

LOUISIANA Agriculture

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Louisiana Sea Grant and the LSU AgCenter
commemorate a 50-year partnership



Expanding cryopreservation to improve genetics in aquatic species

Rick Bogren

For more than 70 years, germplasm repositories based on cryopreservation — frozen sperm — have been widely used in improving animal genetics, particularly in cattle. Frozen sperm moved from research to commercialization and industrial development with cattle beginning in 1947. The use of cryopreservation in aquaculture, although starting at the same time, “has been trapped in research mode,” said LSU AgCenter researcher Terry Tiersch.

In the past 20 years, however, aquaculture has been catching up. Scientists have mapped the genomes of several fishes, including tilapia, trout and catfish, and are improving the production of hybrid catfish.

Recently, Tiersch has expanded from concentrating on farmed fishes to large-scale cryopreservation of a broader variety of aquatic species, including those found in the wild and in zoos and aquariums. More importantly, he is developing approaches for protecting genetic resources for fish used in biomedical research.

Tiersch and colleagues have established the Aquatic Germplasm and Genetic Resources Center in the former AgCenter Dairy Improvement Center building near the LSU Baton Rouge campus. They are outfitting the 23,000-square-foot facility to have commercial-scale capabilities. The center can process and freeze a half million samples per week — more than all of the other aquatic researchers in the world combined could produce in years of work.

“We want to preserve and distribute genetics of value by supporting development of repositories for saving genetic resources.”

With current grant funding of \$2 million from the National Institutes of Health and more than \$150,000 from the U.S. Department of Agriculture and other groups, Tiersch’s group has pioneered high-throughput processing of genetic resources for improving disease resistance and fast growth in a variety of aquatic animals while also addressing environmental concerns.

“We want to preserve and distribute genetics of value by supporting development of repositories for genetic resources,” Tiersch said. “No one else was prepared to do this at a commercial-scale before we started this center.”

The cryogenic technology Tiersch’s group has created can be used to create repositories for saving genetic resources. Zebrafish are the largest aquatic model for studying diseases. They have the same basic genetics as humans, and they’re small and can be easily maintained.

“Researchers can keep thousands of zebrafish in a few tanks when other animals like rats or monkeys would need significantly larger space and cost much more,” Tiersch said.

Tiersch’s group is collaborating with several engineering disciplines to develop technologies for collecting and maintaining germplasm. This includes core technologies in 3-D printing, microfluidics, and electrical and computer engineering.

In addition to zebrafish, the AgCenter facility is developing resources to collect and maintain genetic information from improved farmed strains and endangered species. Current efforts include work with live-bearing fish, oysters, and marine species such as coral and sea slugs, which have a nervous system used to mimic human neurons.

Samples and genetic information from the AgCenter facility go to the USDA National Animal Germplasm Program. Similar to the USDA plant preservation program, the animal program has specific committees for each species. Tiersch is chairman of the Aquatic Species Committee, which includes representatives from universities, industry and government.

“This is the leading repository for preserving our nation’s animal genetic resources,” he said.

Rick Bogren is associate editor of Louisiana Agriculture and a professor in AgCenter Communications.

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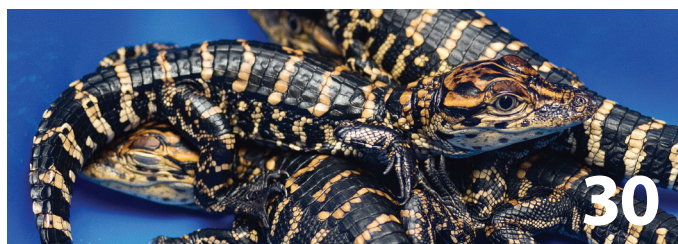
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ON THE COVER: A shrimp vessel pushes shrimp skimmer nets in early morning in Vermilion Bay near Cypremort Point. Rodney Olander is the captain of the boat, which is named Big Rod. Photo by Thomas Hymel

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Nutritionist garners \$5 million grant to improve rural health

The LSU AgCenter has been awarded a \$5 million, five-year grant that will fund an ongoing program to improve health in rural Louisiana and expand it to more parishes.

The AgCenter was among institutions in 15 states that received High Obesity Program grants from the Centers for Disease Control and Prevention Division of Nutrition, Physical Activity and Obesity. Depending on the availability of funds, the AgCenter is expected to receive \$1 million per year until 2023.

The grant will support an initiative called Healthy Access, Behaviors and Communities, or Healthy ABCs, and will continue work that began in 2015 in Madison, Tensas and St. Helena parishes through the AgCenter Healthy Communities program, which was funded by a previous CDC grant. Assumption, Claiborne, East Carroll and Morehouse parishes will be added to the effort.

All seven parishes have an adult obesity rate of at least 40 percent, said Denise Holston, an AgCenter nutrition specialist and principal investigator for the project.

"Healthy ABCs will continue to leverage local cooperative extension services to expand the use of evidence-based strategies that increase access to healthier foods and safe and accessible places for physical activity," she said. "Using a community-led approach, this work will help reduce the number of people with obesity and the effects of obesity in the targeted parishes."

Holston said participants have persuaded local stores to stock more healthful items, established farmers markets, promoted physical activity at schools and community centers, and pushed for safety improvements to streets, among other accomplishments.

Partners in the Healthy ABCs project include the Pennington Biomedical Research Center, Southern University Ag Center, Louisiana Department of Health, Well-Ahead Louisiana, Center for Planning Excellence, Food Bank of Northeast Louisiana, Louisiana Department of Transportation, Louisiana Farm to School, and Capital Area Planning Commission.

Olivia McClure

Students learn about agriculture at field day

Agriculture experts told more than 200 middle and high school students about the importance of the industry at an LSU AgCenter event held Sept. 26 in Winnsboro. The youth learned about using drones in agriculture; forest and wildlife management; how sweet potatoes are grown, harvested and graded; and insects and pollination.

"We want our kids aware of where their food comes from and where their clothing comes

from," said Ashley Powell, the 4-H coordinator for the AgCenter Northeast Region. "Some kids go to the grocery store or a restaurant to buy their food and don't realize where it comes from."

She said presentations at the event also expose youth to education and career tracks they can pursue in agriculture, which is a major economic force in northeast Louisiana.

Olivia McClure



Leadership program director wins international award

Bobby Soileau, director of the LSU AgCenter Agricultural Leadership Development Program, has been named recipient of the 2018 Outstanding International Leadership Program Director award by the International Association of Programs for Agricultural Leaders.



Soileau began working for Ag Leadership in 2005 and is currently leading his sixth class as the program leader.

Ag Leadership is a two-year program for individuals connected with the agriculture industry. The curriculum consists of a series of classroom and travel seminars that require approximately 45 training days. Since the program began in 1988, it has produced 419 graduates.

"Ag Leadership is successful because of the quality participants from all aspects of Louisiana agriculture. We strive to help class members become better informed spokespeople in all aspects of agriculture, forestry, natural resources and agribusiness," Soileau said.

Rick Bogren

Louisiana volunteer named to National 4-H Hall of Fame

Fran Castille, of Amite, Louisiana, who has been involved with 4-H in some capacity since her childhood, was inducted into the National 4-H Hall of Fame in Chevy Chase, Maryland, on Oct. 19.



Castille's first venture into 4-H was in 1964 when she joined a 4-H club in rural St. Helena Parish. She began showing Guernsey cows but later focused on leadership opportunities within the youth organization. By the time she graduated from high school, she had been elected to every officer position.

As an adult, she was asked to lead her niece's local community club. Since that day, she has spent the past 32 years serving as volunteer leader and has been a positive role model for 4-H youth.

Castille is a charter member of the Louisiana 4-H Volunteer Leader Association and has served as president, vice-president and past president. She has raised more than \$75,000 in donations and in-kind contributions for 4-H causes, such as scholarships, 4-H trainings and club grants for supplies and awards.

Craig Gautreaux

Water regulations suspended in Louisiana and 27 other states

For the time being, a 2015 rule that regulates which waterways are subject to federal jurisdiction will not be enforced in Louisiana and 27 other states. Louisiana is covered by an injunction granted by a district court in Texas in September 2018 and will continue under rules set by the 1972 Clean Water Act until a new definition can be written.

The Environmental Protection Agency and the Army Corps of Engineers introduced a new rule in 2015 that changed the definition of waters of the U.S. — which bodies of water may be regulated by the federal government. That prompted concern among farmers and landowners, who feared they would come under stricter scrutiny for water and land use.

Entomologist teaches pollination using Minecraft gaming platform

In real life, LSU entomologist Kristen Healy works to preserve pollinators in the environment, such as bees and butterflies, and now she is helping develop tools so students can do the same in a virtual world.

Healy teamed up with AgCenter information technology manager Andrew Garcia to develop a teaching module for building a pollinator garden in the education edition of the popular gaming platform Minecraft.

Healy developed the lesson plan, and Garcia built the virtual world, which includes a museum, characters that provide information and tools, and plots of land for the garden.

Healy said she wants students to understand the importance of pollinators and the ways to attract them and to appreciate the value of

“It’s a problem for farmers because irrigation water is an important component for many to grow their crops, and they just want to get some clarity,” said Naveen Adusumilli, an LSU AgCenter economist.

“Many of the drainage ditches and small streams in the state don’t affect the major water bodies because they don’t normally flow unless there is major rainfall,” he said. “And many of those small bodies of water are either dry for the major part of the year or simply evaporate before reaching a major water body.” **Rick Bogren**

pollinator gardens. Any teacher with a Minecraft Education license can implement the lesson. The goal is for the students to navigate through the world while learning about pollinators, their habitat and how to protect them.

Healy and Garcia both have children who play Minecraft and said it’s a great way to engage students in the lessons. Many students don’t have access to real gardens, but this provides a virtual field trip for a class. The lesson can be found online by searching: “building a pollinator garden Minecraft.” **Tobie Blanchard**



LSU AgCenter entomologist Kristen Healy is developing ways to use video games to teach students about insects, such as bees, butterflies and mosquitoes, and their place in the world. Photo by Tobie Blanchard



This is a screenshot from the Minecraft Education Edition module on building a pollinator garden. LSU AgCenter entomologist Kristen Healy and information technology manager Andrew Garcia created the module to help students understand the importance of pollinators.

AgCenter receives \$590,000 for beginning farmer program

The LSU AgCenter is launching an initiative to train small- and medium-scale farmers who are new to the business. The Grow Louisiana Beginning Farmer Training Program is funded by a nearly \$590,000 U.S. Department of Agriculture grant. It will target those with 10 or fewer years of farming experience.

“This is a great opportunity to grow more farmers in Louisiana,” said AgCenter horticulture professor Carl Motsenbocker, who is the principal investigator for the project. “We need more Louisiana farmers in order to supply products into local and regional food systems. There is definitely an unmet demand for local horticulture products.”

AgCenter horticulture specialist Kiki Fontenot and agriculture economist Maria Bampasidou are co-principal investigators. Collaborators on

the project include SPROUT NOLA, MarketUmbrella and the Acadiana Food Alliance.

The Grow Louisiana program will offer an intensive one-year training course to at least 12 farmers per year for three years. Classes in the first and third year will be in New Orleans, focusing on farmers there and on the north shore of Lake Pontchartrain. Farmers in southwest and central Louisiana can participate in the second year in Lafayette.

“The focus of the program is horticulture as well as business practices to ensure the long-term viability of the participants,” Motsenbocker said. **Olivia McClure**

Savoie named outstanding agricultural economics alumnus

David Savoie, center, of Crowley, was named the outstanding alumnus at the LSU Agricultural Economics and Agribusiness Alumni Association annual award ceremony on Sept. 22. Savoie received his master's degree in agricultural economics from LSU in 1981. He received his undergraduate degree in agribusiness from the University of Southwestern Louisiana, now the University of Louisiana at Lafayette. He is the vice president and large agriculture corporate sales manager for Sunshine Quality Solutions and has worked in the farm equipment industry since 1981. The alumni association also gave out 13 scholarships to students studying agricultural business in the LSU College of Agriculture. Presenting Savoie with the award are Mike Salassi, head of the Department of Agricultural Economics and Agribusiness, and Christine Schmidt, association president. Photo by Tobie Blanchard



Scholarship awards total \$375,000

LSU College of Agriculture students who received a 64 Parish Strong scholarship were recognized at the college's Honors Convocation held on Aug. 30. They were among the 140 students who received scholarships from the college. The total amount awarded to both incoming and continuing students was \$375,000. Photo by Tobie Blanchard



Neal and Martin named assistant deans

The LSU College of Agriculture has restructured the Dean's Office to better serve the needs of students, faculty and staff. Jennifer Neal, former director of student services, now serves as assistant dean for student and academic affairs. Brandon Guillory, the office's academic coordinator, will assume the role of manager of student services. Amanda Martin is now the assistant dean of recruitment and student development. She was the director of recruitment and retention. Henry Hebert, who coordinated recruitment and retention, is now the manager of recruitment. These changes streamline the team's ability to meet the college's goals and mission.



Jennifer Neal



Amanda Martin

Layni LeBlanc elected National FFA secretary

Layni LeBlanc, a junior studying animal sciences in the LSU College of Agriculture, was elected as National FFA secretary at the National FFA Convention in Indianapolis. LeBlanc will serve with a national officer team of five other students from across the country. National officers commit to a year of service to National FFA. LeBlanc will travel nationally and internationally to represent FFA and interact with agricultural industry leaders, FFA members, teachers and government officials. She will help lead personal growth and leadership conferences for FFA members across the country. LeBlanc is the first female national officer from Louisiana, and the state hasn't had a national officer since 1988.



Alumna St. Paul gives Golden Girls new look

Suzanne Perron St. Paul has designed gowns for celebrities, brides, debutantes and Mardi Gras royalty, but the New Orleans-based designer recently took on new clients, the LSU Golden Girls. "My goal was to come up with a fleur-de-lis-inspired outfit, a lot more gold, but on a white base, and we did it," St. Paul said. The uniforms include hand-painted fabric and more than 1,000 Swarovski crystals per outfit. St. Paul was a Golden Girl in the 1980s. She studied textiles, apparel and merchandising. After graduation she taught for a year at LSU and then was accepted into an accelerated program at New York's Fashion Institute of Technology. "I was thrown right in the program. It was like fashion vo-tech. All of our professors worked in the industry. I met so many designers." St. Paul worked for top designers Carolina Herrera, Anna Sui and Vera Wang before returning to Louisiana to open a studio in New Orleans.



New Faculty PROFILE

Bats, rats, deer and feral hogs – all part of Ashley Long's job

Tobie Blanchard

Bats and rats are just part of the job for Ashley Long. So are deer, feral hogs and different species of birds.

Long, a new faculty member in the School of Renewable Natural Resources, serves as the AgCenter state wildlife extension specialist and has an extensive research program.

A native of Wisconsin and Illinois, Long was turned on to wildlife conservation during her undergraduate years at Northland College in Ashland, Wisconsin.

"During undergrad, I took classes from an instructor who was very passionate about wildlife conservation and who made it a priority to get his students out in the field," Long said. "He showed me how interesting and how much fun it could be to learn about wildlife."

Long got her Ph.D. in wildlife and fisheries science from Texas A&M and worked as a research scientist at the Texas A&M Natural Resources Institute before coming to the AgCenter in early 2018.

As the wildlife specialist, Long is responsible for public outreach and education. Two topics she has worked on include feral hog management and education on chronic wasting disease in deer.

Included in her research responsibilities is a project that involves looking at the roosting habitats of bats across the state. She is partnering with the Louisiana Department of Wildlife and Fisheries to learn more about their distribution in the state.

"Bats are essential to agricultural production from a pest management standpoint and are important to overall biodiversity," she said.

She is working with an undergraduate student who will use acoustic monitoring to determine where bats are and the types of habitat they are using.

She is also working with Wildlife and Fisheries to conduct surveillance for white-nose syndrome, a disease that affects hibernating bats. The disease has been detected in states around Louisiana, but not yet in the state.

Another disease she is focusing on is leptospirosis, a bacterial disease that can affect a range of mammals. She is partnering again with Wildlife and Fisheries to collect baseline data to see which species it is in and to what extent. Undergraduate students in the School of Renewable Natural Resources are helping to collect the data by capturing wildlife such as rats for blood testing.

Much of Long's research involves birds. She is studying how forest stand type and age influences bird habitat, and a

graduate student she is mentoring will look at grassland birds that winter in Louisiana.

She also is working with a post-doctoral researcher who uses geospatial analysis for habitat forecasting. Long said this could help with habitat management for the endangered golden-cheeked warbler.

Long also teaches wildlife habitat management, but much of the learning happens outside of the classroom. She often takes her classes into the field like the instructor who influenced her.

She said mentors have made the difference in her career, and she hopes to do the same for her students.

"I have a lot of respect for the work they've done to advance wildlife conservation through their research, and they have built strong connections over the years with their students, their colleagues and the general public," she said.



Tobie Blanchard is the assistant director of LSU AgCenter Communications and the communication coordinator of the LSU College of Agriculture.



Ashley Long, a new AgCenter state wildlife extension specialist, bands rails at the Yellow Rails and Rice Festival in Jennings, Louisiana.

Supporting Louisiana Seafood Through a Land Grant and Sea Grant Partnership

Rex Caffey

In 2012, the LSU AgCenter commemorated the 150th anniversary of the Morrill Act, which established the land-grant system of colleges across the country, along with the 125th anniversary of the Hatch Act, which established agricultural research at these colleges. Two years later, in 2014, the 100th anniversary of the Smith-Lever Act, which set up a system for extension education and outreach from the land-grant universities, was celebrated. The success of the land-grant system provided a model for creating the National Sea Grant College Program in 1966 and the establishment of Louisiana Sea Grant in 1968.

Louisiana State University is home to one of 33 Sea Grant College programs

located in each of the coastal and Great Lakes states. These programs conduct education, research and extension in four areas: 1) sustainable fisheries and aquaculture, 2) healthy coastal ecosystems, 3) resilient communities and economies, and 4) environmental literacy and workforce development. While Louisiana Sea Grant maintains activities in each of these areas, aquatic resources have always been a major focus of the program. This emphasis is not surprising in a state known for seafood.

Louisiana's location at the terminus of the world's third largest river basin has made the state a perennial leader in fisheries landings. The sediments and nutrients of the Mississippi River

support a large expanse of coastal habitat and stimulate fishery productivity in the northern Gulf of Mexico. Second only to Alaska in landings volume, Louisiana has accounted for more than two-thirds of the northern Gulf fisheries harvest for the past 70 years (Figure 1). In 2016, Louisiana ports led the Gulf region in landings of white shrimp (46 percent), eastern oyster (59 percent), blue crab (73 percent), and menhaden (80 percent). The National Oceanic and Atmospheric Administration (NOAA) has estimated the combined economic impact of the state's commercial and recreational fishing sectors at \$4.6 billion, with nearly 50,000 jobs supported by seafood harvesting, processing,



distribution, retail and ancillary businesses. The firms, trade associations and resource agencies associated with this industry are some of the oldest constituents and partners of Louisiana Sea Grant.

SEAFOOD RESEARCH AND EXTENSION

Since it began sponsoring research in 1968, Louisiana Sea Grant has supported more than 1,000 applied research projects at Louisiana universities, many of which have gone to the LSU AgCenter. Seafood-related research (wild caught and aquaculture, freshwater and marine) has historically accounted for the largest single fraction (40 percent) of the program's biennial research portfolio. Such projects focus on commercially relevant species of crustaceans, mollusks, reptiles and finfish and span numerous areas of analysis related to stock assessment; reproduction and genetics; seafood safety, nutrition and processing; aquaculture feasibility; disease and water

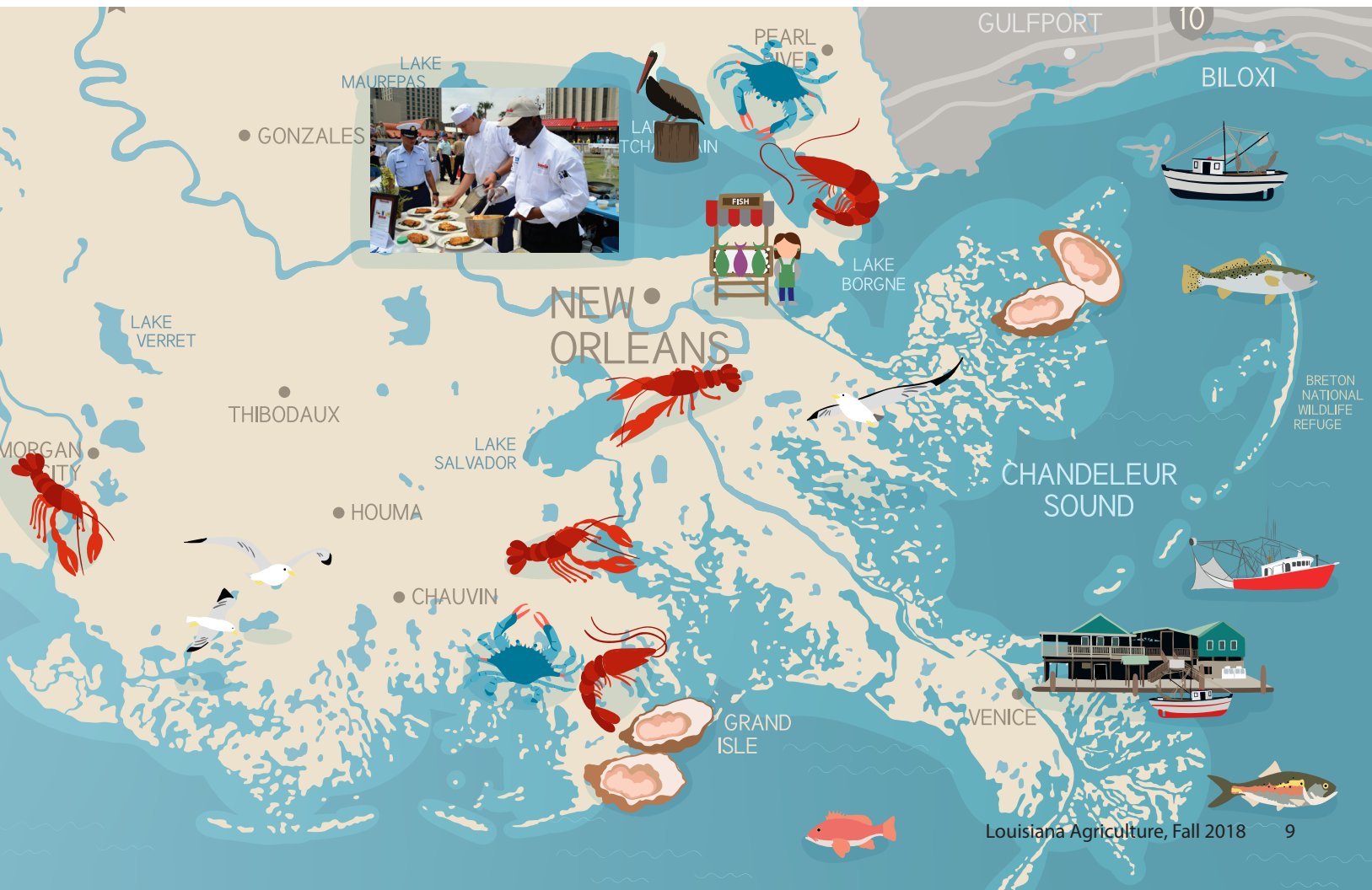
quality; and natural resource economics and policy.

Dissemination of this research is coordinated by the Marine Extension Project, a team of specialists and agents jointly supported by Sea Grant and the LSU AgCenter. The team has expertise in fisheries, aquaculture, water quality, toxicology, ecology, geography, economics and law. In addition, a team of faculty and associates with training in marine and environmental sciences works from coastal field offices. This team serves industry clientele through on-site consultation, participation on advisory committees and task forces, demonstration projects and workshops, publications and presentations, radio and video outreach, and web-based programming and social media.

INDUSTRY CHALLENGES

In the early years of Sea Grant, seafood programming was characterized by fisheries development. Research and extension projects focused primarily on use of resources and technology transfer in the harvesting and pro-

cessing sectors. By the mid-1980s the program was expanding to address a growing number of economic and environmental concerns. The market for Louisiana seafood, which had been somewhat insulated, was entering an era of global trade. Declining dockside prices were forcing heavily capitalized fleets to find new strategies for economic survival. Meanwhile, biological limits for marine resources were becoming increasingly evident through documented cases of overfishing. Management agencies implemented new restrictions for nearly every species, season and gear type. In the ensuing years, research would respond through investments in aquaculture, fisheries marketing, value-added processing, byproduct utilization, and an array of projects aimed at understanding fisheries recruitment, management and sustainability. Extension would follow suit as agents and specialists mediated disputes over resource allocation and helped firms to maximize revenue, minimize costs, and navigate a spate of new regulations at the state and federal



levels. Seafood-related challenges have continued to expand in recent years, with two specific issues accounting for much of the program's focus: foreign trade and coastal wetland loss.

The effects of globalization are most evident in the shrimp sector, the state's largest commercial fishery by value. U.S. imports of farm-raised shrimp have risen sharply over the past three decades. Imported shrimp (all product forms) increased from approximately 200 million pounds in 1980 to more than 1.3 billion pounds by 2016. During that same period the average dockside price for Louisiana shrimp remained flat, between \$1 and \$2 per pound. Adjusted for inflation, this stagnation equates to a 75 percent reduction in the real price of shrimp since 1980 (Figure 2).

Competitive pressures on price have been exacerbated by rising input costs and a series of natural and human-made disasters. As a result of these pressures, the shrimp harvesting fleet in Louisiana is less than half of what it was just 10 years ago. This is based on annual commercial shrimp gear license sales, estimated by the Louisiana Department of Wildlife and Fisheries at 12,590 in 2007 and 6,219 in 2017. From 2010 to 2012, the LSU AgCenter and Louisiana Sea Grant partnered to provide more than a hundred technical assistance workshops as part of a Trade Adjustment Assistance program designed to help shrimp fishermen adversely affected by import

competition. More recently, the Marine Extension Project team has focused on direct marketing and quality enhancement strategies to help shrimpers differentiate their product from the commodity market.

Compounding these economic challenges is a looming environmental concern: the threat of habitat collapse. Louisiana has lost nearly 2,000 square miles of coastal land in the past century, primarily due to hydrologic modification, navigation canals, nutrient and sediment starvation, sea level rise and subsidence. To address the problem, the state has developed an ambitious coastal master plan that calls for large-scale river diversion projects that would reintroduce nutrients and sediments into the coastal zone. This strategy is supported by scientific understanding of deltaic processes, much of which was gained through research funded by Louisiana Sea Grant during the early years of the program.

More recently, Sea Grant researchers have delved into ecological and economic assessments of coastal restoration, with a particular emphasis on implications for the seafood industry. This research indicates that river diversions are vital for sustaining coastal fisheries habitat in the long run, but the short-term could be more problematic. Large-scale diversions could result in economic disruptions to certain fishery sectors depending on location, flow rate and timing of operations. The

challenge involves finding ways to mitigate the short-term effects to fishers while assuring the long-term benefits to fishes. The Marine Extension Project has conducted outreach on this subject for decades, but tensions have risen as recent plans for much larger diversions have emerged. Adaptive management of these structures will rely on objective research and extension to help strike a balance between economic viability and ecological integrity.

As Sea Grant marks its 50th year in Louisiana, the program's influence is evident across a wide range of entities, but its partnership with the LSU AgCenter is especially prominent. This edition of Louisiana Agriculture features numerous examples of research and extension projects supported through that partnership. Readers will find articles related to niche marketing of seafood, advancements in fisheries genetics and reproduction, regulatory compliance, seasonal labor in processing, best management practices for quality enhancement, fisheries outreach with diverse audiences, and reconciling fisheries with coastal restoration. These examples reflect only a snapshot of the progress being made in support of the state's seafood industry.

Rex H. Caffey is director of Marine Extension for Louisiana Sea Grant, director of the LSU Center for Natural Resource Economics & Policy, and the D. Welge Endowed Professor in the Department of Agricultural Economics and Agribusiness.

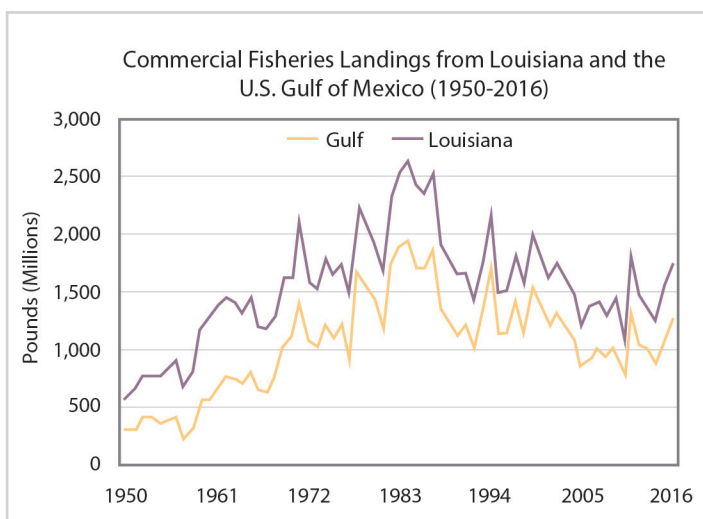


Figure 1. Louisiana leads the lower 48 in seafood landings volume and has averaged more than two-thirds of the U.S. Gulf of Mexico fisheries harvest for the past 70 years (Source: NOAA)

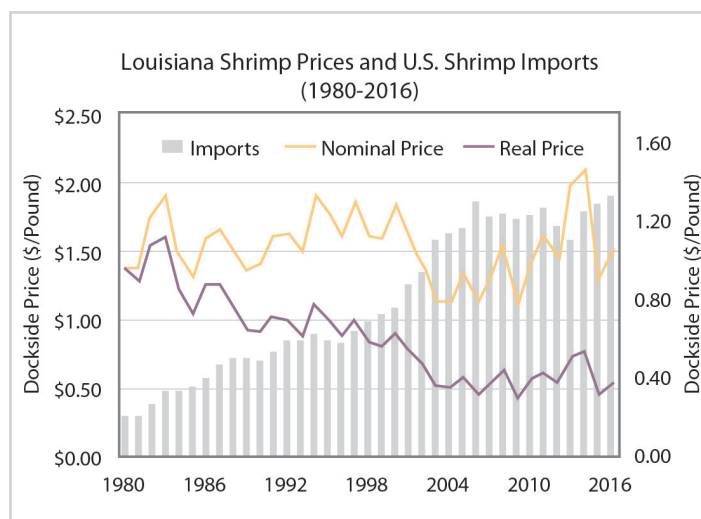


Figure 2. The rise of imported shrimp in the past 25 years has resulted in a strong downward pressure on domestic shrimp prices. Adjusted for inflation, Louisiana shrimp prices are a mere fraction of what they were in 1980.

Louisiana Sea Grant Marks a Half Century

Roy Kron

It was 86 degrees in Baton Rouge on July 1, 1968 — cooler than usual. The median monthly income of a family in the United States was \$719. A woman's haircut cost \$2.15. Gasoline averaged 34 cents per gallon. And with initial funding of \$198,000 from the federal government, Louisiana Sea Grant was born.

Two years earlier, Congress founded the National Sea Grant College Program, which created a university-based system dedicated to the responsible development of the nation's coastal and marine resources through research, education and extension. Officials at Louisiana State University recognized this unique opportunity and pursued establishing a state program under that federal umbrella.

"I was asked if I would like to come back to LSU and help set the thing up," said Jack Van Lopik in a 2006 interview. "So, I came back from Texas Instruments ... on a two-year leave of absence just to get the program started." Van Lopik, who earned his doctorate from LSU in 1955, ended up serving as Louisiana Sea Grant's executive director for 37 years — 1968 to 2005. He passed away in 2015.

One of the first hurdles in launching Louisiana Sea Grant was money. State programs had to match federal funds with in-kind services or cash. "We did a lot of talking with legislators. This was done not only by myself, but by people like the chancellor and (other) people that were involved at LSU at the time," said Van Lopik.

But even with support from LSU administration and state and federal funding, there was no guarantee university researchers would buy into the Sea Grant concept. Its multidisciplinary, applied-research approach was not the norm.

"Sea Grant was across all different kinds of disciplines ... not only from the science and engineering part of the university, but also from the law center and sociology and economics ... trying an interdisciplinary approach to (solve) a lot of the problems in the coastal zone," said Van Lopik. "Sea Grant was trying to get involvement of not just people in the academic community, but to get people from academia tied into real-world problems."

As a new faculty member at LSU in 1984, Chuck Wilson recognized Louisiana Sea Grant's importance to his research, and he received his first grant from the program the following year to study the reproductive biology of red drum. Twenty years later Wilson took the helm as Sea Grant's second executive director — serving in that capacity for eight years, through 2012.

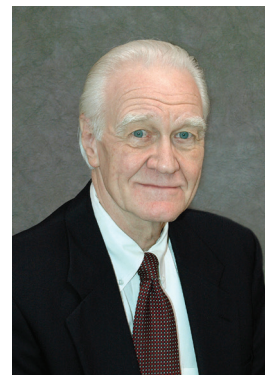
"That first year as Sea Grant director posed a number of challenges," Wilson said. "It was 2005, and communities and businesses along the coast were devastated by hurricanes Katrina and Rita. At that moment, the program took on more of a response and recovery role than it had ever had in the past. When hurricanes Gustav and Ike came along — as well as the 2010 oil spill — we were in a much stronger position to help coastal communities affected by those disasters."

Robert Twilley became Louisiana Sea Grant's third executive director in the summer of 2012. As a young researcher, he also benefited from Louisiana Sea Grant funding, initially in 1987.

"Louisiana's coastal communities are experiencing accelerated environmental changes driven by the highest rates of coastal land loss and relative sea level rise, more than any other coastal region in the United States. In response, Sea Grant is creating more focus on strategic adaptations for communities and industry. An innovative research approach that is integrative across the sciences, just as described by our first director, Jack Van Lopik, is necessary to address our coastal issues. And we must continue to improve our ability to communicate that knowledge with strong engagement and outreach efforts," said Twilley.

"For a program celebrating a half-century of service, Louisiana Sea Grant continues to innovate and be a leader in bridging our state's academic expertise with the needs of those who manage, conserve, enjoy and make their living on the coast. Louisiana Sea Grant has demonstrated that it is prepared to help coastal communities meet immediate and future challenges," Twilley said.

Roy Kron is the director of Communications and Outreach, Louisiana Sea Grant College Program.



JACK VAN LOPIK
1968-2005



CHUCK WILSON
2005-2012



ROBERT TWILLEY
2012-present

Louisiana Fisheries Forward

Unleashing the potential of the wild catch market

Thomas Hymel

The LSU AgCenter research and extension model that has strengthened the state's agriculture industry — its cotton, sugarcane, soybeans, rice, and more — is also applied to its commercial seafood industry through the Louisiana Fisheries Forward program.

Established to improve the economic strength and resource stewardship of Louisiana's commercial fishing industry, Louisiana Fisheries Forward is a voluntary educational program for all industry members, with a focus on harvesters, docks and processors.

At its heart, Louisiana Fisheries Forward provides a mechanism to develop and deliver relevant information and improve the education, proficiency and stewardship of the commercial fisheries business. It strengthens a wide variety of best management practices by keeping all sectors informed of rapidly changing regulations, equipment and technology, handling techniques, safety issues, responsible harvesting, global trends and more.

The Louisiana Fisheries Forward program is a partnership among the LSU AgCenter, Louisiana Sea Grant, the Louisiana Department of Wildlife and Fisheries and seafood industry stakeholders. It is funded with state and federal resources through Wildlife and Fisheries and administered by the AgCenter and Sea Grant through the Marine Extension Program. The subject matter expertise and outreach of university scientists, field biologists and fisheries resource managers are complemented by the hands-on work of community-embedded marine extension agents. The program is further supported by fisheries and seafood specialists, a marine resource economist, and other specialists, who identify

issues and offer up-to-date information and solutions.

Louisiana is the largest producer of seafood in the lower 48 states, and its world-class offerings have been the backbone of its coastal economy and culture for generations. Unfortunately, the resource has taken hits from hurricanes, coastal land loss, increasing seafood imports, rising expenses and the negative perception of seafood safety created by oil spills. Ninety percent of seafood consumed in the United States is imported, simply because the amount produced locally does not get close to matching demand.

“ Louisiana is the largest producer of seafood in the lower 48 states, and its world-class offerings have been the backbone of its coastal economy and culture for generations. ”

A major goal of the Louisiana Fisheries Forward program is to unleash the potential of the Louisiana fisheries industry by improving harvesting and stewardship practices to strengthen this wild, renewable and natural resource and sustain it for the enjoyment and economic benefit of future generations. An industry development effort had already been successfully carried out in Alaska, the nation's No. 1 seafood producer. Although Alaska's industry

is dominated by larger businesses, and Louisiana's features mostly smaller, family-run groups, the baseline was set to prove that such a program could succeed here.

The seeds of the Louisiana Fisheries Forward program developed during a half century of coastal resource management and fisherman education provided by the Marine Extension Program in partnership with the seafood industry, following the Sea Grant program's birth in 1968.

Then in 2012, in the devastating aftermath of hurricanes Katrina and Rita in 2005 and the BP oil spill in 2008, Sea Grant and the AgCenter hosted the first Seafood Academy. With an eye to addressing concerns, industry players and the Marine Extension Program came together to strengthen the flagging seafood industry. Workshops helped fishermen move forward and staffers discover unmet needs. The Department of Wildlife and Fisheries and other seafood industry stakeholders also recognized the value of a consistent program, and the idea for Louisiana Fisheries Forward was born.

Program efforts began with the shrimp industry and soon expanded to all sectors, including crab, oysters, marine fin fish, inland freshwater seafood (catfish, crawfish, etc.), recreational for hire (charter fishing), docks and processors.

The principal goal is to help these groups get ahead of the curve quickly by presenting new business trends, technologies, equipment, regulatory rules and policies that lead to financial success and resource sustainability.

Thomas Hymel is a marine extension agent with both the LSU AgCenter and Louisiana Sea Grant. He serves as director of the Louisiana Fisheries Forward and Louisiana Seafood Direct programs.

Wild Plate Frozen adds value to Louisiana shrimp

Bruce Schultz

A project by the LSU AgCenter and Louisiana Sea Grant, called the Louisiana Limited Wild Plate Frozen shrimp program, is helping seafood buyers and sellers create a market for a superior product.

"This is the ultimate premium product," said Thomas Hymel, fisheries agent. "It's like it fell out of a cast net, and it's frozen."

Shrimp are packaged in 5-pound containers, then held on a plate freezer that is kept at minus 35 degrees. The products treated with this process look fresh from the ocean when they are thawed, Hymel said, with heads and even antennae intact.

"This is as close to the ocean as you can get," he said, adding that a few shrimp can be removed from the package if a small amount is needed.

The process also can be used for fish, Hymel said.

The Port of Delcambre has entered into a partnership with the AgCenter and Louisiana Sea Grant for the "Wild Plate Frozen" label that tells buyers the shrimp has been plate frozen.

"We engaged industry, refined the method, developed a concept of handling and created a brand," said fisheries specialist Julie Lively, who obtained a grant to bring the product into the marketplace. "Chefs had no idea they could get shrimp that looked like that."

The freezing method gives shrimpers flexibility for selling their catch. "They can hold the shrimp until off-season when they will get a much better price," she said.

Lively worked to develop a protocol for handling the shrimp from the net to the freezer, so suppliers would have a consistent high-end product. She obtained a design for the "Wild Plate Frozen" logo to identify the shrimp, and seafood buyers were surveyed to learn the demand and potential pricing for a high-quality shrimp.

Lively has been testing products that use an organic compound extracted from kiwi fruit to reduce black spot in shrimp. The condition is the result of enzymes in the shrimp reacting with air to cause discoloration — a cosmetic condition that does not indicate the shrimp has spoiled.

After the Deepwater Horizon oil spill catastrophe in 2010, a campaign was undertaken to promote the Gulf Coast seafood industry, Lively said, but it fell flat because an inadequate supply could not meet demand.

But with this freezing technology, sellers can store their supply and collaborate to fill large orders with shrimp that has been processed and packaged under a uniform system of standards.

The cost of a plate freezer is roughly \$30,000, and it can be installed on a boat or used dockside, Hymel said.

Shrimp have to be graded and packed into plastic bags, then boxed, before the freezing process.

The heads are left intact for chefs who prepare dishes with heads on. "They look fresh when thawed out," Hymel said.

Bruce Schultz is a writer and photographer with LSU AgCenter Communications.



Wild Plate Frozen shrimp after boiling. Photo by Thomas Hymel



Lance Nacio, of Montegut, Louisiana, standing in one of his freezers, has been using the plate freezer for about 13 years. He learned of the technology from a Washington-based company that builds custom refrigeration units for worldwide use. He saw the advantage of being able to have quality shrimp available roughly twice as long as brine-frozen shrimp. They are easier to peel than brine-frozen shrimp, he said, and they don't develop the discoloration either. Nacio also freezes small shrimp to be sold as bait shrimp in winter. Photo by Bruce Schultz



A Wild Plate Frozen shrimp after thawing. Photo by Thomas Hymel



■ Thu Bui stands on the deck of one of her father's shrimping boats, the Miss Thu Tahoe II, which is named for Thu Bui and a sister. Bui is deeply immersed in the south Louisiana Vietnamese fishing community.

Photo by Kyle Peveto

Thu Bui: A voice for those who make a living from the water

Kyle Peveto

Since she learned to talk, Thu Bui has been a voice for her family and the community in which she was raised.

As the first child of Vietnamese immigrants in coastal Louisiana, Bui has been a translator — and an advocate — for the men and women who came here to make a living from the water.

She didn't plan on working for the LSU AgCenter and Louisiana Sea Grant. But she was a natural fit.

"To me it was a natural transition to be an extension agent," said Bui, who is an associate fisheries extension agent. "I didn't know everything an extension agent did. Then I found out it was everything I was already doing."

Bui was initially hired to help connect the Vietnamese fishing community in St. Mary, Iberia and Vermilion parishes with Sea Grant and AgCenter agents.

Along with Mark Shirley, a longtime Sea Grant and AgCenter agent, Bui has become embedded in the south Louisiana fishing world. As a team they have reached those who may have been overlooked before, Shirley said.

"Thu probably has a greater understanding of knowledge of the shrimp industry than I do," said Shirley, who is an aquaculture and coastal resources specialist. "She grew up in it."

Bui's story begins well before her birth. After the Vietnam War and the fall of the South Vietnamese government

in 1975, thousands of Vietnamese fled the country by boat and eventually resettled in the United States or one of a handful of other countries.

Her parents were among the "boat people" who made it to the Philippines, where a camp was established for refugees from Vietnam, Cambodia and Laos. She was born there in 1981.

After a year or so, her family was resettled in North Carolina, where Bui's father worked in a clothing factory.

"You can imagine coming to the United States," Bui said. "A different language, not knowing anyone and pretty much you're an alien put on another planet."

A fisherman back in Vietnam, her father had heard of Vietnamese communities that popped up along the Gulf Coast where fishing jobs were plentiful. When Bui was 3, the family moved to Abbeville, where her father began working as a deckhand on a shrimp boat and her mother worked in shrimp, crawfish and fish processing plants.

At that time in the early 1980s, Shirley was a new fisheries agent. The majority of the shrimp fleet then was owned by Louisiana natives, mostly white men.

"The Anglo fishermen were getting old and retiring and selling their boats," Shirley said. "As these boats became available, this younger crowd of Vietnamese fishermen were able to step up and fill that void."

The Vietnamese fishers would pool their money to buy a boat, then loan money to others, Bui said. Soon, her father had his first boat with a partner. Then he owned it outright.

After learning English, Bui became a liaison for her parents, then her community. She would translate from the time she was in elementary school, and by the time she was 13, she was meeting the family's accountant to do their taxes.

After she graduated from LSU with a degree in biological sciences, Bui worked in Intracoastal City on the dock owned by her husband's family, helping them run their business buying shrimp and selling it to the processors.

There Shirley first met her and tried to recruit her to work for Sea Grant and the AgCenter to help with the Vietnamese fishing community.

"For him it was hard," Bui said. "He didn't know the language. He has been around for a while, but the Vietnamese folks didn't really understand what extension was."

Some Vietnamese fishers didn't trust that the Sea Grant and AgCenter agents were there to help, Shirley said.

"The government in Vietnam was there to regulate them and, in many ways, extort money from them," he said.

A year or so after Shirley first recruited her, in 2007, Bui became an extension agent with the AgCenter and Sea Grant. She was six months' pregnant, and, at first, she was the sole female Sea Grant agent.

"I wasn't your normal extension agent," Bui said. "But I was hired to work with a nontraditional group to begin with."

Bui was more than just a translator, Shirley said. She knew how to reach across the cultural divide. When she first began organizing meetings, Bui would call her father to ask advice. He would tell her, for example, how to first approach a respected elder and allow him to spread the word. That was the key to getting others to attend meetings.

Bui also understood the fishing community's inclination to stay quiet and refrain from questions.

"They came from a time when there was a war, and if you were too outspoken, you probably didn't live," she said. "It was a survival mechanism that you couldn't be too vocal."

Bui has served on the Coast Guard's Commercial Fishing Vessel Safety Advisory Committee and helped eliminate barriers to safety. She helped create safety materials for the Vietnamese community, teaming with other agencies and a university in Texas and teaching hands-on safety classes with a simulator — a boat cabin where crews can practice signaling other vessels. She also learned that many of the crew members were uncomfortable making mayday calls in English, so she created drill programs to practice.

After the 2010 Deepwater Horizon oil spill in the Gulf, Bui stayed on the radio, helping crews know what latitudes and longitudes were closed to

fishing. Also, she and Shirley organized the first meetings for fishers after the spill.

"She's not just an asset to the Vietnamese fishermen," Shirley said. "The Anglo fishermen really appreciate her efforts."

But she has also helped the Vietnamese fishing community communicate with the government and researchers. They have decades of experience on the water both in Vietnam and Louisiana, Bui said, and she is learning from them and passing that knowledge on.

"They may not have education, but they definitely know a lot about fishing that sometimes doesn't get captured in books," Bui said.

Bui is learning more every day. She is finishing her thesis for a master's degree in fisheries management at LSU.

While Bui never considered becoming an extension agent growing up, she said her family is proud of the work she does.

"My dad always told me it didn't matter what I did as long as I was some good to society," she said.

"I may not be a doctor, lawyer or engineer, but I was a member of the community. As a younger person in the community, I'm respected. My job with Sea Grant has solidified that role."

Kyle Peveto is an assistant communications specialist with AgCenter Communications and assistant editor of Louisiana Agriculture.



LSU AgCenter and Louisiana Sea Grant fisheries agent Thu Bui, left, provided Vietnamese translation for members of a Coast Guard rescue team demonstrating rescue techniques at the 2015 Louisiana Fisheries Forward Seafood Summit in Houma, Louisiana. Photo by Bruce Schultz

Fisheries agents protect and defend Louisiana's fishing industry

Bruce Schultz and Kevin Savoie

For the past 50 years, Louisiana Sea Grant has played a vital role in the coastal community, assisting with its expertise in the marine environment and helping the seafood industry maintain its essential role in the state's economy.

Stationed on the coast and working directly with the fishermen are eight Sea Grant and LSU AgCenter fisheries agents. One of these agents is Kevin Savoie, headquartered in Cameron Parish. Among his activities are helping the fishing industry find buyers for seafood, as well as assisting with programs to make their work safer and more efficient with technology transfer.

"It's really about helping the local community find a better way to do things," Savoie said.

Finding buyers comes about with phone calls, or with a website (louisianadirectseafood.com) and the Cameron

Direct Seafood Facebook page to let the public know about a shrimper with a fresh catch available for sale. Savoie said buyers of Cameron Parish seafood come from as far away as Illinois, Las Vegas and Miami, Florida.

Savoie works with freshwater and saltwater fisheries, so one morning he may be helping a crawfish operation and then later give suggestions to a shrimper.

Savoie said the four main goals of Louisiana Sea Grant are a healthy ecosystem, sustainable fisheries, a resilient coastal community, and environmental literacy and workforce development. Working in partnerships with federal, state and local governmental agencies, Sea Grant has helped with several programs.

Here is Savoie's account of what he does to benefit Calcasieu and Cameron parishes:

WE HELP LOUISIANIANS 'FIND BETTER WAYS TO DO THINGS'

HURRICANE RITA RECOVERY

In September 2005, Hurricane Rita made landfall at the Louisiana/Texas border, dealing a mighty blow to southwest Louisiana and devastating Cameron Parish. The 125-mile-per-hour winds and 10-foot storm surge left Cameron's infrastructure in shambles.

Businesses were heavily damaged, including the seafood industry. Landing docks, ice plants, fuel docks and many vessels were destroyed. Sea Grant worked on a state, federal and private corporate level to assist in getting the seafood industry back on its feet. Shell Oil donated ice machines to be placed at strategic locations across the Louisiana coast to provide ice to the seafood industry, one of which was located in Cameron.

Louisiana Sea Grant was instrumental in forming the Louisiana Seafood Industry Recovery Coalition, which petitioned the Louisiana Recovery Authority for funding. They were successful and received \$20 million for seafood recovery projects across the coast. The Cameron Fisheries Project

received the largest grant award and built a state-of-the-art landing and processing facility to produce high-quality and safe seafood products.

Also after the hurricane, Louisiana Sea Grant partnered with local commercial and recreational fishermen to mark and map debris scattered into Calcasieu

Lake by Rita. GPS technology was used to locate items, and much of the debris was removed from the waterway.

NATURAL FISHERIES

The spotted sea trout, or speckled trout, is one of the most sought-after fish species in coastal Louisiana.



Kevin Savoie is one of eight Sea Grant/AgCenter fisheries agents located along the Louisiana coast. Photo by Bruce Schultz



Damage in Cameron Parish after Hurricane Rita hit the coast in 2005. Photo by Kevin Savoie



Louisiana Sea Grant has worked with fishermen in Calcasieu Parish to make the oyster industry more profitable and sustainable. Photo by Kevin Savoie

Calcasieu Lake is a mecca for anglers seeking to land a trophy-sized spotted sea trout in Louisiana. In a series of educational meetings with recreational and charter fishermen, a common theme arose about how old were these big (25 inches and longer) trout and where they go in summer.

The Louisiana Department of Wildlife and Fisheries database did not have much information about these large trout because sampling methods excluded them. Sea Grant partnered with the Louisiana Department of Wildlife and Fisheries to recruit volunteer anglers and charter fishermen to try to answer the questions.

The volunteer anglers were trained to measure the fish and remove otoliths, a hearing/sensory bone in the fish's head used to age the fish. Through this volunteer effort, 254 fish longer than 25 inches were submitted. Prior to this, there were 128 in the database. These fish were discovered to be 3-9 years old, with the majority between 4 and 7 years.

The second question was: Where do these fish go at certain times of the year when anglers struggle to catch them? Do they leave the system and go offshore? An acoustic tagging research project was initiated through a partner-

ship with Wildlife and Fisheries, the LSU Coastal Fisheries Institute and Louisiana Sea Grant. The two-year study began in May 2007, and 120 adult spotted sea trout were implanted with acoustic transmitters. An array of 50 receiver buoys was deployed throughout Calcasieu Lake and the ship channel to track their movements. The study showed movement was different for males and females and varied according to seasonal changes, with few fish ever leaving the estuary.

We also will be working on a study of flounder in the Calcasieu Lake area.

Calcasieu Lake's oyster industry has gone through many changes over the years. It is a valuable fishery to local folks who rely on it for income through the winter months. Louisiana Sea Grant has worked with this industry to make it more profitable and sustainable. In partnership with the Cameron Parish Police Jury, the Calcasieu Oyster Task Force was formed to give the local oyster industry a voice on management issues such as season dates and sack limits. Through these efforts, the quality of oysters coming from Calcasieu Lake has drastically improved. Over the past 15 years the average price per sack has increased from \$12-\$14 to \$35-\$40 per sack.

GIANT SALVINIA MANAGEMENT

The invasive species giant salvinia is listed among the most noxious invasive aquatic weeds in the U.S. Under the right conditions it can double in size every five to seven days. It has spread across the state and in the past five years was found in every watershed in Louisiana. It can grow to form thick mats, which clog drainage and block sunlight, thus reducing productivity of waterways and marshes for fish and wildlife habitat.

The giant salvinia weevil, which is reared in nursery ponds and released into existing stands of giant salvinia, has become established in areas of Cameron and Calcasieu parishes and other areas of the state to control the spread of the floating weed, restoring habitat for fish and wildlife and ensuring proper drainage. Sea Grant has worked with Cameron Parish landowners and LSU AgCenter researchers to monitor weevil populations and the recovery of habitat.

Bruce Schultz is a writer and photographer with LSU AgCenter Communications. Kevin Savoie is the Louisiana Sea Grant/LSU AgCenter agent in Cameron and Calcasieu parishes.

Reviving the Soft-Shell Blue Crab Industry

Carol Franze and Julie Anderson Lively

The commercial blue crab industry in Louisiana lands 40 to 50 million pounds, reflecting about \$50 million to \$60 million annually. Soft-shell blue crab is a value-added subsection of the larger commercial crabbing industry done at shedding facilities across the coast. Shedding crabs in Louisiana dates back to the late 1800s, and production increased steadily in the 1930s and 1940s, historically producing about half a million pounds of meat annually, predominantly for restaurants.

A soft-shell crab is produced by taking advantage of a crab's life cycle. To grow larger, crabs must molt or shed their old shells. Based on a color change on the edge of the back fin, crab fishers and shedders can tell how close a crab is to molting. Peelers or busters are hard-shell crabs getting close to shedding. At shedding facilities, peelers are held in tanks until they molt. To shed the old shell, a crab swells with water and busts the old shell along the back edge of the shell. The crab then wiggles out through the back. The new shell has already formed and is about a third larger, but it is still soft. The crab will remain truly soft for a couple of hours in the water. If removed, the hardening stops. Shedders must remove soft-shell crabs quickly — at all hours of the day — to prevent shell hardening.

This value-added industry sees a six-to-seven-time increase in price over hard-shell crabs. However, since the 1990s, the number of producers in Louisiana has gone from an estimated 300 to fewer than 40 today. This loss has not always been felt across the U.S. market because, increasingly, soft-shell crab production is moving away from domestic production as more and more soft shells are imported into the United States. In 2017, only about 10,800 pounds of soft-shell were produced in Louisiana.

Although part of the loss in numbers of producers can be blamed on hurricane damage to shedding facilities often located right on the water or near the coast, shedding is a full-time, round-the-clock job that can also be a deterrent for younger fishermen. The lack of generational knowledge being handed down through family shedding facilities has resulted in a need for education of a new cohort of blue crab shedders to accommodate local demand and future industry expansion. Additionally, high mortality levels are common during this stressful life event for crabs, and while 25 percent mortality is not uncommon, 100 percent mortality is a real possibility if there is a problem in the system. Peeler crabs have been harder to get as blue crab populations have been in decline over the past few years, making higher survival rates even more important.

In 2013, LSU AgCenter agents and specialists developed workshops, a portable shedding demonstration unit, a shedding video and print materials to support the education

and enhancement of crab shedders. Seven crab industry workshops have been conducted from 2013 to 2018. Each workshop is based on needs identified in the region. Topics have included crab biology, existing and new regulations, handling, shedding systems, achieving and maintaining good water quality, value-added opportunities, economics, and new research and technologies.

Historically, soft-shell crab systems were floats held off docks or on boats. Over time the industry transitioned to on-shore tank systems next to or near local waterways. These "flow-through" systems pump the local, natural habitat waters through the tanks. Good water quality is difficult to maintain in floats or flow-through systems using local waters. Large fluctuations in water temperature or salinity can cause high rates of mortality. To better maintain good water quality, a recirculating system was developed and tested in the 1980s. Today crab-shedding facilities can be located for convenience and do not have to depend on local waterways that might also be at high risk for flooding. The system's water can be maintained at a constant temperature and salinity, and excessive nutrients or toxins can be reduced.

The crab industry workshops and demonstrations have focused on running recirculated systems in a cost-efficient manner. Additionally, handling of the crabs by fishers before they enter the shedding system can play a large role in survival. Best handling practices are encouraged for the fishers to maintain high quality in hard-shell and peeler crabs. Several naturally occurring crab diseases can cause high mortality levels in shedding systems, as well as in the wild populations. Good disease management includes not throwing diseased crabs back into the local waterways and running a recirculated system to prevent spread of disease between the wild populations and shedding facilities.

AgCenter research efforts will continue under a recently awarded grant funded through the National Oceanic and Atmospheric Association, "Revitalizing and increasing resilience in soft-shell crab aquaculture." Outcomes of this research will include the following: determining the cause of increased virus mortality and providing alternatives for reducing the virus within shedding facilities; increasing the number of recirculated shedding facilities adapted to the effects of coastal natural hazards; increasing the number of shedding facilities using best management practices; and increasing production of domestic, soft-shell blue crab.

Additional outreach materials are in development, and workshops and demonstrations are being planned to help our crab shedding industry survive another 100 years.

Carol Franze is a marine extension agent in the Southeast Region, and Julie Anderson Lively is a marine fisheries specialist in the School of Renewable Natural Resources.

Crab shedders persevere as Louisiana soft-shell crab industry shrinks

Kyle Peveto

Where the gravel road dead ends into Bayou Cypremort, Daniel Edgar wanders up and down the crab tanks in a metal building to see if any crabs have busted out of their shells.

Before soft-shell crabs end up on platters or in po'boys in restaurants, the crabs shed their shells here — or at a few dozen places like it along the coast.

Crab shedders buy “busters,” as crabbers call blue crabs about to lose their shells, then they keep them in shallow tanks until they molt and lose their hard shells.

“This is a hard business,” Edgar said, picking up a slippery crab from its shallow tank.

Recently, this traditional Louisiana business has been in decline. The industry peaked in 1945 when the state produced 2.37 million pounds of soft-shells, according to sta-

tistics from Louisiana Sea Grant. In 2017 the state produced only 10,865 pounds, according to the 2017 LSU AgCenter Ag Summary.

Researchers are studying the causes of the soft-shell crab decline. Overfishing and disease are possible reasons, said Julie Anderson Lively, a Louisiana Sea Grant and LSU AgCenter fisheries specialist who monitors the industry. Or, she wonders, is the job too labor-intensive or expensive for crab shedders?

In the early 1990s, there were an estimated 300 crab shedders operating in the state, Lively said. Today Sea Grant agents know of just 40 or 50.

“I think we are in danger,” Lively said. “In the next generation or two, it could disappear.”

■ Daniel Edgar holds a box of soft-shell crabs that are kept in a refrigerator at 45 to 48 degrees. After the crabs shed their shells, they must be refrigerated until they are sold so they will not form a new hard exoskeleton.

Photo by Kyle Peveto



Lively and Carol Franze, an AgCenter and Sea Grant specialist, are working to revive the soft-shell crab industry. Since 2013, AgCenter and Sea Grant specialists and agents have led workshops focused on crab shedding to stoke interest in the industry and educate the fishers who sell crabs.

Crab shedding is a full-time job. The crabs can shed their shells at any time, and within a couple of hours they must be removed from their tanks and refrigerated before their new exoskeletons form.

For many, the soft-shell crab business is a part-time endeavor for crabbers or fishers. Some do it for extra income in retirement, while some crabbers and fishers will set up a crab shedding operation at their homes and enlist family members to help check to see if the crabs have shed their shells.

"We're seeing a lot less of the family tradition," Lively said. "A lot of soft-shell facilities, it was the grandparents who taught the parents. It has passed from parent to child."

While tough, the business has potential to pay well. A soft-shell crab is worth seven times the value of a regular blue crab, Lively said. And demand is much higher than supply. Louisiana crab shedders regularly get calls from restaurants in other states searching for soft-shells.

"They can barely keep up with their orders locally, and they're not going to mess with trying to ship things out of state when they are trying to fill things in state," Lively said.

Daniel Edgar owns St. Mary Seafood near Franklin, where he raises crawfish and buys seafood off boats at his dock. For one month a year he hunts alligators and appears in the reality television show "Swamp People" with his family.

He runs his crab shedding operation in a Quonset hut a few hundred feet from his dock. A large operation, it has room for thousands of crabs at any time. He created a system that draws fresh "city" water into a series of cinder-block tanks at the rear of the hut where bacteria and a little salt are added to create an environment suitable for crabs. That water is then piped out to the fiberglass trays where the crabs live until they molt.

Once they shed their shells, Edgar, or one of his employees, pulls the crabs and places them in coolers set to 45 to 48 degrees Fahrenheit, where they stay until they're sold. These tanks aren't as full as they once were.

"Mother Nature, she just doesn't give me the busters," Edgar said.

Edgar fondly remembers the season in 2000, when he says he would buy more buster crabs in one day than he gets in two weeks now. One day in particular stands out, Edgar says, when he bought 144 wooden crates — at 100 pounds each — of buster crabs.

"At this rate it would take me a year or two years to buy that many busters now," he said.

Blue crab populations have dropped since then, and Lively and other Sea Grant researchers are trying to figure out why.

"Is it just overfishing? We don't really think it is the result of overfishing or a result of fishing pressure," Lively said. "Fishing pressure has not changed a whole lot."

Limits on crabbing have been implemented by the Louisiana Department of Wildlife and Fisheries. In 2017, the department closed the blue crab fishery for 30 days, and the state now restricts the harvesting of immature female crabs that haven't had a chance to mate and reproduce.

"Even though fishing may not be the direct cause, it is one of the causes of mortality the state has direct control over," Lively said.

For Edgar, soft-shells are just one line of business. He keeps his operation running into the fall even as the season winds down and fewer crabs come in. Keeping his crabbers happy is important, he says. He doesn't want to quit crab shedding.

"We've been here a long time," Edgar said, "and I don't want to go out of business."

With help from the AgCenter and Sea Grant, he hopes the industry can grow again.

Kyle Peveto is assistant communications specialist with Communications and assistant editor of Louisiana Agriculture.



Daniel Edgar grabs a soft-shell crab that has recently shed its shell at his soft-shell crab facility near Franklin. Edgar has been crab shedding for three decades. Photo by Kyle Peveto



Victor "Red" Jones checks the blue crabs at St. Mary Seafood, removing any crabs that have recently shed their shells. Photo by Kyle Peveto

Only a catfish can have that name

Sea Grant and AgCenter help Louisiana industry comply with new regulations

Evelyn Watts and Thomas Hymel

Catfish is one of the iconic seafood products of Louisiana, from wild-caught to farm-raised. Historically, as with other seafood products, catfish processing had been regulated by the U.S. Food and Drug Administration. However, in 2008, Congress moved jurisdiction over catfish to the U.S. Department of Agriculture Food Safety Inspection Service. In late fall 2015, USDA/FSIS published new regulations affecting processors of catfish and other species in the order Siluriformes, which includes catfish, swai, pangasius, basa and others. This rule mandated that all catfish processors had to comply with the USDA/FSIS inspection program as of March 2016. Along with imported Siluriformes fish, Louisiana farm-raised and wild-caught catfish processors were affected by the rule. This was the first time regulation of seafood products moved from the FDA to USDA/FSIS. Processors had to comply with facility standards and inspection hours and had to document their food safety programs.

Catfish harvesters and processors had an 18-month transition period to come into compliance with USDA/FSIS regulations and facility standards. They were also required to develop and implement protocols and record keeping associated with Sanitation Standards and Hazard Analysis and Critical Control Points (HACCP) to assure the safety of the product. In response, Louisiana Sea Grant and the LSU AgCenter developed a food safety model that would assist the Louisiana wild catfish industry in developing, implementing and validating their food safety systems. Sea Grant and the AgCenter are working with Louisiana farm-raised and wild catfish processors through visits, some in conjunction with USDA/FSIS officers; establishing sanitation standards documentation and monitoring; and developing, implementing and validating HACCP.

Even though some processors participated in seafood HACCP workshops in the late 1990s, many needed an update. Sea Grant and the AgCenter created a training curriculum, adapting the National Seafood HACCP Alliance curriculum to USDA regulations. In cooperation with Louisiana Fisheries Forward program, Sea Grant and the AgCenter offered two one-day workshops for wild catfish processors. During the transition period, USDA/FSIS assigned inspection personnel to be present during all hours of operation in processing facilities. At the end of the transition period, inspection coverage was adjusted to once per production shift. Typically, processors are approved for eight-hour processing shifts. Additional

charges for inspection service outside these hours limit operations for processors that cannot afford overtime.

Marketers are required to use the correct market name on the product label. While processors are adapting to this new regulation, Sea Grant and the AgCenter are creating awareness among consumers, food service providers and distributors over proper naming of catfish. Only those catfish species historically harvested from the wild or raised in aquaculture systems in the U.S. can legally be sold or listed as catfish. The issue of substituting other fish species for domestic catfish has been a problem for quite a while. Regulations were established in Louisiana to guard against this practice since the 1990s. The USDA also regulates catfish labeling. Fish such as swai, basa and others cannot be sold in the U.S. as “catfish.” Although it is not illegal to sell swai and basa in the U.S., it is illegal to sell them as catfish. Consumers are advised to look for the USDA stamp of inspection (Figure 1) and check the common name on the label as catfish.

Since Sept. 1, 2017, full enforcement has been in place. Sea Grant and the AgCenter are playing an important role assisting the local industry to comply with USDA inspection programs.

Evelyn Watts is an assistant professor in the School of Nutrition and Food Sciences, and Thomas Hymel is a marine extension agent with the LSU AgCenter and Louisiana Sea Grant.



Figure 1. Example of USDA/FSIS stamp of inspection.

Preventing Black Spots from Appearing on Healthy Shrimp

Julie A. Lively and Evelyn Watts

Keeping the fresh look of shrimp straight out of the water faces a major challenge: melanosis or black spot. Black spot occurs when the shell on the shrimp begins turning black within hours or days after harvesting. This darkening is due to an enzyme process causing oxidation in the shrimp, just like in cut apples. It's not harmful or indicative of spoilage, but it's not attractive. This can create a problem for fishermen and processors because black spot can result in a loss of quality during inspection or simply rejection by buyers. However, black spot is preventable.

For years, fishermen have used sulfite powders, often on the boat right after harvest, to stop the blackening of the shell. However, sulfite use comes with some risks.

First, it is known to cause hypersensitivity reactions, which are especially harmful to those with asthma, and it is required to be labeled on the ingredient list for any product that includes sulfite at any point in the harvest or processing chain. Additionally, more buyers are requesting sulfite-free shrimp.

Second, it must be handled correctly. Most often, fishermen or docks will create a liquid dip for the shrimp. If the dip is not mixed to the proper concentration or the shrimp is dipped too long, shrimp could have a sulfite residue over 100 parts per million, the legal limit set by the U.S. Food and Drug Administration. Additionally, using too much powder can be hazardous for workers because hydrogen sulfite gas can be given off.

New products for black spot prevention have entered the market, but none were developed with Louisiana shrimp in mind. These new products use a 4-hexylresorcinol (4HR) formulation, a compound originally derived from kiwi fruit that does not require a statement on the package label. However, before these products could be recommended to the Louisiana shrimp industry, they needed to be tested for effectiveness, ease of use and overall quality.

LSU AgCenter and Louisiana Sea Grant researchers began working with shrimp fishermen to test two new products, EverFresh and Prawnfresh, beginning with the manufacturers' recommendations. Both products were developed for shrimp or prawn fisheries in other parts of the world and designed to be integrated easily into those fisheries. That did not mean they would work with Louisiana shrimp or climate. For example, Prawnfresh recommends a dip time 10 times longer than for sulfite (10 minutes versus one minute) and in freezing-cold, full-salinity seawater, something easy to find off the coast of the United Kingdom where the company is located but not common off the coast of Louisiana.

To test effectiveness in Louisiana, fresh shrimp were treated with these compounds and compared with sulfite-treated and untreated shrimp over 10 days to see what levels of black spot developed. Variations of the manufacturers' recommendations were also tested so the products could be swapped seamlessly into current Louisiana shrimp harvest processes. At the end of the testing, not only are the 4HR products effective, they are more effective and safer than using sulfite. While sulfite will delay melanosis three to five



The shrimp at left have developed black spot, which can occur within hours or days of harvesting due to an enzyme process causing oxidation, just like in cut apples. It's not harmful or indicative of spoilage, but it's not attractive. Black spot is preventable using a compound derived from kiwi fruit. LSU AgCenter and Louisiana Sea Grant researchers are working to develop products and procedures using this compound appropriate for the Louisiana seafood industry. Photo by Nick Haddad

days, 4HR-treated shrimp looked fresh 12 days after harvest. Researchers also tested the texture and color of the shrimp, and no differences were found.

The alternative products using 4HR can create a higher-quality shrimp product that does not contain sulfite and can be sold for higher prices and longer times by extending the shelf life. The outcome of the work is being shared directly with commercial fishermen through the Louisiana Fisheries Forward program with fact sheets, workshops and direct partnering. Consumers can now find sulfite-free Louisiana shrimp in the market. The AgCenter and Sea Grant are now working to improve the process of incorporating these products into brine- and plate-frozen shrimp.

Julie A. Lively is an associate professor in the School of Renewable Natural Resources and Louisiana Sea Grant, and Evelyn Watts is an assistant professor in the School of Nutrition and Food Sciences and Louisiana Sea Grant.



Looking over a tray of fresh shrimp at Randol's restaurant in Lafayette area, from left, graduate student Nick Haddad; Evelyn Watts, an assistant professor with the LSU AgCenter School of Nutrition and Food Sciences and Louisiana Sea Grant; and Thomas Hymel, an agent with the AgCenter and Sea Grant. They are developing ways to better package shrimp in trays sealed with plastic film using the equipment in the background. Photo by Olivia McClure

Seafood HACCP and safety programs help sustain Louisiana's communities

Evelyn Watts

Louisiana ranks second behind Alaska for domestic seafood harvesting by volume. Seafood is one of the main sources of lean protein around the world, and its consumption continues to grow annually. To guarantee the safety and wholesomeness of seafood products, state and federal agencies work together regulating the seafood industry.

Since 1996, the LSU AgCenter and Louisiana Sea Grant have led seafood processing safety programs in Louisiana. In 1997, the U.S. Food and Drug Administration Seafood Hazard Analysis and Critical Control Points (HACCP) regulation became final. This regulation mandates that all individuals engaged in seafood processing for commercial purposes must develop and implement a HACCP plan. It also requires that in each seafood processing facility, a person trained in the seven principles of HACCP must keep and review all plant records. Also in 2016, catfish inspections were moved from the FDA to the U.S. Department of Agriculture Food Safety Inspection Service (USDA/FSIS), which also requires a HACCP plan and documentation.

To assist the seafood industry in complying with regulatory requirements for seafood safety, the national Seafood HACCP Alliance provides education and training. The structure of this program is based on collaboration among federal and state food inspection officials, academic food safety researchers and educators, and various representatives from the seafood and aquaculture industry. Seafood specialists from the AgCenter and Sea Grant have played a lead role educating the Louisiana seafood industry about keeping products safe through the supply chain.

The seafood HACCP inspection regulation mandated that all seafood processors would be in compliance by December 1997. In response the AgCenter and Sea Grant offered a series of 15 workshops along the Louisiana coast, targeting shrimp, crawfish, finfish, crab and oyster industries. Most attendees were owners and managers. Following this first series of workshops, the AgCenter and Sea Grant collaborated with the FDA and the Louisiana Department of Health to continue to offer two-and-a-half-day basic seafood

HACCP workshops. Through time, plant floor supervisors and food handlers have attended as well.

In addition to developing and implementing a HACCP plan, seafood HACCP regulations require processors to monitor good sanitary conditions and practices. In 2000, the Seafood HACCP Alliance developed the one-day training curriculum "Sanitation Control Procedures for Processing Fish and Fishery Products" to assist the industry in developing and implementing sanitation control procedures. The AgCenter and Sea Grant participated with Seafood HACCP Alliance developing this curriculum, which has been offered twice a year since 2001.

The AgCenter and Sea Grant continue collaborating with the Seafood HACCP Alliance, reviewing and updating training curricula. Through the seafood HACCP and seafood safety workshops, more than 2,650 people from the state, national and international seafood industries have been reached.

Evelyn Watts is an assistant professor in the School of Nutrition and Food Sciences.

Development of Sperm Banks to Save Endangered Fishes

Yue Liu and Terrence R. Tiersch

Imagine waking up after being dormant or asleep for 42,000 years. It sounds like something from science fiction movies. However, this story turned out to be real in 2018 when worms that had been frozen for thousands of years under the ice of Siberia returned to life moving and feeding in petri dishes with the help of scientists, demonstrating the capability for long-term preservation of cells and organisms by cryopreservation.

Using similar principles of “cell time travel,” researchers at the LSU AgCenter Aquatic Germplasm and Genetic Resources Center are developing sperm banks using cryopreservation to assist in the conservation of aquatic species, including endangered fishes. Such banks are also referred to as germplasm repositories and include cryopreserved germplasm, such as sperm, eggs or embryos; a comprehensive database that contains information related to the germplasm donor, such as genetics, physical characteristics, quality of male and female cells, and habitat information; sample preparation methods; and inventory.

With appropriate freezing and thawing procedures, metabolic and molecular activities can be paused at cryogenic temperatures of minus 196 degrees Celsius (minus 320 degrees Fahrenheit) in liquid nitrogen for thousands of years and be revived with normal cellular functions. In humans, cryopreservation has been used to bank sperm and embryos and is a multibillion-dollar industry to assist reproduction. In agriculture, sperm cryopreservation has been applied for decades for genetic improvement of livestock. For example, in the 1950s the LSU Dairy Improvement Center began to cryopreserve bull sperm containing specific genetic features relevant to dairy production. In 2015, the Aquatic Germplasm and Genetic Resources Center was started at the former Dairy

Improvement Center and adopted approaches used with livestock to develop germplasm repositories to assist breeding and genetic improvement of economically important aquatic species in Louisiana, such as the eastern oyster, blue catfish and red snapper.

In addition to human reproduction and agriculture, germplasm repositories have been used to assist genetic management in conservation programs for endangered land animals, such as the giant panda, black-footed ferret and pheasants. Valuable genetic resources of imperiled animals can be preserved as cryopreserved germplasm that can be used in the future to produce live young for integration into conservation programs, such as habitat restoration, captive breeding and translocations. These activities are used to compensate for genetic losses or negative changes that would otherwise be permanent. For example, in the recovery program for the black-footed ferret, sperm were cryopreserved from six of the last 18 survivors, and 20 years later the offspring produced from thawed sperm were incorporated into the captive breeding program, enhancing genetic diversity and reducing inbreeding. In addition, cryopreservation of germplasm can be relatively safe, low-cost, fast and efficiently managed, allowing for easy transport and administration, especially compared to maintaining live animals.

The United States has about 250 threatened species of fishes listed by the International Union for Conservation of Nature. There is urgent need to save from extinction these and thousands of other imperiled fishes around the world. Unfortunately, little attention has been given to using germplasm repositories to assist conservation programs of imperiled fishes. For example, in about 86 current recovery plans of endangered or threatened fishes developed by the U.S. Fish

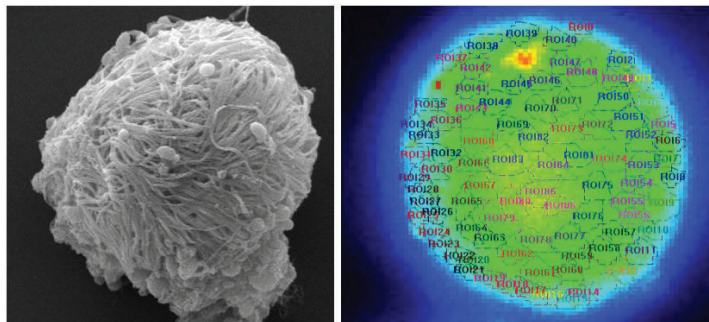


Figure 1. Sperm of live-bearing fishes are found in the male packaged into bundles (electron microscope), at left. This challenges development of cryopreservation protocols. Cell imaging techniques were used to investigate ionic signals, indicated by fluorescent colors (fluorescent microscope), at right, of sperm cells within bundles. Photos by Yue Liu



Figure 2. Live young of the endangered live-bearing redbtail splitfin produced by artificial insemination of cryopreserved sperm. The ribbon-like structures (trophotaenia) are special features of live-bearing fishes, which contribute to maternal-fetal nutrient delivery and will disappear in a few days after birth. Photo by Yue Liu

and Wildlife Service, only two mention cryopreservation, and those are limited to research purposes. AgCenter researchers have recognized the technical and strategic difficulties impeding the use of germplasm repositories in fish conservation programs and are developing techniques, approaches and facilities to address these challenges.

In the AgCenter, fishes of the family Goodeidae (considered to be among the most imperiled fishes in the world) were used as models for developing germplasm repositories for imperiled live-bearing fishes. This is especially challenging because of their unusual reproductive traits, such as bundled sperm, internal fertilization and bearing live young. Standardized methods were established for the first time to evaluate quality-related attributes of sperm bundles. In collaboration with the LSU School of Veterinary Medicine, important characteristics of sperm within bundles were identified using techniques such as computer-assisted sperm analysis and fluorescent cell imaging (Figure 1). A generalized cryopreservation protocol was developed for live-bearing goodeids, and live young of the endangered redbtail splitfin were produced with artificial insemination using cryopreserved sperm (Figure 2).

AgCenter researchers also proposed a strategy to integrate germplasm repositories into a comprehensive recovery program. In the genetic banking process, sperm of wild populations are collected, cryopreserved, stored and genetically characterized. Fish, testes and fresh sperm can be transported to well-equipped central facilities, such as the Aquatic Germplasm and Genetic Resources Center, followed by processing and freezing. Another option is on-site cryopreservation that can be performed by use of a mobile laboratory developed by the AgCenter, avoiding the loss of sperm quality during shipment. The frozen sperm and related database information are maintained within germplasm repositories and can be used for routine genetic enhancement and long-term backup or to address specific needs identified by genetic analysis. Should genetic diversity of wild populations decline in the future, previously stored genetic resources can be used through artificial insemination with thawed sperm. Offspring produced with thawed sperm can be used for future breeding purposes or be incorporated into wild populations to enhance genetic diversity.

Beyond technical expertise, one difficulty in integrating germplasm repositories with conservation programs is developing collaborations among diverse sectors and people with different objectives. An ideal conservation or recovery

program for endangered fishes should include a comprehensive approach, combining major concerns such as habitat restoration; population propagation and maintenance by captive breeding or translocation projects; and preservation of genetic diversity by germplasm repository projects. Lack of any of these can render a conservation or recovery program ineffective. Comprehensive programs require strong collaborations. For example, ecologists and legislators are needed for habitat restoration projects; reproductive biologists and hatchery managers are needed for captive breeding; cryobiologists and data specialists are needed for establishing central germplasm repositories; and conservation geneticists and administrative agencies are needed for comprehensive planning and implementation. All of these activities require dedicated funding, but such programs can better offer a chance for the future maintenance of endangered fishes.

Yue Liu is a postdoctoral researcher and Terrence R. Tiersch is a professor in the Aquatic Germplasm and Genetic Resources Center, School of Renewable Natural Resources.



Postdoctoral researcher Yue Liu opens a tank of liquid nitrogen to remove a sample of fish genetic material at the LSU AgCenter Aquatic Germplasm and Genetic Resources Center.

Photo by Olivia McClure

Roseau Cane Die-offs

Threaten Louisiana Coast

Blake E. Wilson, Madeline Gill, Ian Knight, Rodrigo Diaz, Andy Nyman and Jim Cronin

One of the most important marsh grasses along the Louisiana Gulf Coast, roseau cane (*Phragmites australis*, also known as common reed), has recently begun to suffer widespread die-offs in the Mississippi River Delta. Roseau cane is considered an invasive plant pest in many parts of the country, but in Louisiana the grass provides critical ecosystem services to the Gulf Coast. Roseau cane is an integral part of unique Louisiana marsh ecosystems, which provide abundant habitat for fish, birds and other wildlife. The cane is also important for protecting coastal infrastructure. Roseau cane has extensive root systems that hold large amounts of sediment in place, helping reduce coastal erosion and maintaining economically important shipping lanes. The above-ground cane can absorb substantial amounts of wave energy, reducing the effects of storm surge on coastal communities and oil and gas industry structures.

Roseau cane has historically been considered one of the toughest grasses along the coast because of its ability to tolerate a range of salinities, water depths and temperatures that would be unsuitable for other marsh plants. However, die-offs of roseau cane observed in the Mississippi River Delta have raised concerns among local communities and national industries that depend on the coast (Figure 1). The die-offs result in conversion of healthy stands of roseau cane into open water or allow for expansion of invasive aquatic plants, including elephant ear and alligator weed. The effects of the die-offs are immense in scale, and the change in land cover can be seen from satellite images covering hundreds of thou-

sands of acres (Figure 2). As of 2018, the die-offs are confined to the Mississippi River Delta, but if the problem expands, it could threaten roseau cane along the entire Gulf Coast from Texas to Florida.

WHAT IS CAUSING THE DIE-OFFS?

The direct cause of roseau cane die-offs remains unknown. Reports of brown roseau cane were first made during the fall of 2016, and die-offs were observed to be associated with a scale insect. The scales were identified as roseau cane scale, or *Nipponaclerda biwakoensis* (Figure 3), a new invasive species that originated in China and Japan. The scales are known to infest roseau cane in China, where the cane is grown for paper production, but how and when it arrived in Louisiana is unclear. The scales remain attached to the cane stalks, feeding on liquids in plant tissues for most of their life cycle. Only the newly hatched nymphs, called “crawlers,” are mobile and capable of dispersing to new host plants.

The effect of scale feeding on roseau cane health is not well understood, but the high population densities and the discovery of the scales coinciding with die-offs suggest the scales are contributing to the die-offs. Roseau cane die-offs occurring in Europe were found to be the result of several contributing factors, including pollution, changes in water quality, pathogenic fungi or bacteria. Insects and numerous other influences also may be involved.



Figure 1. Roseau cane stand affected by the die-off in Plaquemine Parish. Photo by Louisiana Department of Wildlife and Fisheries

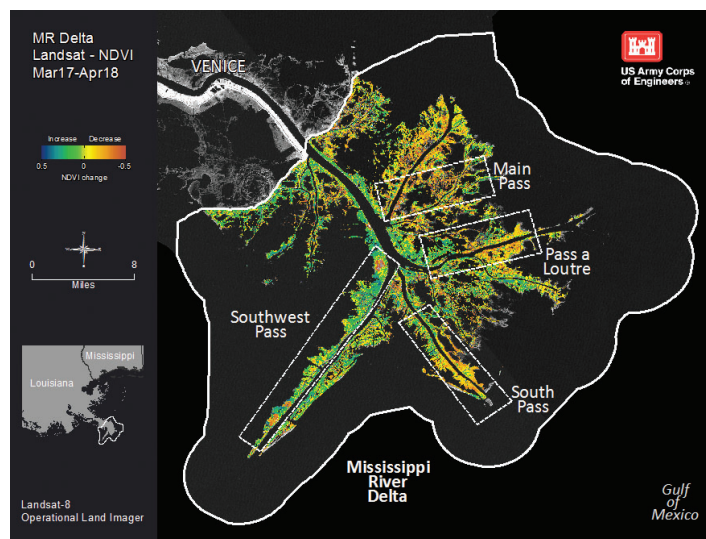


Figure 2. Satellite image depicting changes in the normalized difference vegetation index (NDVI). Orange-red coloration indicates areas where vegetation is receding. Image provided by U.S. Army Corps of Engineers

WORKING TOGETHER TO FIND A SOLUTION

The roseau cane die-offs have attracted attention from numerous local, state and national agencies because of the potential for the problem to disrupt economically important coastal industries, including fisheries, oil and gas resources, and international commerce associated with the Port of South Louisiana. LSU AgCenter scientists are working with the Louisiana Department of Wildlife and Fisheries, the Louisiana Department of Agriculture and Forestry, the Coastal Protection and Restoration Authority and local governments. They also are receiving federal support from the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service. Even private citizens concerned about the health of Louisiana marshes are getting involved with the research efforts. The team of researchers includes entomologists, geneticists, wetland ecologists, plant pathologists and coastal scientists who are working together to better understand the problem.

One solution may lie within roseau cane itself. The Mississippi River Delta is a hotbed of roseau diversity, with numerous varieties of the cane interspersed. Some of these varieties are less affected by the die-offs and may allow for restoration of areas where die-offs have occurred. Ongoing research is examining genetic differences among roseau varieties to determine which traits may be contributing to the resistance to die-offs. Natural enemies of the roseau cane scale are also helping mitigate the problem.

Another insect from China, which was likely introduced along with the scale, is the parasitic wasp *Neastymachus japonicus*, which lays its eggs within the scales (Figure 4). The larvae develop inside the scales, killing their host and emerging as new parasitoid wasps. Entomologists are examining the potential to improve the efficiency of these wasps in controlling the scales.

Control of the scale with insecticides is also being investigated. While this approach could rapidly reduce scale infestations, caution must be used to avoid causing unintended environmental effects. AgCenter scientists are working to identify chemical control strategies that are effective in

suppressing scale infestations while posing minimal risk to the ecosystem. Additional studies are examining potential for the roseau cane scale to attack other grasses, including rice, sugarcane and corn, as well as native marsh plants. Physical factors, including salinity and prolonged exposure to above-average water depth, may be contributing to the decline of roseau cane health. Characterization of chemical and physical properties of marsh soils also is being conducted.

The roseau cane die-offs are continuing to affect large swaths of coastal marshes, and the situation has not shown any signs of improving since the problem was first discovered in late 2016. While research efforts are just getting underway, multiagency and multidisciplinary cooperation among researchers aims to attack the problem from all sides. The number of scientists involved in the project continues to grow as public awareness of the dilemma increases. Teams of scientists are now striving to find answers and protect the coast before this problem expands.

Blake E. Wilson is an assistant professor, Madeline Gill is a research associate, Ian Knight is a postdoctoral associate and Rodrigo Diaz is an assistant professor in Department of Entomology. Andy Nyman is a professor in the School of Renewable Natural Resources. Jim Cronin is a professor in the LSU Department of Biological Sciences.

Scale Sightings: Citizen scientists help map invasive insect distributions along the Gulf Coast

Madeline Gill

The LSU AgCenter conducted a survey-based citizen science project in the summer and fall of 2017 to expand knowledge of the distribution of the roseau cane scale in south Louisiana. The survey was accessible through the AgCenter website and included information such as coordinates of roseau cane sites, scale recognition tips and articles on cane health.

Contributors were able to submit photographs used for verification and were encouraged to send leaf samples from visited sites to be used for genetic identification of cane varieties. Contributors included employees from state and federal agencies, collaborators from other states, interested citizens and landowners familiar with the ecologic importance of roseau cane.

These survey efforts continue through 2018 as researchers hope to expand distribution knowledge further east and west along the Gulf Coast to better assess the effect of the roseau cane scale. Citizens interested in contributing to the survey can obtain more information online at <http://bit.ly/2BYmDiQ>.



Figure 3A. A close-up of the invasive roseau cane scale *Nipponaclerda biwakoensis*. Photo by Rodrigo Diaz



Figure 4A. The parasitoid wasp *Neastymachus japonicus*, which was introduced along with the scale. Photo by Rodrigo Diaz

Multistate team investigates roseau cane decline

Tobie Blanchard

LSU AgCenter researchers along with scientists from multiple agencies are collaborating to investigate the decline in health of roseau cane, a vital marsh grass in the lower Mississippi River Delta.

Earlier this year, Congress directed the U.S. Department of Agriculture Animal and Plant Health Inspection Service and Agricultural Research Service to work with stakeholders to develop a pest management program for control of the roseau cane scale infestation in the delta. This additional funding allowed research efforts to expand into plant pathogens, soil health, and plant and insect genetics.

With support from the Louisiana Legislature, AgCenter coastal ecologist

Andy Nyman will use remote sensing to measure roseau cane health in the marsh, and Ehab Meselhe, vice president for engineering with the Water Institute of the Gulf in Baton Rouge, will model the potential impact of die-offs on navigation dredging in the lower delta.

Nyman said his goal is to determine when roseau cane first began to die off and how much of it has died and not replaced itself. He will conduct field work in the marsh to accurately verify what is out there. He will also use satellite imagery taken over time to measure if green vegetation is in the area and if die-offs happen over time.

AgCenter entomologist Ian Knight said different varieties of roseau cane

have varying levels of susceptibility to the scale. A delta variety and a European variety of roseau cane are two types that grow in Louisiana marshes. Preliminary data has shown the delta variety is more vulnerable to the scale.

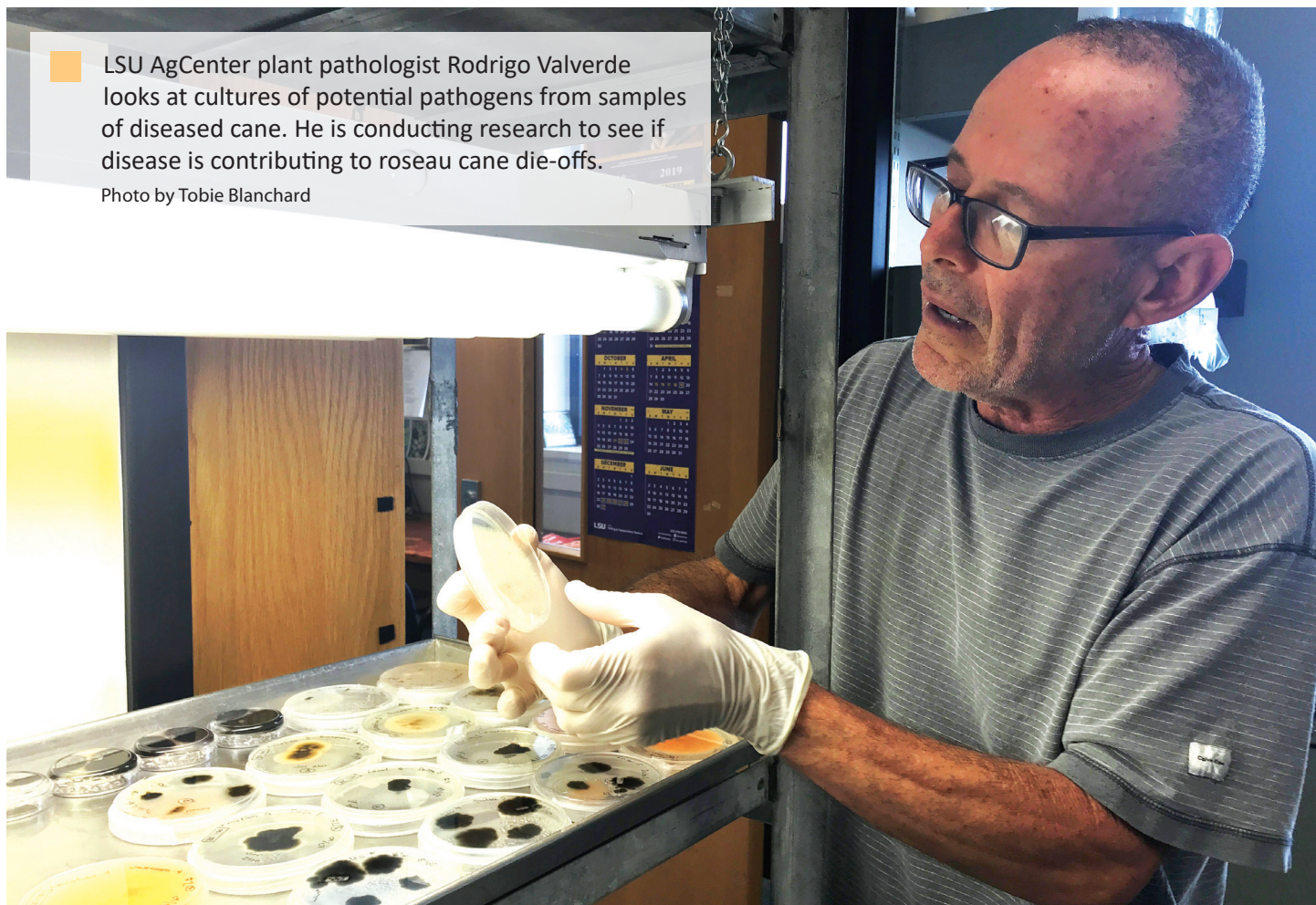
"The European variety doesn't seem to exhibit die-off symptoms as severely," Knight said.

Knight is providing Laura Meyerson at the University of Rhode Island with cane samples so she can study the genetic characteristics of the Louisiana varieties of roseau cane. In addition, Scott Schneider at the USDA-ARS in Beltsville, Maryland, will be studying the genetics of the roseau cane scale.

Jim Cronin, a professor in the LSU Department of Biological Sciences,

LSU AgCenter plant pathologist Rodrigo Valverde looks at cultures of potential pathogens from samples of diseased cane. He is conducting research to see if disease is contributing to roseau cane die-offs.

Photo by Tobie Blanchard



suspects multiple stressors could be affecting roseau cane health. He is studying soil chemistry in the marsh to see if cane die-off may be caused by toxic chemicals in the soil.

"We will compare soil chemicals from where it's died off to areas where it is healthy," Cronin said.

With the sediments and chemicals that come down the Mississippi River and are deposited into the marshes that make up the lower river delta, phyto-toxic properties could be found in the soil. Cronin plans to analyze samples

from locations across coastal Louisiana to look for patterns in areas of die-off.

AgCenter plant pathologist Rodrigo Valverde also believes that more than one culprit is affecting the cane health. He is looking at the die-offs from a plant pathogen perspective.

"We are going to the affected areas, collecting samples of diseased plants and bringing them to the lab," Valverde said.

Valverde is isolating potential pathogens from the plants he collected and is growing cultures of some of

them. His plan is to inoculate healthy roseau cane with the pathogens to see if they are causing disease or death.

The LSU AgCenter roseau cane website, www.lsuagcenter.com/roseaucane, offers information on die-offs, research and scale recognition.

Tobie Blanchard is the assistant director of LSU AgCenter Communications and the communication coordinator of the LSU College of Agriculture.

Study finds roseau cane scale has not attacked crops or grasses

Tobie Blanchard

LSU AgCenter scientists conducting research on roseau cane scale, an insect that may be causing die-offs of roseau cane in marshes along the Louisiana coast, said a recent study showed this insect has not attacked commercial crops or marsh grasses important to Louisiana.

Leslie Avilés, an entomology graduate student, conducted greenhouse and field studies on 17 types of grasses, including sugarcane, corn, rice, sorghum, smooth cordgrass and California bulrush, and found that the scale was not a threat to these grasses and appears to be restricted to roseau cane.

Avilés planted stems from each individual grass in containers and added a stem of roseau cane heavily infested with the scale and tied the stems together. She also included scale-free roseau cane in a container with infested cane as the control.

After a month she checked the stems for infestations and found crawlers, which are the first generation of the scale, on bulrush and cordgrass. The crawlers had attempted unsuccessfully to settle on those native grasses but did not mature into adulthood. No crawlers were found on the commercial crops.

Avilés also went to the mouth of the Mississippi where heavy infestations are found to see if the scale was infesting native grasses in the marsh.

"We found native grasses growing next to heavily infested roseau cane," Avilés said. "We

peeled back hundreds of samples from several species of marsh grasses and searched for the scale but didn't find any."

These results are good news for Louisiana farmers and for the Louisiana Department of Wildlife and Fisheries, which uses smooth cordgrass and bulrush in coastal restoration projects.

Tobie Blanchard is the assistant director of LSU AgCenter Communications and the communication coordinator of the LSU College of Agriculture.



Leslie Avilés, and LSU graduate student in entomology, inspects roseau cane that is part of an experiment she conducted at a greenhouse on the LSU campus. She was looking to see if roseau cane scale, a pest that infests the cane, would spread to commercial crops or marsh grasses. Photo by Tobie Blanchard

AgCenter Research Aims to Boost Louisiana Alligator Industry

Robert Reigh

Alligator aquaculture ranks among the top five animal enterprises in Louisiana, with a current farm-gate value exceeding \$82 million annually. While alligator farmers share many concerns common to livestock producers in general, alligator aquaculture presents a unique set of challenges. Unlike other types of livestock production, alligator farmers draw their farm stock from the wild under permitting authority of the Louisiana Department of Wildlife and Fisheries, which employs an extensive research and management program to ensure the well-being and sustainable use of Louisiana's wild alligator populations. Farmers collect more than a half million eggs annually from wetland habitats for which the Department of Wildlife and Fisheries has set egg-harvest quotas. A majority of these wetlands are privately owned. Farmers establish lease agreements with landowners to collect eggs during the May-June alligator nesting season, which produces income for the landowner and incentive to maintain marginal land as wetland habitat for alligators.

Eggs collected in the wild are transported to farms and incubated under controlled conditions to produce hatchlings for grow-out (Figure 1). Because eggs are available only once per year and collection costs are high, it is important to maximize egg-hatching success and optimize growth of each alligator-year class to maintain farm productivity. At present, however, there is limited science-based information on best practices for alligator husbandry, including optimal conditions for egg incubation and nutritional requirements for optimal growth.

Recent studies at the LSU AgCenter Aquaculture Research Station have focused on improving alligator feeds to increase nutrient utilization and allow greater cost control through use of alternative ingredients. Experiments have evaluated different protein concentrations and compositions in alligator diets; measured protein digestibility, energy digestibility and essential amino acid availability of ingredients of plant and animal origin; and tested plant-based diets to deter-



mine the value of plant products as substitutes for animal products in compounded feeds. Results have demonstrated that a nutritionally balanced feed containing up to 80 percent plant products — including soybean meal, wheat gluten and yellow corn — can be effectively used by alligators without negative effects on health or body composition.

Information on the efficiency with which alligators utilize nutrients in a variety of feedstuffs expands the range of ingredients producers may select to optimize dietary nutritional balance and product cost. Digestibility studies with a growing list of ingredients have been underway for years and will continue indefinitely as the nutrient-availability database expands. Knowledge of minimum dietary requirements for essential nutrients, all of which are unknown for alligators, is also necessary to truly optimize diet formulations. A study in progress at the Aquaculture Research Station is investigating requirements for lysine and methionine, two critical dietary-essential amino acids, as a first step in providing this information.

Also of interest are effects of incubation conditions on egg-hatching success and identification of husbandry practices that negatively affect skin quality. Recent incubation studies have shown that maintaining oxygen concentrations above the normal 21 percent level in air does not improve egg-hatching success. However, relative humidity is a critical factor affecting embryo development (Figure 2). Humidity of approximately 90 percent appears to be optimal.

A study in progress is investigating whether high-oxygen, or hyperoxic, incubation conditions promote faster closure of the umbilicus, the site of egg-sac attachment on a developing embryo (Figure 3). Failure of the umbilicus to close properly after a hatchling emerges from the egg creates a scar, which can significantly reduce the value of an alligator skin at harvest. Anecdotal evidence suggests hyperoxic conditions during embryonic development might reduce scarring, but this remains to be proven. Other skin-quality problems also are being investigated to determine causes and solutions, including possible nutritional or environmental factors that contribute to these costly conditions.

The AgCenter alligator research program is developed annually with input from an advisory group of farmers, Department of Wildlife and Fisheries personnel and private industry stakeholders. The goals of the program are to address the practical research needs of farmers involved in one of Louisiana's major livestock industries while providing fundamental new information on the biology of the American alligator.

Robert Reigh is a professor and director of the LSU AgCenter Aquaculture Research Station.



Figure 1. Alligator hatchling emerging from an egg. The number on the shell identifies the clutch (nest) from which the egg was collected. Lines mark the area where the embryo was attached to the shell at time of collection. Eggs must remain upright until hatched. Photo by Robert Reigh



Figure 2. Eggs that failed to hatch due to below-optimum humidity during incubation contained embryos in a range of developmental stages. Photo by Robert Reigh

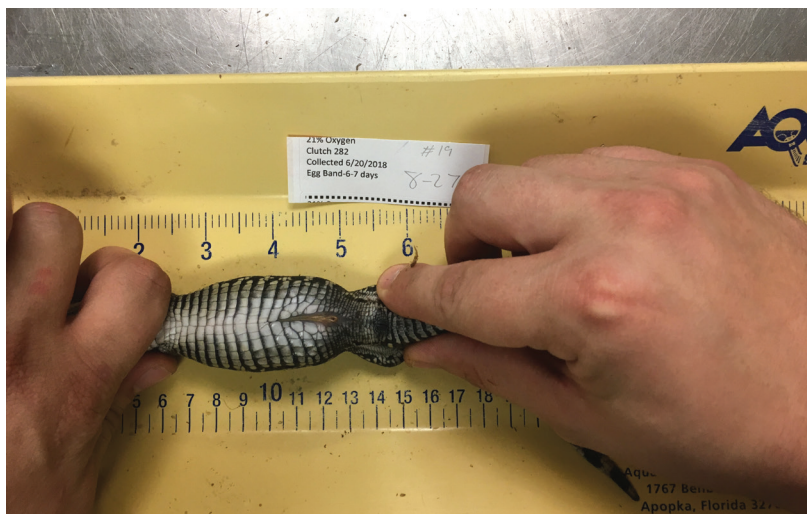


Figure 3. Incomplete closure of the umbilical opening will produce a scar on the belly skin at harvest. Photo by Millie Williams

Understanding growth, mortality of Louisiana oysters helps ensure sustainability

Megan K. La Peyre and Jerome F. La Peyre

Louisiana remains one of the largest U.S. suppliers of oysters, producing, on average, more than 34 percent of U.S. landings, a value of more than \$68 million in 2016, according to the Louisiana Department of Wildlife and Fisheries. The oyster industry represents an integral aspect of Louisiana culture and coastal ecosystem. The reefs formed by oysters also provide valuable fish habitat, protect shorelines from erosion and may help in improving water quality.

With multiple natural and man-made disasters, combined with ongoing large-scale re-engineering of coastal Louisiana, oyster populations and the industry dependent on them have faced dramatic fluctuations. While Gulf Coast oyster populations are known for their high ability to settle as larvae onto the substrate (recruitment) and rapid growth rates, often reaching market size within less than 18 months, variations in growth and mortality can have significant effects on oyster production. Understanding the growth and mortality rates of oysters and how they change with environmental conditions are critically important in ensuring the long-term sustainability of oyster populations and are necessary for developing realistic management models and predicting future restoration and climate-related effects.

“ Louisiana produces more than 34 percent of U.S. landings of oysters, a value of more than \$68 million in 2016. ”

For the past 15 years, research conducted through the LSU AgCenter School of Renewable Natural Resources and School of Animal Sciences has quantified the effects of changing coastal conditions on eastern oyster growth and mortality. Measuring growth and mortality rates of individually tagged oysters either placed in the field or exposed to controlled changes in salinity and temperature in the laboratory has demonstrated that Louisiana oysters are most sensitive to lowered salinities when water temperatures are high – above 86 degrees Fahrenheit. This response varies over an oyster’s life. Newly recruited oysters less than three months old were more tolerant of low-salinity and high-temperature conditions, while larger market-size oysters experienced

significant mortality at high temperatures and even greater mortality when low salinity levels coincided with the high temperatures.

Given that Louisiana estuaries normally experience high variations in salinity throughout the year, the researchers further examined how exposure to short versus long periods of lowered salinity might affect oyster growth and mortality. Overall, Louisiana oysters were relatively tolerant to short low salinity events, particularly during spring and winter time periods, although growth rates were decreased.

Explicitly examining growth and mortality using Louisiana oyster populations provides critical data because these populations appear to be more tolerant of low salinity and high temperature compared to Atlantic Coast populations of the same species. Recent analysis of 40 years of Louisiana Department of Wildlife and Fisheries monitoring data from public oyster reefs, with collaborators at the University of New Orleans, the School of Renewable Natural Resources and LDWF, showed that the optimal combinations of temperature and salinity where Louisiana oysters experience maximum net growth are skewed toward lower salinities and higher water temperatures that were used in oyster models. Outside of that optimal range, oysters experience increased mortality and reduced growth.

Having a realistic understanding of how Louisiana oyster populations respond to environmental conditions enables development of models to predict the effects of harvest, restoration and climate on riverine inflow and weather events. Most recently, these data were used to develop an energetic budget model of the eastern oyster that incorporated salinity for the first time. This model may now be used to assess potential management, restoration and climate scenarios on oyster growth within coastal Louisiana, providing a useful tool to inform decisions.

Current work is examining the reproductive stage of oysters. Reproductive capacity and recruitment of oysters remains the missing piece of the puzzle. School of Renewable Natural Resources researchers are examining oyster recruitment, survival and growth at different water depths within southeast Louisiana waters. Data from this project will provide insight into how changes in hydrology (salinity, water depth, turbidity) may influence oyster recruitment and their subsequent survival and growth to adult size. This work, combined with efforts to assess reef reproductive capacity, will provide some means to fully understand and model the effects of changing environmental conditions on oyster population sustainability.

These data help refine the growth and mortality models used to ensure sustainable reefs for long-term harvest and ecological function, benefiting not only the oyster and its associated ecological role but also the oyster industry.

Megan K. La Peyre is with the U.S. Geological Survey, Louisiana Fish and Wildlife Cooperative Research Unit and is an adjunct professor in the School of Renewable Natural Resources; and Jerome F. La Peyre is a professor in the School of Animal Sciences.

Genomic Variation and Local Adaptation Among Natural Stocks of Eastern Oysters in Coastal Louisiana

Morgan Kelly and Jerome La Peyre

Louisiana's eastern oyster fishery is the largest in the nation, yielding nearly 5.5 thousand tons worth more than \$68 million in 2016. However, recent years have signaled trouble for this culturally and economically important fishery, with sharp declines in some areas in the natural production of juvenile oysters, called spat. One reason for these declines may be changes in the amount and timing of freshwater inputs into Louisiana estuaries. Oysters thrive in habitats where fresh water from the land mixes with salt water from the ocean. Too much seawater brings disease and predators, while too much fresh water can stop oysters from feeding and reproducing. Prolonged fresh water may even lead to death, especially for sensitive juveniles. Increasingly, diversions and large rain storms are bringing large pulses of fresh water to Louisiana oyster reefs, potentially threatening their survival.

In a Louisiana Sea Grant-funded project, LSU researchers are seeking to understand the effects of increased fresh water on oysters in Louisiana. In particular, they are trying to understand how fresh water might affect some populations differently than others. Every oyster, just like every human, is genetically unique. Each oyster's unique genetic makeup affects how it handles stress, with some handling it better than others. The researchers hypothesized that oysters from habitats with a long history of low salinity might already be

better adapted to those conditions. To test this, they collected stocks of oysters from three sites: Lake Calcasieu (relatively high salinity), Sister Lake (mid salinity) and Vermilion Bay (low salinity). These stocks were spawned at the Louisiana Sea Grant Hatchery in Grand Isle, and juvenile oysters from all three parental stocks were placed back in the wild at high-, mid- and low-salinity sites for one year. Researchers monitored the oysters every couple of months, measuring their growth and checking for mortality and disease. Meanwhile, they took tissue samples from four oyster populations to the lab to sequence their DNA and test for genetic differences among populations. They found that oysters from different stocks do indeed differ in their growth rates, mortality and susceptibility to disease. They also identified several genes that differ among populations and may be responsible for their differing growth rates and disease resistance.

Results from this project will have important applications to management and conservation of Louisiana oysters. As conservation efforts move toward hatchery production and restoration, this research will help managers identify parental stocks most resistant to disease and those best suited to out-plant sites with differing levels of fresh water.

Morgan Kelly is an assistant professor of biology at LSU, and Jerome La Peyre is a professor in the School of Animal Sciences.



Graduate student Joanna Griffiths prepares to measure sizes of oysters from a field experiment. Photo by Hollis Jones



Graduate student Hollis Jones prepares to take tissue samples from oysters. Photo by Morgan Kelly

Reducing Carcinogens in Tanned Alligator Skins

Ioan I. Negulescu

Several Louisiana alligator products are at risk of missing out on the European market because of carcinogenic compounds used in the tanning process. European Union restrictions on hexavalent chromium in leather items affect many alligator skins tanned both in Louisiana and abroad, according to an analysis of these skins by researchers in the LSU AgCenter Department of Textiles, Apparel Design and Merchandising.

The Louisiana alligator industry is a multimillion-dollar business in Louisiana, with more than 300,000 wild and farm-raised American alligators (*Alligator mississippiensis*) harvested each year. Farm-raised alligators are the second-largest segment of the state's aquaculture industry, worth \$82 million in gross farm value in 2017, according to the LSU AgCenter Ag Summary. Combine other alligator-related businesses, and the state's alligator industry is likely worth \$100 million a year, the Louisiana Department of Wildlife and Fisheries Alligator Management Plan Annual Report estimates.

While Louisiana leads the nation in the production of alligator skins, less than 10 percent of all alligator skins produced in Louisiana have been tanned in recent years. Most skins are tanned in Europe or Asia.

Tanneries convert the raw, stiff, horny Louisiana alligator skins into supple, workable, long-lasting leather. The skins arrive salted from the suppliers, and the first process is beaming — cleaning, removing the salt and rehydrating the skins. Next, in a process called liming, the scales, nails, mucins, and natural greases and fats are removed. Then the skins are delimed and pickled in an acid bath to remove bone calcium so the alligator skin becomes more pliable. After pickling, the treatment with chromium salts will render the skin durable and resistant to the elements.

In the finishing operations the leather is re-tanned using vegetable-based products so that the tough skin from the initial tanning process is made supple. The leather is then dyed and shaved down to the thickness and weight needed for

the application — clothing, boots or luggage, for example. Then the leather is finished with seasons and protective coats to feel and look nice.

The alligator skin's fibrillary structure makes it fashionable for textile design applications. The alligator leather is ready to be delivered to the manufacturer, where it is turned into the finished goods, with products varying from earrings to sofas.

Chromium salts are used extensively in the leather industry as a tanning agent. Chromium may be present in the finished leather as trivalent or hexavalent cationic compounds. However, it has been proven that hexavalent chromium is toxic to humans and animals. Aquatic life is vulnerable if discharged wastewater from tanneries contains chromium. It can produce lung tumors when inhaled and readily induces skin sensitization. Hexavalent chromium is closely monitored by the U.S. Department of Health and Human Services, and in 2015, the European Union implemented restrictions on chromium-tanned leather on the European Union market. There could be negative consequences for the marketing of Louisiana alligator leather if tanned with chromium salts.

AgCenter researchers analyzed chromium levels in Louisiana alligator skins. The project used energy dispersive X-ray analysis to examine Louisiana alligator leather specimens tanned both in Louisiana tanneries and abroad in locations such as Singapore and brought back to the United States. These showed alarming amounts of chromium compounds present in the samples, proving that the alligator skins have been tanned with chromium salts. AgCenter researchers are assisting in identifying alternative chromium-free tanning procedures to aid the economic development of Louisiana's alligator industry.

Ioan I. Negulescu is the Grace Drews Lehmann Professor in the Department of Textiles, Apparel and Merchandising.



Alligator skins are processed at the Mark Staton Co. leatherworks in Lafayette Parish. A dozen employees at the company near Broussard use wild and farm-raised alligator hides to make a wide variety of high-end products, including boots, belts, wallets, cellphone cases, money clips, purses and even clothing. Photo by Bruce Schultz

H-2B Worker Program and the Louisiana Seafood Processing Industry

Maria Bampasidou and Mohammad Rajib Hasan

One of every 70 jobs in Louisiana is related to seafood. Seafood is part of the cultural and culinary identity of the state. Crawfish, crabs, shrimp, oysters, alligators and finfish are produced and processed in Louisiana. Also, Louisiana is the only state commercially producing alligator products, and the crawfish industry competes in the world market.

The Louisiana seafood processing industry is labor-intensive and depends on seasonal and temporary hired labor. One source is foreign workers hired under the H-2B program. Factors affecting this program include the statutory cap, the application process, and a potential increase in the minimum wage schedule. All could influence the industry in terms of the number of people it is able to afford to employ.

The H-2B program allows employers to hire temporary foreign workers (often called guest workers or nonimmigrant workers) in low-skill, nonagricultural seasonal positions. Congress has established an annual limit of 66,000 people who can be granted H-2B status. This is a statutory cap with 33,000 spots available for employment from October 1 to March 31 and the rest from April 1 to September 30. Within this cap, the seafood processing industry competes with other industries. In Louisiana, major competitors include landscaping and sugar, seafood and meat processing.

The cap often is reached prior to the end of the application period. According to the U.S. Department of Labor Office of Foreign Labor Certification, the first-half fiscal year 2018 cap was reached on December 15, 2017, and the second-half cap was reached on February 27, 2018. On May 31, 2018, U.S. Citizenship and Immigration Services increased the cap by 15,000 additional visas. The application period was May 31 to September 30, 2018, but the cap was reached by June 6, 2018.

Employers applying to the program need to consider both the application processing time and that the cap may be reached early in the petition cycle. On average, an application decision takes 46 days.

Competition for the number of people an industry can employ through the H-2B program can affect patterns of use in the H-2B program. For the Louisiana seafood processing industry, the past years have had an increase in the number of H-2B workers (Figure 1). On average, Louisiana seafood processors employed about 1,100 workers each year from 2008 to 2017, with the number of processing facilities fluctuating over the years. In 2008, 31 facilities employed 1,627 workers. In 2017, 45 facilities employed 1,595 H-2B workers. Data for 2018 show 41 operations employing 1,630 workers. The most

H-2B workers were reported in 2018 and the fewest in 2013. An H-2B worker is attached to a contract and can stay for the period authorized on the temporary labor certification. For the Louisiana seafood processing industry, the average contract period is seven months.

The main job titles in Louisiana include crawfish, crab and alligator processors; peelers; fish cutters and trimmers; deckhands; and oyster shuckers. The basic wage rate offered to workers is based on the job attributes and the prevailing wage as well as the hourly wage, usual benefits and overtime offered to the majority of workers within a particular area as established by the Department of Labor. For example, the basic wage averaged \$7.21 per hour in FY 2008, \$9.91 per hour in FY 2017 and \$9.50 per hour in FY 2018 (Figure 2). The average offered wage is above minimum wage rates, which signals the need to fill these positions.

Maria Bampasidou is an assistant professor and Mohammad Rajib Hasan is a former graduate student in the Department of Agricultural Economics and Agribusiness.

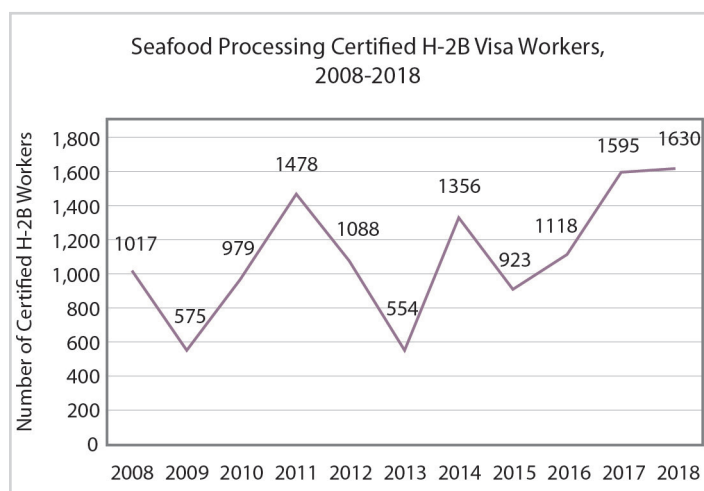


Figure 1. Number of H-2B visa workers certified and employed by Louisiana seafood processors during 2008-2018. Source: Annual administrative data from employers' H-2B applications (reported in ETA Form 1942)

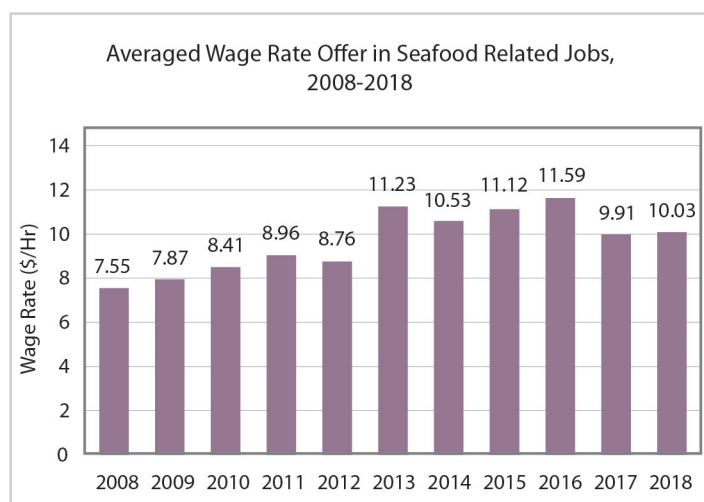


Figure 2. Average wage rate offer by the Louisiana seafood processors during the period 2008-2018. Source: Annual administrative data from employers' H-2B applications (reported in ETA Form 1942)

Inside:

Read the stories of how two of the Sea Grant/AgCenter fisheries agents, Thu Bui and Kevin Savoie, help Louisianians make a living from the water.

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Reviving the Louisiana soft-shell crab industry offers economic opportunity.

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Sea Grant/AgCenter scientists are perfecting ways to prevent black spot from spoiling shrimp sales.

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Roseau cane die-offs threaten the Louisiana coast and the fishing industry.

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Researchers work to rid carcinogens from the alligator tanning business.

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