SUPERHERO: PROTECTING ITSELF AND SERVING ITS ENVIRONMENT

BY CALLIE RAINOSEK • PHOTOGRAPHS BY DR. AVERY SCHERER



Oysters are simple organisms with impressive abilities. They have no physical nose or centralized brain like humans do, yet they are capable of sensing predators and determining when to grow heavier, stronger shells to protect themselves from the sharp pincers of blue crabs.

Dr. Avery Scherer, now a senior ecologist at an environmental consulting company in Sacramento, California, explored this oyster-shell phenomenon for her Texas Sea Grant-funded doctoral research at Texas A&M University. Scherer focused on what information oysters use to determine how and when to make changes to their shells to reduce predation risk.

“My studies showed that oysters can incorporate lots of information, including their own size, food availability, and the diet of their predators, to determine how much energy to invest in altering their shells,” Scherer says.

For example, oysters can sense when crabs have been eating other oysters, a bright red flag for oysters to make changes to their shells to protect themselves. But if oysters have no physical nose or centralized brain, how are they capable of knowing so much about their predation risk?

According to Scherer, oysters have receptors that sense chemicals in the water. When a crab approaches, oysters can detect these chemical changes in the water, which helps them determine whether they are in danger.

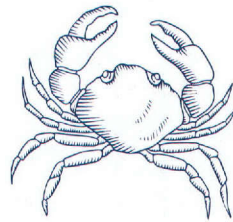
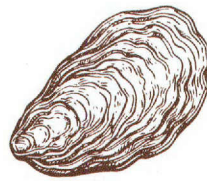
Oyster shells are made mostly of calcium carbonate, but they also contain small amounts of protein. When an oyster shell becomes stronger to reduce predation risk, the ratio of calcium carbonate to protein within the shell changes. These chemical changes are influenced by how much predation risk oysters are experiencing.

To determine which exposures stimulated oysters to change their shell, Scherer introduced oysters in her lab to simplified versions of scenarios that they may face in the wild. She measured the strength of oyster shells by using a probe, or force sensor, connected to a device called a “charge amplifier,” which quantified the amount of electricity and force produced when crushing the oyster shells.

STRIVING TO SAVE OYSTERS

Scherer’s research contributes to helping understand more than just individual oysters. Through her research, scientists can better understand the ecology of healthy oyster reefs, which can help humans restore oyster reefs after oysters are harvested for consumption. Restoring oyster reefs is particularly important considering they are an endangered habitat, with 85 to 91 percent of reefs already lost worldwide.

Oysters can sense when crabs have been eating other oysters, a bright red flag for oysters to make changes to their shells to protect themselves.



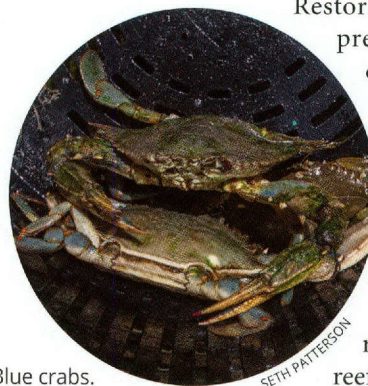
Dr. Avery Scherer

Oysters are one of the largest, most lucrative commercial fisheries in both the United States and Texas, so the survival of oyster reefs also has an economic benefit. However, harvesting oysters contributes to their habitat endangerment. Oysters settle down and attach to solid surfaces, preferably other oyster shells, where they grow for the rest of their lives. These conglomerates of oysters create an oyster reef, which provides protection for other sea creatures. Harvesting oysters, therefore, disrupts the habitat of both oysters and other sea creatures.

“When you remove adult oysters from the ocean, you’re not only removing part of the population, you’re actually removing the habitat for the young oysters to settle and grow on,” Scherer explains. “The more oysters you take, the less the population is able to replenish and grow.”

Restoring oyster reefs is also important for preserving a healthy environment. For example, oysters provide ecosystem services, such as water filtration and protection from wave erosion along the shoreline. If destruction of oyster reefs continues in the future without restoration, there could also be a disruption in the ecosystem.

Studies such as Scherer’s are vital to the restoration and conservation of oyster reefs, which help keep our environment and ecosystems regulated. “I want to bring awareness to the fact that oysters are really important,” Scherer says. “I think people dismiss them, but they’re alive. They’re interacting with their environment, and there are really important ways that humans are having an impact on them.”



Blue crabs.

SETH PATTERSON



All hands on deck

How researchers and citizen scientists helped an iconic Texas bay

BY CORLEY-ANN PARKER

Baffin Bay, often revered by fishermen and researchers alike, is located about 50 miles south of Corpus Christi, Texas. This iconic area is well known for great commercial and recreational fishing along with scenic shoreline views, and it is part of the invaluable Laguna Madre ecosystem along the Gulf of Mexico.

However, in 2012, a water quality analysis of the bay showed the waters were being over-enriched with nutrients like nitrogen and phosphorus, leading to algal overgrowth and lower oxygen levels, or hypoxia, significantly harming this treasured ecosystem. Since 1990, persistent brown tide blooms have led to seagrass die-offs in both Baffin Bay and the upper Laguna Madre. In addition, large fish kills that occurred in 2007, 2010, and 2012 were associated with hypoxia in the bay.

There are a variety of factors that can cause hypoxia, including a high volume of algae and the bacteria that consume it, as well as natural conditions like wind, temperature, or salinity shifts. These hypoxic events were wreaking havoc on the wild communities of Baffin Bay, and citizens were starting to take notice.

Locals began to raise concerns about the regular brown tide algal blooms and the deteriorating health of the ecosystem. Long-time Baffin Bay users suggested that these symptoms of declining ecosystem health were unprecedented compared to conditions prior to the 1980s.

A TEAM EFFORT

To address concerns from citizens around Baffin Bay, Dr. Michael Wetz, Harte Research Institute chair for Coastal Ecosystem Processes, along with fellow researchers from Texas A&M University – Corpus Christi (TAMUCC), established a rigorous water quality analysis program with the assistance of volunteers from surrounding communities in 2013.

What makes this research especially unique is the use of citizen scientists to collect and report data. “For some of the potential water quality issues that the bay was facing, we knew that it was going to take a real team effort, a stakeholder effort, to fix any problems,” says Wetz. “There wasn’t a routine water quality sampling that would help us to really pinpoint what the issues were. So from that, we recruited citizens.”

The goal of this volunteer water quality analysis program was to determine when and where the symptoms of water quality degradation were most severe throughout the bay. After four years of sampling, the data from the program showed that chlorophyll levels, which contribute to algal overgrowth, exceeded state limits for the majority of the time in Baffin Bay. The prevalence of chlorophyll was also partially responsible for decreased oxygen levels in the bay.

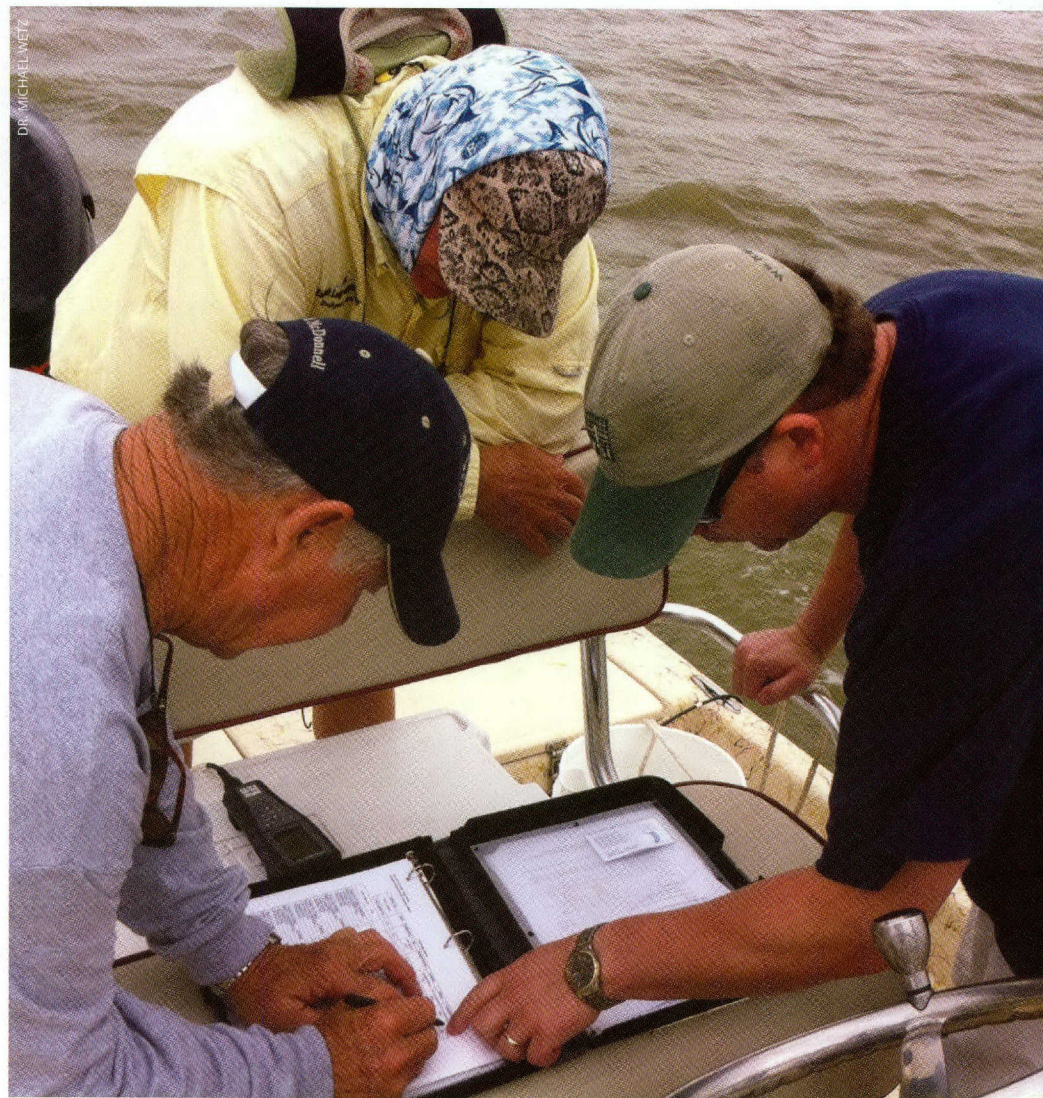
The study also revealed some unique qualities about Baffin Bay. “Unlike a

lot of the Gulf and East Coast estuaries, where these events happen mainly during the summer, it seems like in Baffin Bay it can happen year-round at just about any time,” says Wetz. “We’ve detected fairly significant hypoxic events as late as December and sometimes even into January.”

The program relied on a group of about 15 volunteers including recreational fishermen, business, and property owners, and other invested parties. This group would take two boats around the bay to collect samples and report data to TAMUCC researchers. Wetz recalls, “They were just a huge help to us and helped us get the data we needed to really figure out what was going on down there.”

Volunteers helped the water quality research go beyond the scope of routine sampling and helped researchers get a better picture of the overall health of the bay. For four years these volunteers committed their time and resources to collecting samples and proposing solutions for the area.

“Essentially, we utilized our own boats and our personal time to perform water quality sampling,” says Scott Murray, an active coastal conservationist and local stakeholder who helped the program. “I was just thankful to be able to do something positive for a unique Texas treasure like Baffin Bay: it is very special.”



Citizen scientists working in Baffin Bay



DR. MICHAEL WETZ

Citizen scientists testing water samples from Baffin Bay

A BRIGHTER FUTURE

In 2017, the research group took over sampling the bay, and the citizen scientists became part of a stakeholder group that contributes to planning processes and remains invested in the overall health of Baffin Bay. Now, members of the stakeholder group, which includes concerned citizens, volunteers, and Texas Sea Grant staff, help by increasing awareness of issues around the bay and proposing solutions.

“We want to develop both short-term and long-term solutions for the bay,” says Murray. “These solutions will address a broad range of issues in the watershed that currently negatively impact the bay.” Some of these solutions include creating a watershed protection plan for the bay and restoring habitats in areas that feed into it.

As for future developments in the bay, Wetz says he’s “cautiously optimistic” about the overall health of Baffin Bay. “I think that this is a real potential for Texas to

actually do whole ecosystem restoration on the coast for the first time. I don’t think we’ve ever done this anywhere else, and I think Baffin Bay has the potential to be that system where we do it.”

Murray shares Wetz’s guarded optimism, saying “there is a lot of interest and concern about the future of Baffin Bay, and that interest is translating into positive outcomes.”

Both Wetz and Murray emphasize the importance of increasing and maintaining community awareness of the issues around Baffin Bay. “I think one of the things that people don’t realize is that what they do upstream really does have an impact on the coast,” says Wetz.

Murray suggests that concerned citizens get involved by attending various meetings and taking active roles in helping develop practical solutions, saying “we look forward to getting more input in the future and more citizens involved.”



In 2019, Wetz was awarded the Research to Application Award from Texas Sea Grant for his

efforts with the water quality analysis program in Baffin Bay. The award is given to a Texas Sea Grant-funded researcher whose advocacy impacts the state, local, and federal levels, and it is clear why Wetz was considered. Since its start in 2013, this program has provided many insights about the general health of the bay and has shown how unique this bay is to the Texas coast.



HUNGRY FOR ANSWERS

Why were black drum starving in Baffin Bay?

BY SARA CARNEY • PHOTOGRAPHS BY DR. JENNIFER POLLACK

In South Texas there lies an estuary that is an underwater oasis for black drum. Baffin Bay has long supplied most of Texas' commercial black drum and is a hot spot for recreational fishers, who catch more than 1.3 million pounds of black drum per year from



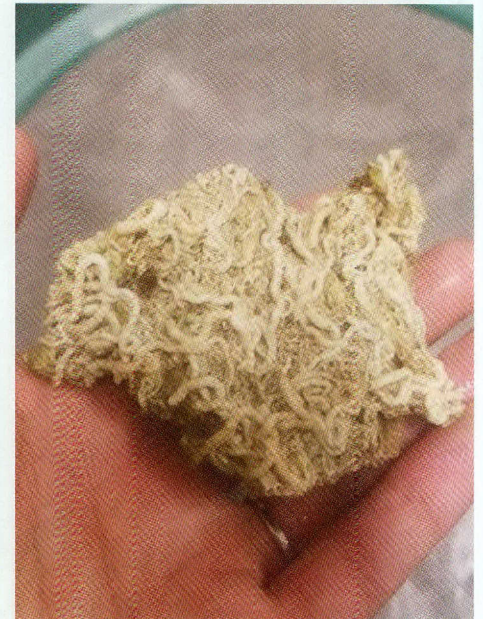
Baffin Bay, according to the Texas Parks and Wildlife Department. It's no wonder Baffin Bay has been described as the "jewel of black drum fishing." But in 2012, there was trouble in paradise.



The upper Laguna Madre ecosystem containing Baffin Bay



Dr. Jennifer Pollack holding a sample of Baffin Bay's benthos



A sample of the serpulid reef formation found in Baffin Bay

In the summer of 2012, recreational fishers in Baffin Bay began to catch small black drum with “jelly flesh” — translucent meat with a texture like gelatin. The fish were starving. Yet, nobody knew why. The mystery led researchers at Texas A&M University – Corpus Christi (TAMUCC) to investigate this important, yet poorly understood, black drum habitat.

“When something happens to the black drum in this system, it is quite disturbing because Baffin Bay is a haven for these fish,” says Dr. Jennifer Pollack, chair for Coastal Conservation and Restoration at TAMUCC’s Harte Research Institute (HRI).

PREY FOR CLUES

Fortunately, this conundrum happened at a time when many scientists were beginning to pull back the veil of mystery surrounding Baffin Bay. Scientists like Dr. Mike Wetz, chair for Coastal Ecosystem Processes at HRI, were beginning to study the most foundational aspects of Baffin Bay, namely the water quality.

Wetz’s work led Pollack and her colleagues to investigate the next link in the ecological chain: the black drums’ prey. “We wanted to connect what was going on with the water quality in the bay with the fish,” she says. “To do this, we looked to the benthos — small critters that live in the sediment

and form the prey base for the black drum.”

Baffin Bay is a peculiar place of extreme conditions. The bay has salinities that reach as high at 80 to 90 parts per thousand (ppt). For comparison, the salinity of the Gulf of Mexico is about 35 ppt. But, following a heavy rain or flood event, the salinity can drop all the way down to that of freshwater.

Despite knowing that such massive shifts in conditions occur, researchers didn’t know how these fluctuations affected the resident life of Baffin Bay. “We wanted to know: In these incredibly hot, salty, stressful conditions that change rapidly, could changes in the prey base play a role in these emaciation events?” Pollack says.

Some black drum prey, such as clams and crabs, live in unique reef structures within Baffin Bay. These habitats were created thousands of years ago by serpulid worms, which form calcareous tubes that contain calcium carbonate. Much like oyster reefs, the innermost scaffold is the oldest part of the reef, which younger generations continuously built onto, eventually creating a rich outer veneer of living organisms.

In comparing the organisms living in the mud bottom, sea grass, and serpulid reefs of Baffin Bay, Tasha Breaux, research associate in Pollack’s lab, discovered that the reefs were teeming with life. In fact,

there were hundreds more lifeforms on the reefs than in the mud bottoms. “Under a microscope, everywhere you look there is something moving and changing,” she says.

THE STRANGE EFFECTS OF SALINITY

After continued monitoring, Breaux and Pollack discovered that the community of organisms in Baffin Bay’s mud bottom habitats are sensitive to changes in salinity. As salinity increased, fewer prey were found in these areas, but when salinity decreased, there were more prey. While this finding was not surprising, what the researchers uncovered next was quite unexpected.

You’d be forgiven for thinking that a decrease in prey following high salinity conditions would cause black drum to venture beyond their normal hunting grounds to find other prey. Yet, the opposite is true.

Using stable isotope analysis, Breaux and Pollack were able to track down where black drum were getting their food from. What fish eat ends up leaving a chemical signature in their tissues, indicating whether black drum are eating prey from Baffin Bay or somewhere else. “As salinity increases in the bay, and we see reduced food resources, we also see a strange phenomenon where fish were staying in the bay more and feeding on the limited

resources,” Breaux says. “You might think ‘fish can swim and leave,’ but that’s not what they are doing.”

The high salinity events appear to create a stressful environment for the drum, in which it becomes more ideal for them to conserve their resources by staying put rather than venturing out. “Just trying to survive and move becomes more costly to them under high salinity conditions,” Breaux says, “so checking out a new area to forage for food could be more energetically costly. It’s almost like they hunker down.”

However, in lower, less stressful salinity conditions, black drum have the ability to venture out into the Laguna Madre to look for food despite the fact that there is plenty of local food within Baffin Bay.

If this still seems counterintuitive, imagine this scenario: It’s Friday evening. You’ve just got paid, and you want to go out to eat, even though you have a refrigerator full of food at home. You have a car and the money to go wherever you want for



Researchers with a black drum caught in Baffin Bay

measurements. So, we haven’t really been able to identify the trigger,” says Pollack.

a reference for when things drastically change.”

IN LOWER, LESS STRESSFUL SALINITY CONDITIONS, BLACK DRUM HAVE THE ABILITY TO VENTURE OUT INTO THE LAGUNA MADRE TO LOOK FOR FOOD DESPITE THE FACT THAT THERE IS PLENTY OF LOCAL FOOD WITHIN BAFFIN BAY.



dinner. Compare that to a few weeks later. You don’t have as much spending money, and it’s been a while since you’ve grabbed some groceries. Plus, your car is in the shop. Although you’ve only got some pre-packaged meals in the freezer, you opt for that because it just isn’t worth it to go out. This is a similar situation to the one black drum find themselves in.

These findings were also confirmed by Texas Sea Grant funded-researcher at HRI Dr. Greg Stunz, who used acoustic telemetry to track the black drum. With this technique the black drum could be seen moving around more as the salinity decreased.

THE CAUSE OF JELLY FLESH?

The challenge with identifying the true cause of the black drums jelly flesh in 2012 is that nobody was studying these conditions in Baffin Bay at the time. “We haven’t detected another emaciation event while we’ve been taking these

“The likelihood is that there are a lot of things happening at once to cause an emaciation event.”

However, the work of Pollack and Breaux indicates that changes in the salinity do affect black drums’ prey and ultimately alter their behavior.

“We certainly see during the period that we’ve been monitoring that salinity changes affect the prey base. So, we could speculate that, at really high salinities, you would see more extreme effects to the prey base that would cascade to the fish, but we have not directly observed that in the period we’ve been measuring,” Pollack says.

To know the cause for sure, a similar event will need to happen again. However next time researchers will be equipped with a better understanding of the bay. “Now we are constantly taking the pulse of Baffin Bay, and that’s important,” Pollack says. “You need to know what things look like during normal conditions so you can have

NEXT STEPS

Pollack and her lab are still working to understand what lies beneath the surface of Baffin Bay. Now they are turning their attention to the unique reef structures that provide a home to so many of Baffin Bay’s species.

Serpulid reefs in Baffin Bay are declining in size and distribution compared to historic levels, and it still remains undetermined if the reefs can be restored. With support from the Coastal Conservation Association, Pollack’s lab is working on better understanding how to conserve and restore the reefs. This may mean building new habitats for the reef-resident organisms or it may mean creating habitat that supports sportfishing away from the reefs, which are often hit by boat bottoms. But, this is only the beginning.

“It’s just the tip of the iceberg: understanding a unique habitat type, in a unique estuary that we know virtually nothing about.” Pollack says. “I think that the Baffin Bay research and monitoring program will sustain itself for a long time because there is so much to learn and because it’s such an exceptional system.”

BY SARA CARNEY AND KIMBER DE SALVO
PHOTOGRAPHS BY SETH PATTERSON

THE COAST IS YOUR

OYSTER



Texas oysters are known for their distinct flavor and are a favorite among locals and visitors alike. A popular food source for centuries, oyster harvesting in Texas even dates back to the Karankawa tribe of Native Americans. Today, whether they are fried or on the half shell, oysters are a cherished coastal culinary tradition.

Oysters provide a wealth of economic and environmental benefits. Annually, the oyster fishery is worth about \$20 million in Texas alone and about \$236 million nationwide. Oyster reefs are great habitats for fish, which not only means a healthier ecosystem, but also

ANNUALLY, THE OYSTER FISHERY IS WORTH ABOUT \$20 MILLION IN TEXAS

great fishing spots for recreational fishers. Other benefits of oysters and oyster reefs include shoreline protection and water filtration.

The mighty oyster isn't invincible. Droughts, flooding, hurricanes, and chemical spills are among the various pressures devastating the natural reefs and harming the fishery. Since 2010, Texas oyster landings have declined by 40 percent.

Although natural Texas oyster reefs have degraded, the demand for oysters in Texas remains high. This has caused some Texas restaurants to import oysters from other states, leaving some oyster enthusiasts disappointed.

However, there is hope. Rather than solely harvesting wild oysters, the time has come for Texans to grow their own. Texas is ushering a new industry: oyster mariculture.

A NO-BRAINER

In many ways oyster mariculture, or farming in coastal waters, resembles how oysters grow naturally. Farmed oysters will be grown in Texas bays and estuaries, a natural environment that provides necessary phytoplankton and nutrients for the oysters to grow.

To protect oysters from predators, farmers grow them in cages. Farmers periodically expose the oyster-filled cages to the air, mimicking the natural rise and fall of the tide on a wild reef. This technique prevents the attachment of unwanted animals or algae growing on their shells and cages.

Mariculture allows farmers to selectively breed oysters to be larger and of more consistent quality. And the days of only eating oysters in months ending in 'r' will be gone, because sterile oysters can be produced year-round when farmed.

"It is a win-win situation for everybody. Oysters are a no-brainer in terms of ecosystem services and benefit to the retail sector," says Dr. Joe Fox, chair of Marine Resource Development at the Harte Research Institute (HRI). "Every other coastal state in the nation does oyster mariculture and has been benefiting from it tremendously."

Mariculture doesn't compete with wild-caught oyster fisheries because these

SINCE 2010, TEXAS OYSTER LANDINGS HAVE DECLINED BY 40 PERCENT.

oysters are typically sold on the half shell — think raw oysters ordered at a restaurant — because mariculture can produce an oyster that is more consistent in shape, look, and taste. On the other hand, wild fisheries generally produce



TESTING THE WATERS

Legalizing oyster mariculture is only the first step. The next question is “will the oysters grow?” Water quality and suitability for oysters are just two of the factors influencing this decision. These questions are easier to answer thanks to the research of Dr. Jennifer Pollack, the chair for the Coastal Conservation and Restoration group at the Harte Research Institute.

Pollack’s lab spent years developing the Restoration Suitability Index, which evaluates the suitability of Texas coastal water conditions for restoring natural oyster reefs. Her team created a map to locate water conditions most suitable for oysters in bays along the Texas coastline.

“Conditions that best support restoration will translate to those that support oyster mariculture,” Pollack says, “If you don’t get that first step right in site location, the farm will be a failure.”

The index was originally designed for natural reefs, but little did Pollack know, the tool would also have applications to mariculture. Pollack was approached by Dr. Joe Fox to collaborate using her Restoration Suitability Index in a model that also includes user conflicts, such as locations of oil and gas pipelines and protected habitat areas, to predesignate the best areas for oyster mariculture on the Texas coast.

“We never would have dreamed in two years the Restoration Suitability Index would be used for mariculture,” Pollack says. “It’s great that this tool has this new life and now to know it can be used by even a larger constituency of interests.”

shucked oysters without the shell, because these catches produce more variation.

“The industry members are supportive, as mariculture will be complementary to and not in place of fishing,” says Dr. John Scarpa, associate professor at Texas A&M University – Corpus Christi. “We want to make it so oyster fishermen can continue to fish, so that together we can supply enough oysters locally, and there can be exports.”

Oyster mariculture also has the potential to help restore the natural reefs and slow down overfishing. When farmed oysters spawn, they release larvae into the water column that may disperse outside of the farm and settle on natural reefs. With an estimated global loss of 85 percent of natural oyster reefs, this ecosystem service could prove to be vital for Texas reef restoration.

Each cage, which is one square meter, can save about 10 square meters of wild oyster reefs harvested, according to Fox. “The main thing is the supply of oysters,” he says. “By supplying oysters through farming versus fishing, we have the potential to save a lot of reefs

**“THE INDUSTRY MEMBERS
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NOT IN PLACE OF FISHING,”**

– DR. JOHN SCARPA

from overfishing and destructive fishing practices.”

THE PULSE OF THE COAST

To legalize oyster mariculture in Texas, people from different sectors had to get onboard: everyone from local community members, to scientists and politicians, to oyster fishermen and other oyster fishery members, to restaurant owners.

Fox and his colleagues attended countless meetings in Austin and with the different fishing communities. Texas Sea Grant extension agents also jumped on board to help develop rapport with industry members and the public.

“One of the things that I like about Texas Sea Grant is that it’s local. Specialists

and extension agents are situated all over the coast. So, when talking to Texas Sea Grant people, you can really feel the pulse of the coast,” Fox says.

One of those early Texas Sea Grant visionaries was Bill Balboa, a retired extension agent and now executive director of the Matagorda Bay Foundation.

After enlisting some advice from some oyster experts, Balboa began to more seriously consider the possibility of bringing oyster mariculture to Texas, and he found the perfect place for it. An abandoned research lab in Palacios, which served as an aquaculture learning facility for Texas State Technical College in a previous life, was a prime candidate. The facility was complete with classrooms, offices, and lab space. “I thought someone should try to buy the facility because it would be the most awesome coastal facility ever,” Balboa says. “There’s no coastal research facilities on the Central Texas Coast, so this would be perfect.”

With a space identified, Balboa’s vision of oyster mariculture was coming together, so he convinced Fox and others to get

onboard. “When Bill Balboa was with Texas Sea Grant, he was one of the first people who got me thinking about oyster mariculture on the Texas coast,” Fox says.

After giving a tour of the facility by Balboa, Fox applied for a RESTORE grant from the National Oceanic and Atmospheric Administration (NOAA) to get the facility up and running. The grant was awarded to him, enabling the creation of the Texas Oyster Resource and Recovery Center, in partnership with Texas A&M AgriLife Research. The center will be primarily responsible for workforce development, while also providing oyster larvae to farms, partnering in research, working with industry, ensuring coastal conservation, and boosting environmental and economic resilience.

SPACE FOR RESEARCH

Maximizing the efficiency of a new industry means working hand-in-hand with researchers. One such researcher working on enhancing oyster mariculture in Texas is Scarpa, who has made a career of bivalve mariculture and knew early on that it was something he wanted for Texas.

Not long ago the Texas industry average was around 5 million pounds of oyster meat produced in a year. Scarpa and Fox pondered how many acres of mariculture it would take to return to this production. After some quick calculations, they estimated it would take about 2,000 acres — only a fraction of the over a million and a half acres of bay water in Texas.

Since those early conversations, Scarpa has received support from Texas Sea Grant, which “dovetails very well with building the Texas Oyster Restoration and Recovery Center,” as he puts it. His research is dedicated to developing ways to restore oyster stocks in places that don’t have enough oyster larvae. This would essentially “jump start” oyster reefs.

Texas Sea Grant will continue to actively partner with emerging oyster

**“THERE IS A NEW ERA OF
SEAFOOD PRODUCTION ON
THE TEXAS COAST.”**

– BILL BALBOA



mariculture efforts, providing continued extension and research support. “I think Texas Sea Grant can move this industry forward by funding research on spawning methodologies and research that helps the oyster industry become more self-sustaining,” Balboa says.

MOVING FORWARD

On May 27, 2019, Governor Greg Abbot signed House Bill 1300 and Senate Bill 682 legalizing oyster mariculture in Texas, making it the last coastal state in America to do so. The bill was championed by Speaker Dennis Bonnen and later Representative Todd Hunter and Senator Lois Kolkhorst.

The bill became law on Sept. 1, and the regulations will be developed over the following year. The legislation enables the Texas Parks and Wildlife Department (TPWD) to create and enforce regulations and guidelines for the industry, which are slated

to be enacted by March 2020, with oyster mariculture ready to begin in September.

Being the last coastal state to adopt oyster mariculture has advantages. Other states have established regulatory framework that Texas can use and modify to fit the needs of the Texas coast. To do so, Fox and Brad Lomax of Water Street Restaurants, Inc. in Corpus Christi were charged with heading up the Task Force to interface with TPWD in setting up the rules and regulations. Representatives from Texas Sea Grant, Coastal Conservation Association of Texas, industry, restaurateurs, local watermen, aquaculturists, and others were invited to have a seat at the table.

The goal of the taskforce is to advise on what regulations could facilitate industry prosperity and protect existing reefs and habitats. “It’s important to not make the rules so restrictive that they will squash industry growth, but we don’t want to make them so loose that they will allow for environmentally destructive practices. The trick is finding the happy medium,” Fox says.

Currently there are several projects in the works for oyster mariculture including the Palacios facility which will be operated by HRI and Texas A&M AgriLife Research and will raise oyster larvae for seeding on reefs. A second hatchery operated by Texas A&M AgriLife Research is also slated to open in Flour Bluff. To evaluate oyster cage culture, a research farm operated by HRI will soon start in Matagorda Bay that will house 180 oyster cages.

“There is a new era of seafood production on the Texas Coast,” Balboa says, “We have the opportunity to create a fishery that is brand new in Texas. This is an opportunity to bring regulators, academics, conservationists, watermen, fish farmers and other stakeholders to the same table to develop a regulatory framework that will minimize the potential for environmental impacts while maximizing ecosystem services and profitability.” ✓



Cooking Seafood

with TEXAS SEA GRANT

BY CALLIE RAINOSEK AND ANNETTE REDDELL HEGEN

Texas' seafood industry is a vital economic resource, contributing around \$175 million to the Texas economy. Additionally, eating the recommended amount of seafood (8 to 12 oz per day) has been shown to have significant health benefits.

John O'Connell, Texas Sea Grant extension agent for Brazoria County, promotes seafood consumption by hosting interactive cooking demonstrations for the public. These seafood demonstrations teach safe handling of seafood and the health benefits of eating seafood according to dietary guidelines. O'Connell has conducted demonstrations for as many as 50 people in auditoriums, event centers, culinary kitchens, and other venues.

"The fun part of doing the demonstrations is teaching people how to cook seafood," O'Connell says. "Many people don't eat seafood because they lack the basic knowledge of how it should be prepared. Once my audience members know more about preparation, many say they will increase the number of meals that include seafood as the main dish."

For Texas Sea Grant seafood recipes, visit tx.ag/HookedonSeafood.



FILLETS TOMATILLO

This is an adaptation of the recipe that was featured in the final cookoff in the first Texas Seafood Challenge for top Texas chefs.

- 2 pounds skinless fish fillets
- 2 tablespoons olive oil
- 2 cups chopped tomatillos
- ½ cup each chopped onion and celery
- ¼ cup chopped bell pepper
- 2 cloves chopped garlic
- 1 can (4 oz.) green chilies
- ½ teaspoon oregano
- ½ cup clam juice or fish stock
- 1 tablespoon chopped fresh cilantro juice from 1 lime
- ¼ teaspoon white pepper
- ¼ teaspoon cayenne pepper
- 1 teaspoon cumin
- salt to taste

In a saucepan, sauté tomatillos, onion, celery, bell pepper, and garlic in olive oil for 5 minutes. Cool mixture slightly and coarsely chop in blender or food processor. Return to saucepan and add all other ingredients except fish. Simmer for 15 minutes to reduce liquid. Bake fillets at 350 degrees for 10 minutes per inch of fish thickness. Place fish on heated platter and spoon sauce over top. Garnish with a tomato skin rose or as desired. This sauce is also delicious with broiled, grilled, or pan fried fish and shrimp. *Makes 4 servings.*

FISH TURBANS FLORENTINE

An eye-catching fillet recipe, rolled to envelop a savory spinach stuffing and topped with a creamy shrimp sauce. Use thin, lean fillets.

- 4 to 6 skinless fillets, 6 to 8 inches long
- 1 package (6½ oz.) seasoned bread croutons
- 1 package (10 oz.) frozen, chopped spinach, well drained
- ⅛ teaspoon salt
- ¼ cup melted margarine
- 1 beaten egg
- ¼ teaspoon thyme
- ⅛ teaspoon pepper
- pimiento for garnish
- Shrimp Sauce

Rinse fillets and pat dry. Place fillets, skinned side up, on a clean working surface. Sprinkle with salt and pepper. In a large mixing bowl, combine croutons, spinach, and remaining ingredients except pimiento and sauce. Place a portion of stuffing on each fillet. With thin end of fillet on top, skewer ends of fish together with wooden picks. Stand turbans on end

in lightly greased baking dish. Bake at 350 degrees for 20 to 25 minutes or until fish is opaque. Extra stuffing can be baked separately or used in another meal. To make SHRIMP SAUCE, combine one can (10 ½ oz.) cream of shrimp soup, ½ cup chopped shrimp and ¼ cup milk. Heat and pour over turbans. Garnish with pimiento strips. *Makes 4 to 6 servings.*

SHRIMP PUPPIES

Hush puppies never had it so good. Try this streamlined version with shrimp.

- 2 cups cooked and shredded shrimp**
- 2 packages (6 oz. each) jalapeño cornbread mix**
- 1 can (17 oz.) cream-style corn**
- ¼ cup chopped green onions and tops**
- 1 finely chopped, fresh jalapeño pepper oil for frying**

Shred cooked shrimp in a food processor or chop finely with a knife. In a large mixing bowl, combine all ingredients. Heat oil to 365 degrees. Drop mixture by heaping teaspoonfuls into hot oil. Deep fry until golden brown. Remove from oil and drain on absorbent paper. *Makes 5 dozen puppies.*

GOLDEN FRIED OYSTERS

A popular way to enjoy one of the bay's most treasured flavors.

- 24 fresh shucked oysters**
- 2 egg whites, 1 egg yolk**
- 2 tablespoons milk**
- 1 teaspoon seasoned salt**
- ¼ teaspoon black pepper**
- 1 cup yellow cornmeal**
- ½ cup flour**
- canola oil for frying**

Drain oysters. Combine eggs, milk and seasonings. Dip oysters in egg mixture and roll in dry mixture. Repeat process to form double breading. Heat oil to 365 degrees. Fry oysters 2 to 3 minutes until golden brown. *Makes 4 servings of 6 oysters each.*

CREAMY SHRIMP FETTUCCINE

Tender shrimp added to a Bechamel sauce laced with wine and dill and served over green fettuccine. Put candles on your table for this one!

- 1 pound peeled and deveined shrimp, 26-30 count or smaller**
- 5 tablespoons margarine**
- 1 tablespoon chopped onion**
- ¾ cup white wine**
- ½ teaspoon salt**
- 3 tablespoons flour**

- 1½ cups milk**
- 1½ teaspoons chopped fresh dill or ¾ teaspoon dried dill**
- 2 teaspoons lemon juice**
- spinach fettuccine**

In a saucepan, heat 2 tablespoons margarine. Add onions, shrimp, and wine and cook for 5 minutes. In a separate saucepan, melt the remaining margarine. Add the flour and stir until blended. Gradually add milk to the mixture, stirring vigorously until the sauce is thick and smooth. Add the sauce and dill to the shrimp mixture and simmer for 5 minutes. Serve over fettuccine. *Makes 4 servings.*

OYSTERS ROCKEFELLER

A classic named after John D. Rockefeller, this 1899 New Orleans recipe features oysters in a flavorful way.

- 1 pint large fresh oysters (approx. 18)**
- ¼ cup margarine or butter**
- ¼ cup chopped celery**
- ¼ cup chopped green onions including tops**
- 2 tablespoons chopped parsley**
- 1 package (10 oz.) frozen, chopped spinach, defrosted**
- 1 peeled garlic clove**
- ¼ teaspoon anisette (optional)**
- ¼ teaspoon salt**
- Rock salt**
- 18 oyster shells or ramekins**
- ¼ cup dry breadcrumbs**
- 1 tablespoon melted margarine or butter**

In small saucepan, sauté celery, onions and parsley in margarine until tender. In blender, combine sautéed vegetables, spinach, garlic, lemon juice, anisette and salt. Blend until almost pureed. When necessary, stop blender and push vegetables into blades. Fill a shallow, oven-proof serving dish with rock salt. Nest oyster shells into salt bed which holds shells in place and keeps oysters hot. Place the oysters in the shells. Top each oyster with spinach mixture. Combine breadcrumbs and melted margarine, and sprinkle crumb mixture over oysters. Bake at 450 degrees for 10 minutes. Serve immediately. *Makes 6 appetizer servings of 3 oysters each.*

BLUE CRAB STUFFING

A spicy stuffing full of tender, sweet claw meat is impressive when served in ramekins or natural shells or as a casserole.

- 1 pound blue crab claw meat**
- ½ cup finely chopped onion**
- ½ cup finely chopped celery**

- ¼ cup finely chopped bell pepper**
- 1 clove minced garlic**
- 2 tablespoons chopped fresh parsley**
- 2 cups crushed butter cracker crumbs**
- 1 teaspoon dry mustard**
- ¼ teaspoon salt**
- dash of cayenne pepper**
- 1 beaten egg**
- ¼ cup milk**
- ½ cup melted margarine**
- 1 teaspoon Worcestershire sauce**

Place crab meat in large mixing bowl. Pick through to remove any remaining shell and cartilage. Stir in vegetables and dry ingredients. Add remaining ingredients and mix thoroughly. Place mixture into shells or casserole dish and bake at 350 degrees for 20 minutes or until golden brown on top and hot throughout. *Makes 6 to 8 servings.*

CRABMEAT STUFFED JALAPEÑOS

You will love these hot and savory peppers as an appetizer or as an accompaniment to a great meal. Use fresh peppers if you prefer.

- 1 pound flaked blue crab meat**
- 1 can (1 pound 11 oz.) jalapeño peppers**
- 2 tablespoons each, finely chopped green pepper, onions, and dill pickle**
- ¼ cup cracker meal**
- 1 beaten egg**
- ¼ teaspoon salt**
- ¼ teaspoon black pepper**
- ⅛ teaspoon cayenne pepper**
- 1 clove minced garlic**
- ¼ cup milk**
- Breading Mixture**

Cut peppers in half lengthwise. Discard pulp and seeds and rinse carefully. In a large mixing bowl, combine remaining ingredients except breading mixture. Stuff pepper halves with crab mixture and press stuffing around pepper. Set peppers aside. To prepare BREADING MIXTURE, place 2 cups cracker meal in a flat pan. In a separate pan, mix 1 cup milk, 2 eggs, and ¼ teaspoon each salt and pepper. Dip peppers in egg mixture, then in cracker meal. Repeat procedure. Deep fry at 365 degrees until golden brown. Drain on absorbent paper. *Makes 30 hors d'oeuvres.*

IN THE SHADOW OF THE STORM:

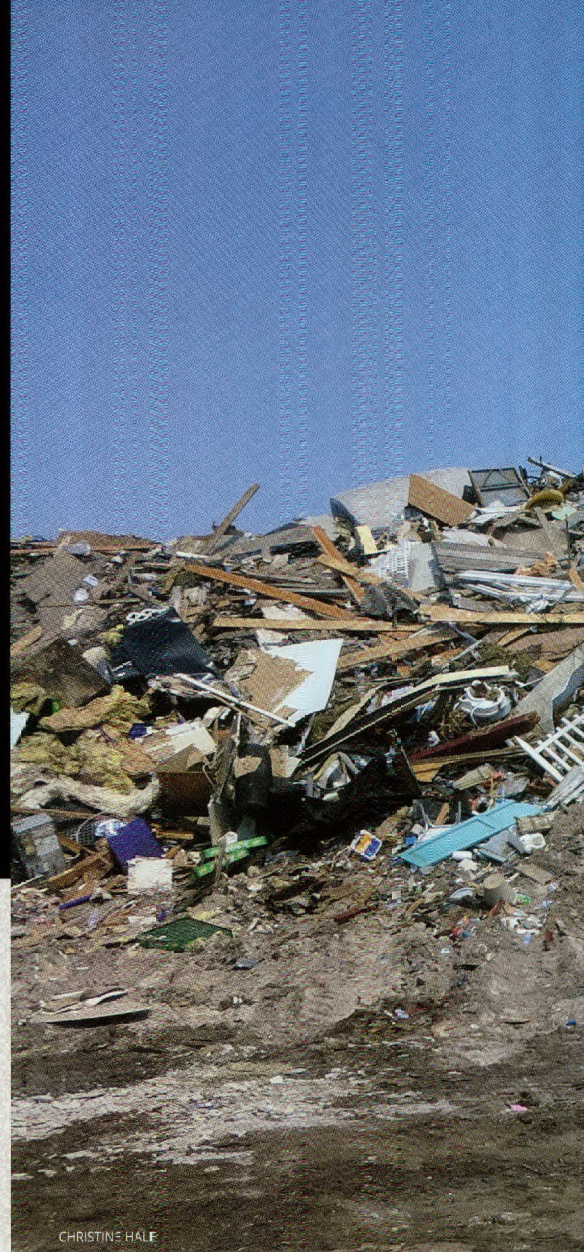
REBUILDING ROCKPORT

BY SARA CARNEY

ON AUGUST 25, 2017, residents of Rockport held their breath as Hurricane Harvey breached the coast, and its eye passed directly over their homes. The initial impact of the Category 4 hurricane was broadcast around the nation. But, over the following days and weeks the realities of the devastation began to sink in. When the media crews packed up their cameras and the aftermath of Harvey began to fade from the nation's consciousness, the people of Rockport continued rebuilding.

Rebuilding doesn't simply mean repairing buildings and removing debris — though that is essential. It also entails planning. A well-prepared city adapts as the city evolves, and plans encompass housing, economics, transportation, land use, and much more. The idea is that when the next storm hits, the community will be more prepared and resilient, and recovery will happen more quickly and efficiently.

Planning specialists with the Community Resilience Collaborative (CRC), a partnership between Texas Sea Grant and Texas Target Communities (TxTC), offered their expertise to the communities of Rockport to jump start the recovery and planning process.



CHRISTINE HALE

HARVEY HITS HOME

When Harvey hit Rockport, many residents had been coasting on their past luck. The last major storm to impact Rockport was Celia in 1970, leaving many residents confident that they would be spared this time.

“Because the Coastal Bend hadn't been hit by a hurricane in decades, people were complacent,” says City of Rockport Community Planner Amanda Torres. “We always talked about it, and we always said ‘This might be the season,’ then we all chuckled to ourselves because we had gotten away with it for so long. But, it finally caught up with us and hit us and Port Aransas directly.”

Initially Harvey didn't look so intimidating, but as the storm grew



The resulting damages Harvey caused to Rockport are estimated at about \$812 million for residents and \$134 million for businesses.

closer, the threat became more apparent. “Harvey totally caught us off guard,” Torres says. “At the beginning of that week it was just a little depression — barely a blip on the radar. Literally within 24 hours it became a bona fide hurricane, and the following day we called for a mandatory evacuation of the county.”

While Harvey pummeled Rockport and surrounding areas, residents feared the worst. Torres recalls wondering if she would have a home to come back to. However, she and other city officials knew they would have their work cut out for them as soon as they returned.

Unlike Houston, where flooding was infamous, the wind shook Rockport the hardest. Wind speeds upwards of

130 mph tore through the town for 12 hours straight. The resulting damages are estimated to be around \$812 million for residents and \$134 million for businesses.

For many communities across the coast, city offices consist of small teams, and normal activities are enough to keep them busy. Adding a disaster to the mix can create chaos. Permits need to be assigned, debris removed, contractors coordinated, inspections completed, and that’s just the short-term needs. Beyond that, recovery can take years.

“I don’t think a lot of people understand how long it takes,” says Kate de Genarro, planning specialist with Texas Sea Grant. “They think you just clean off the roads and rebuild their houses, and

then we’re back to normal. That’s not true.”

THE TEXAS SEA GRANT CONNECTION

Luckily for communities like Rockport, there is help. In winter 2017, Aransas County (which includes Rockport, Fulton, and parts of Aransas Pass) began to collaborate with planning specialists from Texas Sea Grant on a Long-Term Recovery Plan.

Texas Sea Grant was responsible for researching pre-Harvey conditions to help with decision-making during the planning process. Additionally, Texas Sea Grant helped keep up with all the progress being made by many different groups by compiling and summarizing all ongoing efforts into a

single document. The planners worked concurrently with Aransas County officials while parts of the plan were being implemented.

“The whole time we were writing the plan, the city was implementing parts of it,” says de Gennaro. “Some parts can

be done right away, like debris removal. You don’t have to wait until the plan is done to get started.”

The connection between Rockport and Texas Sea Grant has spanned decades, through long-held collaborations with the program’s extension agents. For de Gennaro this project was a return to a community near and dear to her;

she began working with Rockport as a graduate student at Texas Sea Grant on a floodplain management plan.

“On a personal, emotional level, when Harvey happened I was concerned about the Rockport community because I know them personally,” de Gennaro says. “I was already invested in the community.”

BEYOND RECOVERY, BECOMING RESILIENT

Recovering from Harvey is simply one component of a much larger effort to make Rockport more resilient well into the future. Every year, TxTC offers assistance to low-capacity communities for planning projects. Rockport applied and was selected to receive help with a Comprehensive Plan.

The Comprehensive Plan is designed to help Rockport plan for the next 20 years and provide a vision and goals for the community to follow. “This is a long-range planning guidebook that will help guide development over the next 20 to 30 years,” says Jeewasmi Thapa, program coordinator with TxTC. “Rockport has many assets already. One of the exciting

parts of the plan is utilizing these assets and thinking of mitigation approaches such as conserving wetlands, while still developing resiliently and preserving the coastal charm of Rockport.”

Torres echoed this sentiment, stating, “Even though we’ve been hit with a disaster, that disaster brought a lot of opportunities. I think the Comprehensive Plan is giving the community an opportunity to decide how we want to grow.”

Throughout the year, members of the CRC helped introduce and guide residents through the planning process. The CRC coordinated important services including aid from experts from universities and the American Planning Association, and leadership workshops hosted by The Texas Rural Leadership Program.

The experience also provided students an opportunity to learn first-hand about recovery and long-term planning, with a total of seven university classes contributing to the Comprehensive Plan. This includes work from the Texas A&M Department of Landscape Architecture and Urban Planning and the Texas A&M School of Law.

Students at Texas Tech University created and proposed ideas to the city on green infrastructure and low-impact development. Additionally, Texas A&M University – Corpus Christi Master of Public Administration students surveyed high school students on what changes they would like to see to their community, with several suggestions making it into the Comprehensive Plan.

This large selection of expert opinions was a welcome resource in Rockport. “To think, we’re just a little town on the Texas coast, and we have all this brain power focused on how we can be better. It’s been awesome!” says Torres.

TAKEN TO TASK FORCE

Although the help of experts and students was a great resource to Rockport, the most important voices in the planning process were the residents. From the beginning of the process, the community’s voice provided a foundation for the plan. Planners like de Gennaro emphasized the significance of including the community to avoid making life-changing decisions without community input.

To ensure that the community’s voice was kept central in generating the plan,

“Even though we’ve been hit with a disaster, that disaster brought a lot of opportunities. I think the Comprehensive Plan is giving the community an opportunity to decide how we want to grow.”

Amanda Torres, Rockport community planner



Amanda Torres (left) and Jeewasmi Thapa (right) brainstorming with Rockport residents for the Comprehensive Plan

TEXAS SEA GRANT

a task force was developed. The goal was not only to get input from community leaders, but to hear from those traditionally not part of the planning process. Through public outreach, city officials and planning specialists requested that members of the public to serve on the task force.

“The members of the task force were the conduits for providing information from the community,” Thapa says. “They garnered valuable input to inform the plan while also encouraging other community members to participate.”

The task force was a melding of minds. It included many different residents from an array of backgrounds, including people with interests in construction, preservation, the economy, and the environment. This brought about opportunities for individuals who don’t normally interact together to brainstorm.

“It’s a small town. There’s coastal charm, beautiful oak trees, a lush wetland environment, birds, access to the ocean and fishing...”

Chris Hale, Rockport resident.

she quickly learned just how valuable her insight would be as a private citizen.

“There were frank and open discussions that I was happy to be part of about the reality of what the communities in Rockport need,” Hale says.

Although there was a diversity of participants in the task force, what united all the participants was a love for their city. “It’s a small town. There’s coastal charm, beautiful oak trees, a lush wetland environment, birds, access to the ocean and fishing. All of those things were identified at the task force meetings as being why Rockport is so special and what we need to preserve going forward,” Hale says.

COMMUNITY RESILIENCE COLLABORATIVE

The Community Resilience Collaborative (CRC) is a research- and extension-based coastal planning program that combines Texas Sea Grant and Texas Target Communities (TxTC). The CRC provides technical assistance for planning, outreach, and education for coastal communities, with priority given to low-capacity, low-resource and/or underrepresented communities. The CRC also funds small grants for community resilience research and facilitates service-learning opportunities for faculty and students. Learn more at texasseagrant.org/programs/crc.



TEXAS TARGET COMMUNITIES



For many, the act of getting together was as important as the decisions made. “The goal of the plan is not just to have this document at the end but to bring all these people together — people from different walks of life — have them all sit at the table and get them to voice what they like about the community or changes that they need,” de Gennaro says. “They can come to this vision of community that has a place for everyone.”

AN OPPORTUNITY TO GROW

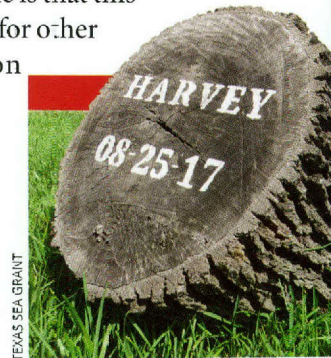
The task force held its final meeting in June 2019. This process was followed by an additional layer of evaluation to ensure the Comprehensive Plan was complementary to existing plans and that all plans promote resilience in an integrated way.

To do this Matt Malecha, a research associate at Texas Sea Grant, worked with city staff to apply the Plan Integration for Resilience Scorecard (PIRS), an analytical method developed at the Texas A&M Institute for Sustainable Communities designed to reduce a community’s vulnerability to hazards by cross-referencing various planning documents. The process then generates recommendations for the community to consider.

According to Malecha, the PIRS process “can enhance community resilience by helping align planning efforts and integrating hazard mitigation throughout a community’s ‘network of plans’ — the collection of documents that guide its development and management.”

The efforts in Rockport are already being recognized. In November 2019, the American Planning Association’s Texas Chapter presented the City of Rockport with the 2019 Resilience Planning Achievement Award – Silver for its exceptional planning work, a much-appreciated confirmation of the community’s hard work.

For planners such as Torres, the plan brings hope even beyond Rockport. The process has the potential to be used as a blueprint for other communities. “The exciting part to me is that this could be a model for other communities on the Texas coast. I’m excited to see how we can impact other communities and encourage them to become resilient too.”



TEXAS SEA GRANT



GRASSROOTS EFFORTS

Texas Sea Grant and Texas A&M – Corpus Christi students worked with Texas Master Naturalists and county government to remove invasive plants from Rockport habitats

BY DAMOND BENNINGFIELD

As an environmental science major at Texas A&M University – Corpus Christi (TAMUCC), Yvonne Sheasby says she’s learned that “issues concerning Earth’s ecosystems are of utmost importance right now.” When the senior from Houston had the chance to help the environment herself, she couldn’t wait to get started.

Under the guidance of Texas Sea Grant, Texas Master Naturalists, and Aransas County, Sheasby and two other students participated in habitat restoration and enhancement project in the summer of 2019. The team helped remove invasive species from hurricane-damaged properties in Rockport, planted pollinator habitats for local birds and butterflies, and learned techniques for assessing the health of coastal habitats.

The internship was initiated collaboratively to help Aransas County restore some native lands damaged by Hurricane Harvey, which

roared ashore in August 2017. The hurricane caused an estimated \$1 billion in damages in Rockport, which is about 35 miles northeast of Corpus Christi, and the rest of Aransas County. The storm destroyed city hall and the county courthouse, causing major damage to more than a third of the county’s structures.

Harvey also left the county without volunteer and resource support or the funding to hire people to cleanup and maintain these properties, an important component of the county’s ecotourism.

In 2010, the county had established Aransas Pathways, a project designed to attract birdwatchers, hikers, kayakers, and others interested in the outdoors. The project unites 18 birding sites in and around Rockport, including several natural areas that are important habitat for migrating birds.

“We get folks from all over the country and as far as Europe,” says John Strothman,

who heads Aransas Pathways and leads the county’s long-term recovery effort. “With Aransas National Wildlife Refuge just down the street, people might come to see the whooping cranes but stay a couple of days to see other habitats.”

The list of Pathways sites includes the Linda S. Castro Nature Sanctuary, a four-acre plot near the county airport, and Ivy Lane, a 28-acre site on Rockport’s northeastern flank. Both are classified as live oak/red bay communities with extensive networks of smaller trees, shrubs, and grasses. They also both include coastal prairie habitat and pollinator habitats

“We’ve cataloged something like 228 plant species growing just in Linda Castro,” says Kris Kirkwood, a member of Texas Master Naturalists, a group that helps maintain natural sites around the state. “That’s some serious biodiversity. And the more biodiversity you have in the plants, the more

you have in birds and other wildlife.” Birders have recorded 234 species in the park, with about half of them showing up at Ivy Lane.

Before Harvey, both sites were having problems with invasive grass species, especially Guinea grass and St. Augustine. “Guinea grass was already in the area and getting worse every year,” Kirkwood says. “It’s growing in everybody’s pastures, and it’s not being fought. When those seed heads work loose, they roll along like tumbleweeds in the wind.”

And Harvey provided plenty of wind. It damaged trees and the undergrowth in the natural areas and blew in more invasive species’ seeds. And with less canopy from the trees there was more sunlight to invigorate the invaders, which quickly expanded their territory.

With a reduced tax base, though, Aransas County had no money to spend to combat the invasive species. “After the hurricane, most of our volunteers were gone,” Strothman says. “We were thinking of ways to bring our sites back, get them cleaned up, and get our native plant program back on track.”

When Texas Sea Grant Natural Resources Specialist Morgen Ayres heard about the problem, she seized the opportunity to work with TAMUCC to develop an internship project.

The goal was to have consistent habitat management efforts on sites with high needs and lower resource capability. “This internship promoted natural resource stewardship as well as ecotourism to support a community recovering from Hurricane Harvey, and the project provided some real-world experience in habitat management for the students in a manner that led them to understand ecosystem value more economically,” Ayres says. “The work consisted of very intensive manual labor — by hand, by shovels, by rakes — using just about all your strength to pull some of the larger clumps of Guinea grass”

Three students were selected for the project. From June through August 2019, they spent about 16 hours per week working at the two sites. They worked four mornings per week, stopping around noon to avoid the draining afternoon heat.

The students were guided by Kirkwood and her husband, Ray, who helped the students identify different species of plants and learn how to conduct a site survey and record their findings, with assistance from Texas Sea Grant.

“Learning to identify all of these different plants was pretty awesome,” says Liliana Cantu, a TAMUCC student who graduated in the summer of 2019.

The students’ main job, though, was to remove the invasive grasses, which they hauled off by the truckload. The invading grasses grow in big clumps or in long runners, so it takes time and effort to pull them out. “The Guinea grass was just growing over and choking out everything else,” says Carinne Johnston, a senior. “The sites were not in very good shape.”

The group planted gardens of pollinator plants, which attract butterflies and hummingbirds, and enhanced pathways to provide easier access to the sites’ interiors. The interns and Texas Sea Grant also potted seeds of both live oak and red bay tree species for a separate project led by Ray Kirkwood.

“One of the lessons we learned was how to care for the plants after you put the seeds in the ground,” Sheasby says. “Not all plants require a ton of sunlight — some like it in the shade. Some don’t need as much water as others. It’s crucial to understand those differences.”

“I felt we were doing some good just by teaching them,” Kirkwood says. “They were really interested, and they did great work. I’d do it again in a heartbeat.”

Although neither site is back to its pre-hurricane condition, the students “made a huge difference,” Strothman says. “Having these young ladies was a godsend — it was a blessing for us.”

The project continued through the fall, with Sheasby and Johnston hired on as Texas Sea Grant interns. They visited the Aransas County sites every other week to monitor their status and, when needed, pulled more invasive grass.

The team also planted native species in areas where dense populations of invasive grasses were cleared. “There’s always work to be done,” Kirkwood says. “It’s a never-ending battle.”



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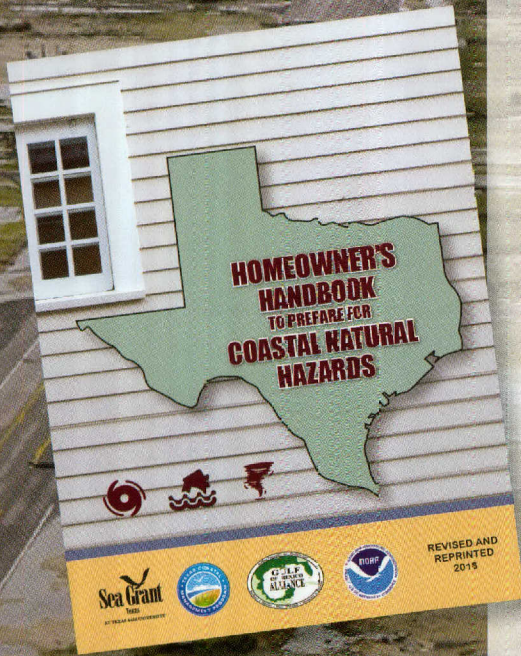
MORGEN AYRES

Top: (Left to right) Carinne Johnston, Morgen Ayres, Liliana Cantu, and Yvonne Sheasby at Linda S. Castro Nature Sanctuary Bottom Left: (Left to right) Kris Kirkwood, Yvonne Sheasby, Liliana Cantu, Carinne Johnston, Morgen Ayres, and Ray Kirkwood. Right: Kris Kirkwood showing students how to identify plant species at Ivy Lane



Now Online at HazardsHandbook.com

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Since Hurricane Harvey, Texas Sea Grant staff have distributed over 8,000 copies of the Texas Homeowner's Handbooks!

This handbook was created to help Texans prepare for natural hazards and help them reduce the risks to lives and property. Although it is never possible to eliminate all risk from a natural hazard, homeowners can take action and implement many small and cost-effective steps that could significantly lower their risk and exposure to those hazards.

This handbook discusses:

- Basic information on hurricanes, tornadoes, and flooding
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- Insurance resources if storm damage occurs
- Help on evacuation planning
- How to protect family members
- A list of essential emergency supplies

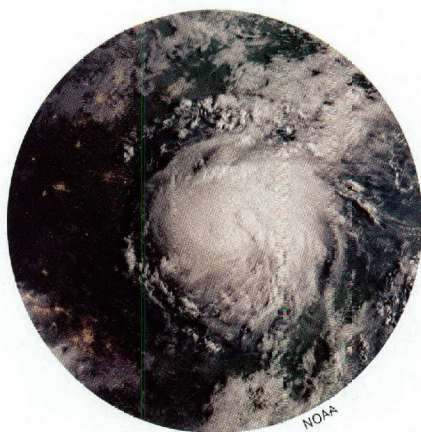
For a printed version email sgpublications@seagrants.tamu.edu or call 979-845-3854



Building Legal Capacity:

Addressing the legal concerns of coastal Texans

BY SARA CARNEY



Law students in Rockport for capstone project

Before August 2017, a plan was brewing between Texas Sea Grant and Texas Target Communities to help coastal communities with little or no planning capacity deal with disasters, such as a hurricane. Like a chemical reaction waiting to take place, the environmental conditions became ripe for reaction. The catalyst was Harvey, and the product was the Community Resilience Collaborative (CRC): a team of professional planners, extension agents, faculty affiliates, and state and federal program partners.

The physical damage and disarray left by a storm is mirrored by the myriad of questions from storm survivors. While the CRC was successful in providing communities expertise to increase their resilience to future disasters and changes, one aspect that was lacking was legal expertise. Enter Texas A&M University School of Law.

Through a partnership with the Texas A&M School of Law, the Sea Grant National Law Center, and the CRC, Texas Sea Grant is taking the first steps to address the legal questions of coastal communities affected by natural disasters. The partnership unites wide-ranging expertise to tackle the challenge.

The goal is to provide the CRC with the capacity to provide relevant legal and policy outreach materials that will aid long-term recovery planning.

It's important to understand what a community needs before providing any legal information. Thus, Texas Sea Grant launched a survey of

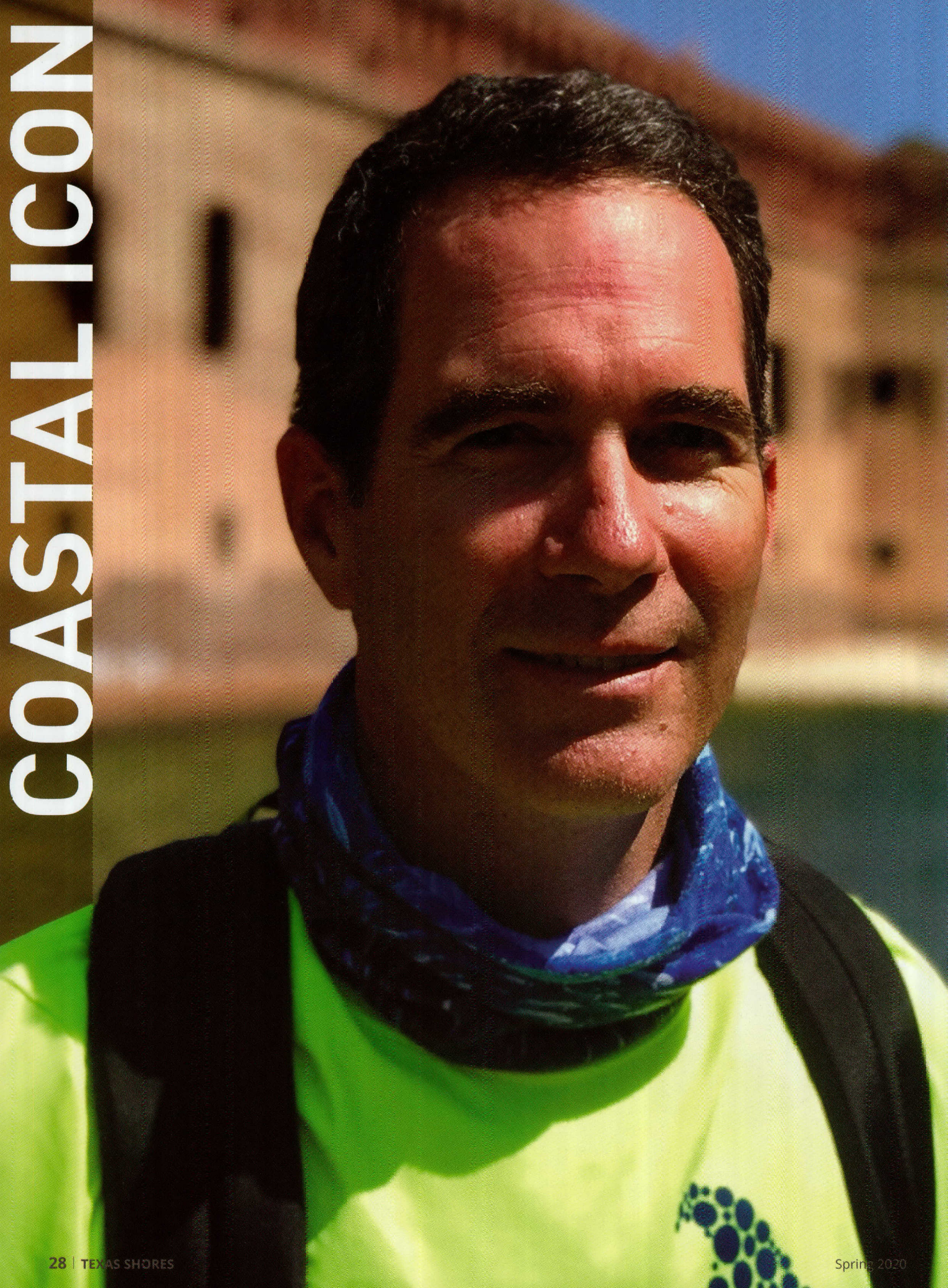
community leaders, managers, and planners to better identify communities' particular needs and what information would be useful. Texas Sea Grant received guidance from lawyers and faculty at the Texas A&M School of Law in developing and executing the questions.

"This grant from the Sea Grant Law Center is providing Texas Sea Grant with critical support to work in partnership with the Texas A&M School of Law to better understand the legal needs in our coastal communities and expand our capacity to better serve them in the future," says Dr. Pamela T. Plotkin, director of Texas Sea Grant.

The project is also enlisting the aid of law students, providing them with a fellowship program that will include real-world training in coastal, environmental, and planning law. This partnership is particularly ideal because of the school's program in Natural Resource Systems.

"Building legal capacity within the CRC, while at the same time training law students in environmental and planning law will strengthen Texas' ability to respond to and recover from future weather-related hazards," says Richard McLaughlin, chair and professor of coastal and marine policy law at the Texas A&M University – Corpus Christi Harte Research Institute.

Following the survey, the project will lead to the formation of a Texas Sea Grant Legal Advisory Committee to develop legal informational materials for coastal Texans. ✓



COASTAL ICON

JACE TUNNELL



FATHER, SCIENTIST, CONSERVATIONIST, AND NURDLE ENTHUSIAST

BY CALLIE RAINOSEK • PHOTOGRAPHS BY JACE TUNNELL

Jace Tunnell goes to the beach. A lot.

But many times he's not there to swim, build sandcastles, or fish — he's hunting for something: tiny, plastic pellets that have invaded Texas beaches.

These tiny pellets, called nurdles, are the building blocks of nearly everything plastic. They are melted down and molded into desirable plastic goods, including single-use plastics, such as water bottles, grocery bags, utensils, and straws.

In today's world, life without plastic is difficult to imagine. Besides single-use plastics that Americans use daily, plastic has made its way into computers, vehicles, and even into the medical field. There's no doubt about it — plastic is a miracle product — and nurdles are its precursor.

Despite the fact that nurdles have been reported on beaches and in the stomachs of wildlife since the early 1970s, nurdles have escaped public attention as a contributing factor to the plastic pollution crisis, until now. Tunnell is bringing nurdles into the spotlight, and he has a sea of supporters.

As director of the Mission-Aransas National Estuarine Research Reserve at The University of Texas at Austin Marine Science Institute (UTMSI) in Port Aransas, Texas, Tunnell is working to increase awareness of nurdle pollution and give that information to regulators to help address nurdle spills that have already polluted

beaches. Specifically, he hopes that his efforts will lead to regulation to reduce pellet-loss during production, transportation, and distribution.

“My goal isn't to point fingers at and blame plastic production companies,” Tunnell says. Rather, Tunnell focuses on the “big picture.” He gathers and analyzes data on nurdle pollution throughout the Gulf of Mexico and reports this information to regulators, such as the Environmental Protection Agency or the Texas Commission on Environmental Quality (TCEQ), which can investigate and create new legislation to handle these pesky plastic pellets.

THE NURDLE PATROL IS BORN

Before Tunnell started making waves in nurdle pollution, one day in September 2018, he and his wife, Kathryn, saw what Tunnell estimates to be millions of nurdles spanning miles down North Padre Island's beaches. He examined the pellets in the palm of his hand and determined that they were indeed tiny pieces of plastic. Before that fateful day in September, he had never seen a nurdle in person. Since then, he has attracted international attention for his efforts.

At the time, Tunnell's nine-year-old daughter, Parker, was searching for a topic for her school science project. Tunnell thought estimating the amount of nurdles on Padre Island and Mustang Island beaches could be a good fit. Thus, the Nurdle Patrol project was born.

With the help of her dad, Parker recruited a few volunteers to help her survey nurdles. The nurdle patrollers reported to Parker how many nurdles they found on the beach during a 10-minute timespan. Based on this data, she estimated that there could be 300,000 to 1 million nurdles per kilometer on the beach, which Tunnell describes as “disturbing.”

Parker’s science project advanced to a regional competition, where she placed third. Although the science project competition was over, the Nurdle Patrol never really ended for Tunnell. He knew that something needed to be done to prevent these unwanted plastic guests from polluting the beaches he grew up on and now took his family to.

“My kids are going out and picking up plastic pellets on the beach instead of seashells,” Tunnell says. “That’s a wake up call.”

A WEB OF NURDLE PATROLLERS

In the midst of helping Parker with her science project, Tunnell contacted TCEQ and reported the alarming number of nurdles on the beach. TCEQ responded by taking samples. They reported that there was likely a spill of nurdles off shore, and they had never dealt with a case of nurdle pollution like this before.

“My thinking was that we needed to find out who made these at the very least,” Tunnell said. “And if we couldn’t do that, at least monitor the problem. How far have these spread? Are they all over Texas? We had no idea.”

In response, Tunnell traveled to Austin where he presented the nurdle spill problem to several regulatory agencies, including the Texas Water Development Board, the Texas General Land Office (Oil Spill Division), the Texas Parks & Wildlife Department and the U.S. Fish and Wildlife Service. They discussed what had happened with the nurdle spill, what they were going to do to prevent future spills, and who had what role in managing and preventing the problem. Ultimately, Tunnell’s presentation

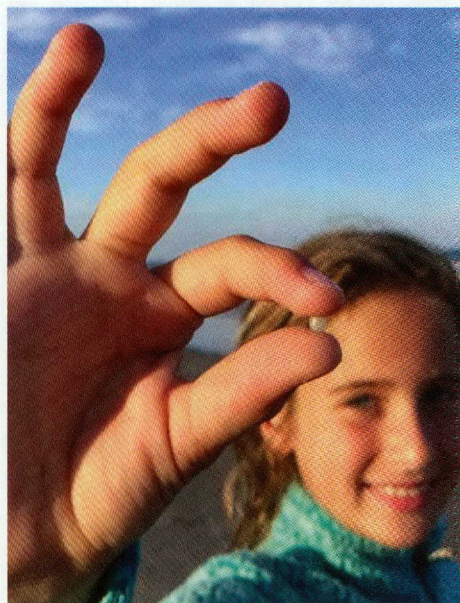
spurred new initiatives for nurdle spill responses.

“There’s specified roles for these agencies when there’s an oil spill, but there isn’t when there’s a spill of nurdles,” Tunnell says.

To justify new regulations to prevent future nurdle spills, evidence of nurdle pollution was needed. However, limited data had previously been gathered on nurdle pollution in the Gulf of Mexico.

“My kids are going out and picking up plastic pellets on the beach instead of seashells.”

— JACE TUNNELL



In response to this need to gather data, Tunnell turned to Facebook in November 2018 to recruit citizen scientists to help him count nurdles. He had never guessed that the Nurdle Patrol would go international.

“I thought there was just going to be two or three people that said, ‘Oh yeah, I’ll help out,’” Tunnell says. “But social media is like a spider web, and we recruited people from almost every state in the Gulf and in Mexico.”

Since then, the Nurdle Patrol Facebook page has gathered almost 1,500 members with 500 of those members actively surveying nurdles for the Nurdle Patrol as of July 2019. Over 1,800 surveys have been done at over 1,000 sites across the Gulf of Mexico spanning from Mahahual, Mexico to Key West, Florida. About 120,000 nurdles have been removed from beaches, with some Nurdle Patrollers finding over 1,000 nurdles per minute near plastic manufacturers in Texas, further highlighting the need for regulations against nurdle spills during production, transportation, and distribution.

Tunnell records and maps nurdle surveys done by the Nurdle Patrol and sends this data to regulatory agencies so they can use this data as justification for strengthening their regulations. The Nurdle Patrol’s data has also justified international research projects on plastic pollution that will hopefully help build a more environmentally healthy future.

NURDLE MAYHEM

When Tunnell examined his first nurdle in the palm of his hand that September day, there was more on his mind than Parker’s science project or what agency to contact about cleaning up the nurdle spill. As a scientist and the son of a marine biologist, Tunnell knew that these pellets were a threat to wildlife.

Tunnell contacted Alicia Walker, the outreach program coordinator at the Amos Rehabilitation Keep (ARK) at UTMSI. Knowing that plastic pollution was already a huge threat to the sea turtles, marine birds, and birds of prey that are rescued and rehabilitated at the ARK, Walker began looking for the effects of nurdles on her patients.

“It’s hard to detect though because nurdles are so small,” Walker says. However, she added that plastic is often passed through the digestive system or found in their gut of rescued animals at the ARK all the time, with balloons, trash bags, and hard plastics being the main culprits.

About 120,000 nurdles have been removed from beaches, with some Nurdle Patrollers finding over 1,000 nurdles per minute near plastic manufacturers in Texas.

“There is a reason to believe that nurdles could have an impact too,” Walker says.

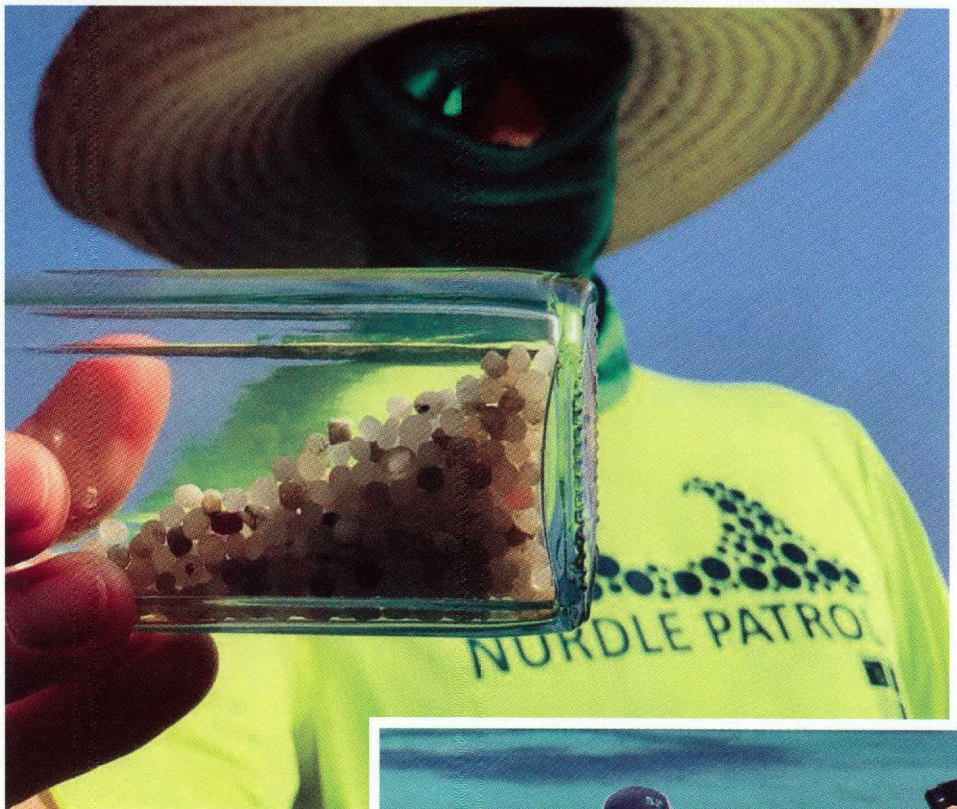
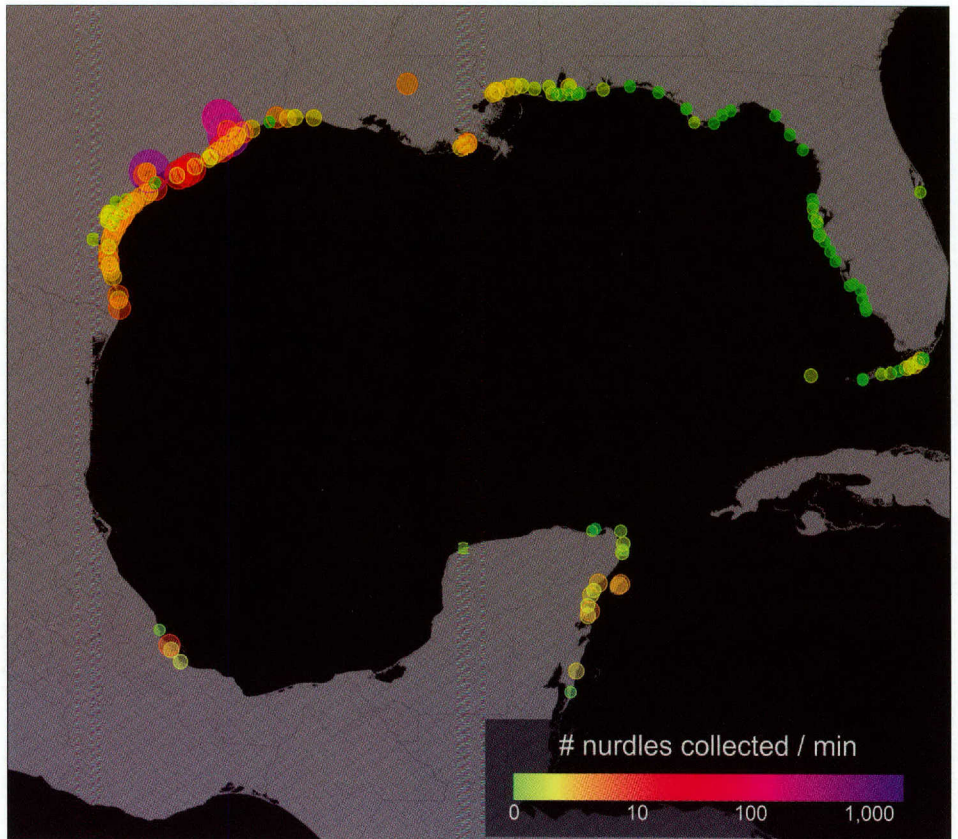
For example, Walker is particularly concerned about hatchling sea turtles consuming nurdles while they “hide out” in sargassum, a type of seaweed that drifts and forms large masses in the ocean. Hatchling sea turtles use sargassum to hide from predators and in turn, the sargassum attracts other small creatures that sea turtles feed on. However, nurdles and other small plastics can get caught in sargassum and may look appetizing to a small sea turtle.

“They can get confused and eat the nurdles,” Walker explains. “For a larger turtle, a nurdle may not be that hard to pass, but for a hatchling — a very small turtle — nurdles can cause some serious problems.”

Sea turtles help to keep seagrass beds and coral healthy, which are home to many other sea creatures. If sea turtle populations decline, it can disrupt the ecosystem. “Turtles really do affect all of the habitat that they live in and help to keep it healthy for all the other animals,” Walker says. “They’re a key player.”

A SEA OF SUPPORTERS

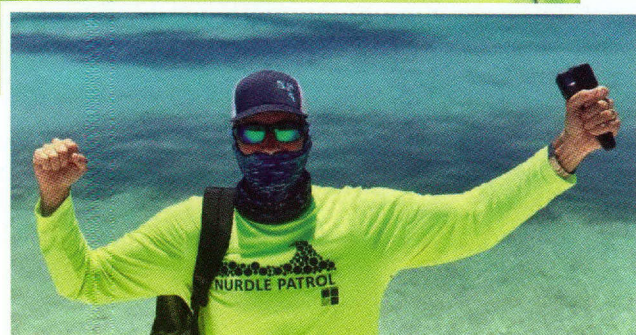
As Tunnell’s Nurdle Patrol crew continues to grow, Walker has complete faith that Tunnell will create change.

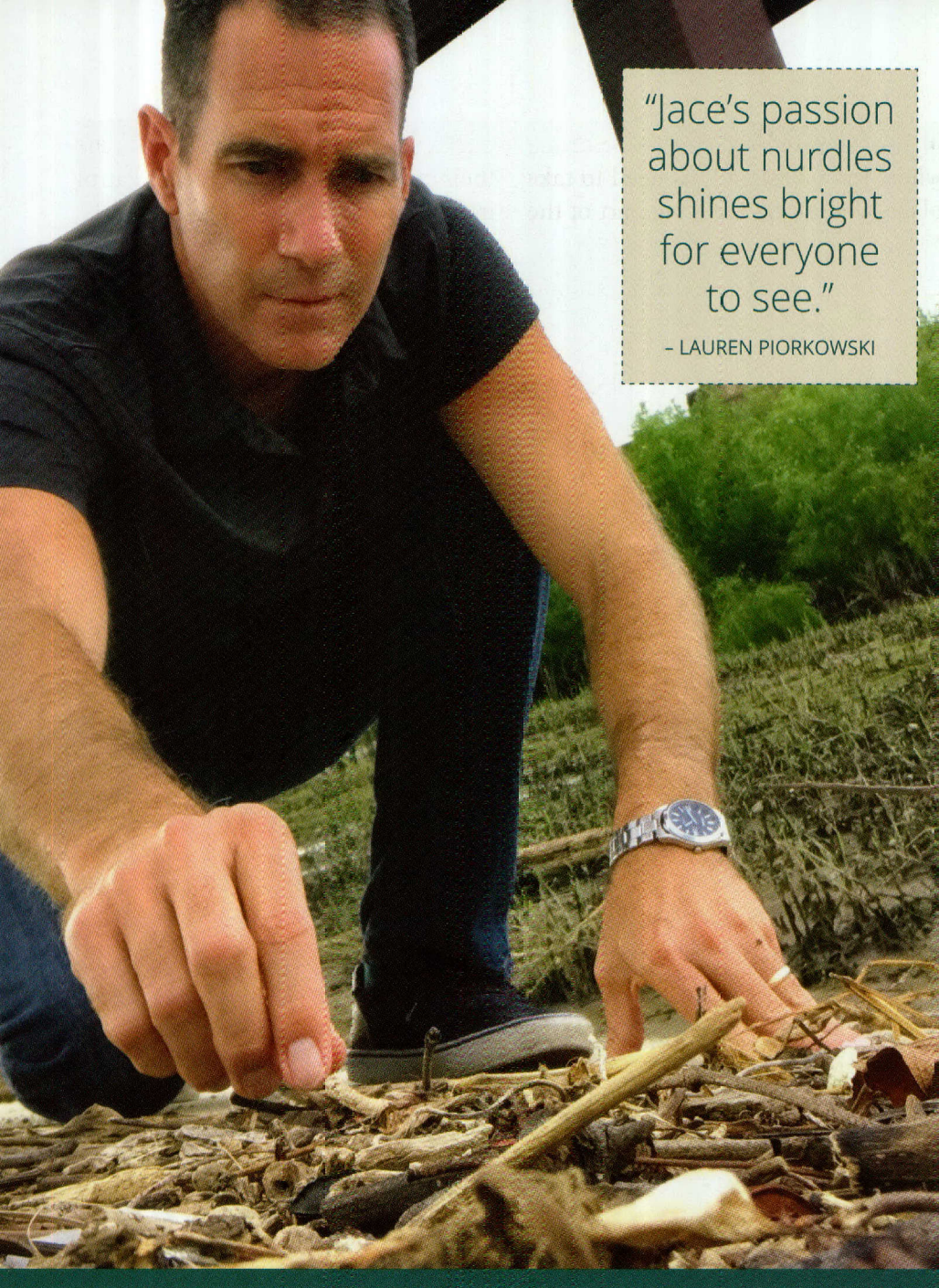


Top: Map of nurdles collected along the Gulf Coast for 10 minutes at a time in July 2019

Middle: Jace Tunnell with nurdles collected on the beach

Bottom: Tunnell after a successful nurdle hunt.





“Jace’s passion about nurdles shines bright for everyone to see.”

– LAUREN PIORKOWSKI

NURDLES AND HUMAN HEALTH

Nurdles may also pose a threat to human health. Studies have shown that toxins in the water can be attracted to plastic. Scientists at the University of Stirling in the United Kingdom tested nurdles found on five beaches in Scotland. All nurdles on the five beaches tested positive for *E. coli*, the bacteria that often causes food poisoning. If nurdles are consumed by fish, humans could ingest harmful bacteria, toxins, and microscopic plastic particles when they eat seafood.

Scientists are currently researching how ingesting tiny bits of plastic could impact human health. “The chemical bisphenol A, or BPA, is present in a lot of different types of plastic,” says Dr. Natalie Johnson, assistant professor at the Texas A&M University School of Public Health. “A lot of research has focused on the neurodevelopmental effects of BPA because it can act like a signaling hormone.” According to Johnson, BPA is structured similar to estrogen, meaning it may have effects that mimic estrogen. Current research focuses on the effects on brain development, children’s behavior, and reproductive signaling pathways.

One thing is for certain — humans are definitely ingesting plastic. In a 2018 study, scientists found microscopic plastic particles in human feces. Only time and more research will tell how plastic, including nurdles, could be affecting our health.

Walker describes the Nurdle Patrol as simply “amazing.”

“Jace saw this problem, and he thought to himself, ‘How do I fix this issue? Let’s bring some awareness to people about it,’” Walker says. “He got the community involved, he’s making people hear him and listen. The fact that so many people have said, ‘Yeah, I want to be a part of this,’ is amazing. His mission is valid, and it’s doable.”

Tunnell has spent countless hours educating the community about nurdle and plastic pollution and what they can do to help. His July 2019 visit to the Oso Bay Wetlands Preserve & Learning Center in Corpus Christi, Texas, is just one example of how his passion for nurdle pollution brings the community together.

“Jace’s passion about nurdles shines bright for everyone to see,” says Lauren Piorkowski, recreation coordinator at the center. “During Jace’s program, the audience was able to hear his excitement and passion in the way he talked about nurdles, which made each person eager to learn. He was encouraging and spoke in a way that even the younger children were able to understand. Many children and adults took home information about the Nurdle Patrol to start participating.”

Tunnell also believes in visuals when educating the community. “He had bottles full of nurdles inside that were passed around so each person had to opportunity to get a closer look at the size, shape, and color,” Piorkowski says. “The audience was amazed at how small the nurdles actually were and that they are affecting our environment in such a large way.”

It’s not enough for Tunnell to educate, though. He encourages others to make changes in their lives that are healthier for the environment, such as ditching single-use plastics. He makes those changes in his own life too.

“A lot of scientists research plastic pollution, but they don’t make changes in their own lives,” Walker says. “But Jace

does. He lives this life. This is his passion, and he feels it's important."

Described by Walker as "a positive person with an infectious attitude," it's not surprising that Tunnell has a sea of followers. The Nurdle Patrol Facebook page is full of uplifting comments by Tunnell, encouraging and thanking his volunteers for participating. Pictures of volunteers proudly displaying the nurdles they found and educational articles about plastic waste flood the page's timeline. The Nurdle Patrol has even had its own artwork contest, in which group members repurposed nurdles and turned them into art. The Nurdle Patrol is a community of people connected by their concern for the environment, but also by the thrill of the hunt.

Tunnell attributes his success to the dedicated volunteers that make the Nurdle Patrol possible. He could never have done the over 23,000 minutes of nurdle patrolling the group has racked up since November 2018 on his own.

"Volunteers do the bulk of the work," Tunnell says. "Now we're getting the big picture, and we're able to see where the

high concentrations of nurdles are and where the investigations need to take place. Volunteers are a big part of the solution that way."

Currently, Nurdle Patrollers send Tunnell data and pictures via email and through Facebook. But Tunnell expects the process of recording data

The Nurdle Patrol is a community of people connected by their concern for the environment, but also by the thrill of the hunt.

will become more efficient with the new website, nurdlepatrol.org. Patrollers can upload data on the website on the computer or through a smart phone app. They even have access to nurdle pollution data maps that they can print

out and use to raise awareness and start their own version of the Nurdle Patrol in their community.

Thanks to Tunnell and his supporters, lawmakers are listening, scientists are researching, and the public is learning. "The Nurdle Patrol is making change and I don't think that that is going to stop happening," Walker says. "It's really just the beginning."

"OFF DUTY"

Even dedicated Nurdle Patrollers such as Tunnell need a break every now and then. When Tunnell is off duty and not patrolling for nurdles, he can still be found on the beach engaging in one of his favorite past times: being a father.

Growing up near Corpus Christi, Texas, Tunnell has always had a love for the beach. He was scuba diving on his own by 10 years old and enjoyed learning from his father during beach trips.

His father's passion for marine biology and his love for the beach inspired Tunnell to study marine science, which led him to earning a B.S. in vertebrate biology and an M.S. in marine science at Texas A&M University – Corpus Christi. Tunnell met his wife in graduate school, and the rest is history.

Tunnell instills the same love for the beach in Parker and his son, 11-year-old Jack. Just as his father did for him, Tunnell encourages his children to explore the beach environment. They attend turtle releases, learn about sea creatures, and of course, hunt for nurdles.

Tunnell continues to see every day as a new opportunity to teach his followers, supporters, and the public something new. He believes in a future of stronger regulations to protect against nurdle spills and a change in human behavior that includes using less plastic in day-to-day life, especially single-use plastics.

"We can make a change now, rather than pushing it off onto the next generation," Tunnell says. "I think that's irresponsible." ♡

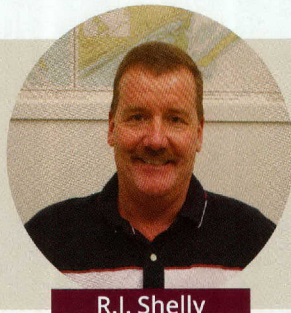


Children collecting nurdles on the beach

New Extension Agents Join Texas Sea Grant



Nicole Pilson



R.J. Shelly



Nikki Fitzgerald

Texas Sea Grant welcomes three new coastal and marine resources extension agents, Nicole Pilson, R.J. Shelly, and Nikki Fitzgerald. They are jointly appointed with Texas A&M AgriLife Extension Service and will be working in Matagorda, Calhoun, and Jefferson-Chambers Counties, respectively.

Before coming on board with Texas Sea Grant, Pilson worked as a fish and wildlife technician with the Coastal Fisheries Division of the Texas Parks and Wildlife Department, monitoring the fisheries of Matagorda Bay. She hopes to “bring awareness to the vital resources of Matagorda through various educational programs.”

Over the past 25 years, Shelly has worked for the Texas Department of State Health Services Seafood and Aquatic

Life Group, working on shellfish classification. He also currently holds a U.S. Coast Guard captain’s license and has been a fishing guide in Port O’Connor since 1996. Through Texas Sea Grant, he plans to provide training and assistance to recreational fishers and those in the oyster industry.

Fitzgerald has an extensive background in youth science education teaching biology, aquatic science, and environmental science. She plans to start a recycling program in Jefferson and Chambers counties. She also will educate youth in conjunction with the Jefferson County Camp Seaport and collaborate in the JASON project at Lamar University. Additionally, Fitzgerald plans to enhance recreational fishing and ecotourism opportunities through educating landowners in pond management.

Remembering Dr. Adrian Dahood-Fritz

Research scientist and former Texas Sea Grant Knauss Fellow Dr. Adrian Dahood-Fritz and her husband, Andrew Fritz, were among 34 who were tragically lost in a Southern California boat fire on Sept. 2, 2019. Dahood-Fritz was a senior environmental scientist for the California Natural Resource Agency’s Ocean Protection Council, working on marine-protected areas in California. She studied marine protected area placement in Antarctica for her doctoral and postdoctoral work. She was selected as a 2010 Knauss Fellow, a competitive and prestigious program from the National Sea Grant College Program. California Governor Gavin Newsom released a statement saying, “Adrian led the state’s efforts to manage California’s network of marine protected areas, and she cared deeply about the ocean and biodiversity. She embodied marine conservation and was a highly accomplished and respected scientific researcher. Adrian’s passion and energy will be greatly missed.” The couple were dedicated animal shelter volunteers and talented photographers. A friend, Josh Baker, told the Austin-American Statesman, “She was passionate about science and reason but also loved animals, penguins and cats.”

Read about Dahood-Fritz’s work at her blog, adrian.fritztech.com.

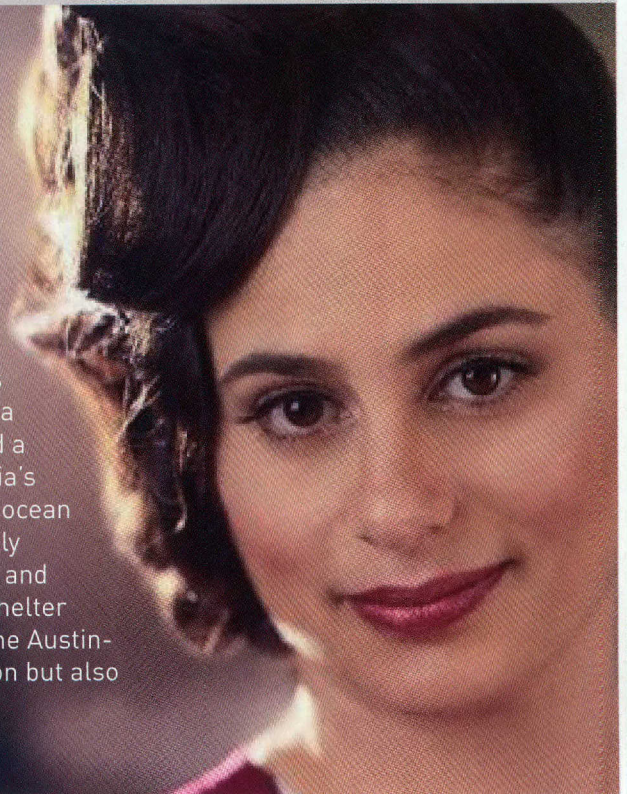


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