COASTAL CLIPS

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Sea Grant Reaches Undergraduates through UROP

Since its establishment in 1992, Louisiana Sea Grant's (LSG) Undergraduate Research Opportunities Program (UROP) has provided assistance to nearly 150 talented undergraduate students interested in pursuing advanced studies in marine-related disciplines. The program awards grants, ranging from $1,500 to $2,500, to assist with research, student wages, travel and supplies.

"The goal of UROP is to increase the number of undergraduates pursuing environmental science careers," said David Nieland, LSG associate executive director and UROP coordinator. "Specific objectives are to provide a mechanism through which undergraduates can have a hands-on research experience, including preparation of a research plan, execution of the plan and writing a research report, and to foster working relationships with faculty mentors."

One such student is Megan Arias, in her fourth year of studies at Louisiana State University in the School of Renewable Natural Resources and majoring in natural resource ecology and management, with a concentration in conservation biology. She began her UROP project, "Prevalence of the Parasite *Lagenophrys callinectes* in Blue Crabs *Callinectes sapidus*," in January and plans to complete the study in January of 2014.

Despite the fact that *Lagenophyrys callinectes* is rarely harmful to crabs, except in numbers so great as to hinder gill function and oxygen transfer, Arias' identification of crustaceans infected with the parasite is helping graduate student Holly Rogers in her broader research on disease prevalence in blue crabs, a commercially important species in the Gulf of Mexico and beyond. Arias handles crab samples, examines them in the laboratory and has direct contact with graduate students and her faculty mentor, Julie Anderson, an assistant professor and fisheries specialist with Louisiana Sea Grant and the LSU AgCenter. Arias will also have the opportunity to travel to a professional symposium to share the results of her research – an important part of working as an academic and an excellent opportunity for professional networking.

Julie Anderson and Megan Arias discuss blue crab gill samples in Anderson's laboratory in LSU's School of Renewable Natural Resources.

"I love the microscope," Arias explained. "This is giving me a different type of experience from what I would have had in previous years. Most people don't take the opportunity to get this kind of practice." Arias said she expects the knowledge gained in the lab doing research will benefit her when she continues her education and will strengthen her resume when applying for summer internships. She has one more year of studies at LSU and plans to pursue a master's degree, probably in environmental toxicology.

"Megan is an excellent student who was motivated to do research before graduate school," Anderson said. "UROP gives her the great opportunity to do her own research project and the funding to attend a national conference. Normally undergrads would not get this chance. This will help give her the background needed to get into graduate school."

In addition to Arias, nine other students at three state universities and one private institution are receiving UROP support in 2013 to explore a wide variety of topics.

The program is open to full-time undergraduates at all public and private Louisiana colleges and universities who have some science background. In addition to the grants, a student may receive academic credit for his or her project, if his or her school allows it. Nieland said that generally junior and senior-level students are best suited for UROP, but any undergraduate with a faculty mentor will be considered. Applications are accepted annually in November and December.

"This research program contributes to participating undergraduates' educational experience and introduces these students to environmental research as a career path," Nieland said. "It also makes the student bodies at Louisiana colleges and universities more aware of the Louisiana Sea Grant College Program and the pressing environmental needs of the state."

More information on UROP, application instructions and a list of current and past research projects can be found online at *www.laseagrant.org/urop*.

Research Update

Seafood Waste Turned into Crab Bait

Julie Anderson, an assistant professor at LSU's School of Renewable Natural Resources and Louisiana Sea Grant and LSU AgCenter fisheries specialist, is looking at ways to turn seafood byproducts into crab bait that could help blue crab fishermen stave off rising costs associated with having baitfish shipped from the Atlantic Ocean.

The experimental bait will start as a gel made from algae. Anderson then will add different types of seafood byproducts to the gel, testing each one to see which is the most appetizing. She said the goal is to create bait that is less expensive but maintains the same blue crab catch levels as traditional bait.

"It's like we're trying different flavors of Jell-O," she said. "We'll work with the seafood industry to try out different byproducts from the oyster, fish, crab and shrimp processors and see which flavor attracts the most crabs."

The most popular baitfish for crabbers is Atlantic-caught menhaden. But the small fish is valuable for more than just baiting crab traps. It is also harvested as a source of omega-3 fatty acids and for other human uses. The high demand has caused Atlantic states to worry that the population is being overfished. Catch limits for Atlantic menhaden have been put in place in some areas, which, coupled with increasing costs associated with shipping and fuel, drives up the price of bait for fishermen along the Gulf of Mexico.

A crab attracted to oyster liquor.

Anderson hopes that by developing a locally sourced alternative crabbers will have a more economically efficient way of baiting their traps. She sees using seafood byproduct for crab bait as a possible win-win scenario for seafood processors and crabbers. Seafood producers often have to pay to have their waste disposed of, usually in landfills. But, if successful, Anderson's vision of repurposing seafood byproducts for use in the crab industry could offer a way for processors to cut down on their own costs by selling the waste instead of paying to have it hauled away while providing crabbers with an alternative to the highly sought Atlantic-caught menhaden.

Researchers Look to Nature to Answer Questions about River Diversions

There are many unknowns in the world of coastal restoration, often involving projects that are large-scale and complex. Two scientists and their team are looking to the natural world for analogues to answers about one type of human attempt to repair the damage to Louisiana's coastline. Alexander Kolker and Brian Roberts, both assistant professors at the Louisiana Universities Marine Consortium (LUMCON) in Cocodrie, are the principal investigators studying the naturally accreting Wax Lake Delta of the Atchafalaya River. The goal of this work is to better understand the impacts of Mississippi River water diversions on the state's coast for the Louisiana Sea Grant-supported project, "Sediment Dynamics and Biogeochemical Cycling in a Developing Deltaic System: Understanding Habitat Quality in a River Diversion."

Freshwater diversions are controlled breaks in the levee system that release sediment-rich Mississippi River water into the surrounding marsh and are heralded as a way to restore the sinking and eroding coastal Louisiana landscape. They figure prominently in the state's 2012 Coastal Master Plan. These diversions, such as Caernarvon near the Plaquemines/St. Bernard Parish line, simulate the positive effects of historic river flooding that were interrupted by man-made levees.

The Atchafalaya River is one of the largest distributaries of the Mississippi, and the silt and nutrients it carries are actually building land in the Wax Lake Delta. By studying the natural system, Roberts and Kolker hope to offer insights that can improve conditions to the east. They are investigating the interaction between land building and biogeochemical processes that influence water quality in the delta and the receiving waters downstream of the system.

"The implications are that there might be better times of year to open the river diversions," Kolker explained. "The relationships are not that simple, but the (Mississippi) river is well-gauged, and there are improvements people can make. You can see pulses of sediment coming and possibly open the diversion at that time. Conversely, you may see carbon and nitrogen and decide not to open."

These PIs, along with Louisiana Sea Grant-supported Tulane University student Ciara Chambers, are investigating a host of parameters that fall into four basic categories – physical processes, chemical inputs, the geological setting and biological activity. Kolker said one of the biggest controls on the chemistry of the surface of the Earth is living creatures through the role they play in the cycling of elements, nutrients and ions. Kolker, Roberts and Chambers are half-way through the study, but they have already made an unusual discovery.

"We have found what we think might be the highest rate of metabolism in any system in the Wax Lake Delta," Kolker said. "It's in an isolated pond in a somewhat secluded part of the delta, and it has the highest respiration rate of any system we've studied. Hydrology plays a really important role in the extremes of nutrient and element cycling. When you can find the highest or lowest values as a scientist, that's exciting."

On the Web:

Louisiana's 2012 Coastal Master Plan,
www.coastalmasterplan.louisiana.gov

Louisiana Sea Grant Research Database,
http://appl003.lsu.edu/seagrant/collaresh.nsf/About?OpenForm

Louisiana Universities Marine Consortium,
www.lumcon.edu

Ciara Chambers (left) and Brian Roberts conduct fieldwork in the Wax Lake Delta.

Message from the Executive Director

When speaking of Sea Grant, we traditionally talk about the three pillars of the organization – research, outreach and education.

No one is too young or too old to learn. And Louisiana Sea Grant (LSG) is always there to help feed the hunger for knowledge. Each year, Louisiana Sea Grant reaches thousands of kindergarten through high school students with environmental education seminars for teachers, marine and coastal science lesson plans, and events like Ocean Commotion and Earth Day celebrations.

Undergraduate students across the state – as you read in our cover story – expand their horizons and are involved in their own hands-on research through LSG's Undergraduate Research Opportunities Program (UROP). Other Louisiana Sea Grant-funded research supports as many as 20 graduate students and up to 100 additional undergraduate students annually.

In fact, since 1971, LSG has invested in educating and training more than 800 graduate students – from natural sciences and engineering to resource economics and law. But our educational investment isn't limited to the classroom or lab. LSG extension personnel lead workshops on seafood safety, ecotourism, aquaculture opportunities, coastal hazards mitigation, and commercial fishing best practices, to name a few, in order to promote coastal literacy among our businesses, elected officials and neighbors.

Take a look around local schools, where you buy groceries, and the coastal outdoors where you recreate. Louisiana Sea Grant education is there, providing unbiased, science-based information that helps make our coast, our communities and our economy stronger.

Robert Twilley, Ph.D.
Executive Director
Louisiana Sea Grant College Program

Sea Grant Louisiana

Oyster Hatchery Marks 20 Years as Research

Louisiana Sea Grant (LSG) marks 20 years of operating its oyster hatchery on Grand Isle in 2013. During those two decades, the facility has been destroyed by hurricanes twice, threatened by an oil spill, relocated once, and now awaits another relocation into a state-of-the-art building.

"Basically my goal over the last seven years has been, 'Just keep the research focus going,'" said John Supan, LSG's oyster specialist and hatchery director. "There were three recent summers where I did all my spawning at Auburn Shellfish Laboratory on Dauphin Island because our hatchery was a wreck from hurricanes. Then the 2010 season was ruined by the BP oil spill. But now we're on a roll," said Supan.

The hatchery was established in 1990 as a commercial operation when the natural production of oyster seed was down because of drought and low Mississippi River discharge. Gulf Shellfish Farms of Louisiana ran the facility at that time, and Supan, who was a young LSG Marine Extension agent, was loaned to them to manage the hatchery and help train oystermen in remote setting techniques.

By 1993, naturally occurring seed production had rebounded, thanks in part to a record rainfall, and the need for a commercial hatchery passed. That could have been the end of it, but when the commercial venture folded, Louisiana Sea Grant acquired the hatchery and retooled it into a research facility with Supan at the helm.

Most of Supan's research has focused on developing a broodstock for producing triploid oysters – which have higher summertime meat yields. But he is also examining alternative oyster growing systems, including two off-bottom cultivation techniques.

One method, called a long-line system, uses mesh bags suspended in the water column on cables attached to posts. The bags can be raised and lowered to protect oysters from predators, fouling and the effects of disasters like hurricanes. The other system, called OysterGro, is less infrastructure intensive. It uses floating metal cages attached to pontoons.

"The systems we're looking at are commercially used in other parts of the world," said Supan. "People are making money with them, and they're recovering more of the oysters they put in the water. One of my former grad students conducted an industry survey and found on average only 35 percent of the oysters planted using traditional methods make it to harvest. With off-bottom

John Supan

A diploid oyster (left) and triploid oyster (right).

Grand Isle

1993
Natural seed production rebounds and demand for hatchery-based seed drops. Louisiana Sea Grant acquires the hatchery for research.

Sea Grant

1990
Gulf Shellfish Farms establishes the oyster hatchery because of a lack of naturally occurring oyster seed, enters a cooperative agreement with the Louisiana Sea Grant College Program.

culture, every oyster you put into the water you get back."

The alternative oyster culture research is conducted at the hatchery's demonstration farm, located adjacent to a new operations center which opened in 2012 to replace a building lost during Hurricane Katrina. The operations center provides a farm service area downstairs, and upstairs living and office space for Supan and his graduate students.

Hatchery functions moved to the Louisiana Department of Wildlife and Fisheries' (LDWF) Grand Isle Fisheries Laboratory in 2009 after being destroyed a second time. In 2005, Hurricane Katrina devastated the hatchery. Supan rebuilt, but the hatchery was razed again in 2008 by Hurricane Gustav. Construction on a new $3 million permanent facility is scheduled to begin later this year, with hopes of moving-in during 2013-14.

The new hatchery is funded with money from a Natural Resource Damage Assessment (NRDA) grant for projects identified as helping speed recovery following the 2010 BP oil spill. The new facility will help Supan's team remain at the cutting edge with state-of-the-art equipment for algal production, water filtration and even a seawater heater allowing the hatchery to extend its larval production beyond the current May-to-September season. The new hatchery also will be able to continue running essential equipment during tropical storms, with reduced hurricane preparation and recovery times.

The Grand Isle demonstration farm.

The seawater heater will help Supan produce more than one billion larvae annually. Some of those larvae can be used to supply commercial oyster farmers with seed through a nearly completed agreement between Louisiana State University and the Louisiana Oyster Dealers and Growers Association. Supan also plans workshops for oyster growers interested in setting up their own shore-side nurseries to cultivate seed.

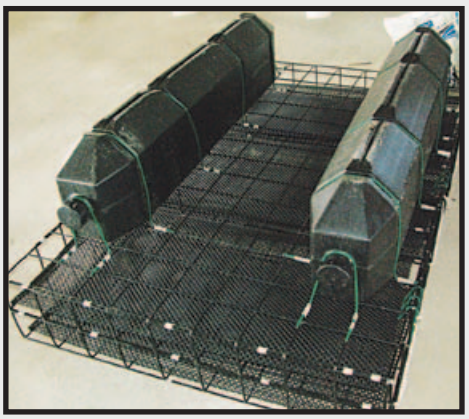
Through an agreement with LDWF, the hatchery will supply half of its larval production to the state for setting in public waters. In return, Supan receives $210,000 annually that has allowed him to hire two full-time research associates. He hopes to add a third this year. But what sets the hatchery apart and makes it commercially appealing is its potential to produce the aforementioned triploid oysters. "For hatcheries to succeed in the Gulf, they're going to have to produce something that nature can't because they can't compete during times of high natural oyster production," said Supan.


Tanks for growing oyster seed.

Triploid oysters have three sets of chromosomes – unlike normal (diploid) oysters that have two – and triploids are sexually sterile. From June through November when diploid oysters are expending energy to spawn and shedding fat stores, triploid oysters remain meaty – creating a possible summer crop for Louisiana oyster growers.

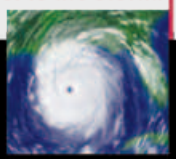
Triploids can be created artificially in the lab by manipulating oyster chromosomes, which Supan has done, but that process is not 100 percent. However, chromosome manipulation can also be used to create tetraploid oysters, which have four sets of chromosomes and can sexually reproduce. When bred with diploid oysters, tetraploid oysters produce 100 percent triploid offspring. Supan's goal is to create a broodstock line for annual triploid production.

"Alternative oyster culture and triploid production both hold promise, but I don't see them as replacing traditional methods used by the Louisiana oyster industry," said Supan. "Nonetheless, I do see them as augmenting natural oyster production and creating new markets for growers and harvesters."


The OysterGro system where grow cages are suspended from pontoons.

le Oyster Hatchery Timeline

2005 Hurricane Katrina destroys the hatchery. Tens of millions of oyster larvae are lost to the storm.



2007 Hatchery operations resume on Grand Isle.

2008 Hurricane Gustav destroys the hatchery.

2009 Hatchery operations move to the LDWF Fisheries Lab.

2010 BP Oil Spill disrupts hatchery operations.

2012 Oyster Hatchery Operations Center opens.

2013 Construction begins on new oyster hatchery building.

2014 Hatchery operations to be established in new building.

Off-bottom Oyster Culture Aided by Sea Grant Legal

Louisiana's oyster farmers are free to experiment with different methods of growing mollusks thanks to a 2012 law that opens state-owned waters to alternative oyster culture, including off-bottom techniques.

In 2004, John Supan, Louisiana Sea Grant's (LSG) molluscan shellfish specialist, wanted to experiment with off-bottom oyster cultivation at the program's oyster hatchery in Grand Isle. But bureaucratic barriers stymied those efforts. "Finally, we said, 'It looks like we need to get special authorization from the Legislature to do this.' So in 2005 we drafted a bill that would allow experimental mariculture operations," said Jim Wilkins, director of LSG's Law and Policy Program.

The legislation Wilkins and his team wrote allows experimental aquaculture on a five-acre water bottom. But even after Legislature approval, issues persisted.

"The Office of State Lands said their policy required permission from adjacent land owners before they would permit the project," Wilkins said. So while Supan's equipment for off-bottom culture sat idle, Wilkins' group tried to track down who owned what land – an arduous task – and several more years passed.

They eventually decided to seek general approval for off-bottom oyster culture.

Working with attorney Larry Marino, hired by the Louisiana Department of Wildlife and Fisheries (LDWF) to coordinate the effort, and former Sea Grant law clerk Cole Garrett, now with LDWF, Louisiana Sea Grant Legal helped draft language that would eventually become HB 1190. "Over the course of several months we assisted with writing the bill. Other user groups – oil and gas, the shrimping industry and others – had their input and we made revisions. Finally, we had a final draft bill, it was submitted, went through the legislative process and it was passed," said Wilkins.

The bill was signed by Gov. Bobby Jindal on May 25, 2012.

The law establishes the use of state water bottoms for alternative oyster culture as a legal use, lays out the process for obtaining permits and allows for alternative methods of oyster culture on qualified existing leases. The Office of State Lands also dropped its provision that oyster growers obtain permission from adjacent landowners. A separate bill drafted by the LSG Law and Policy Program expands Supan's original five-acre experimental aquaculture area to 25 acres.

Louisiana Sea Grant continues to work closely with state agencies in developing regulations so HB 1190 can be implemented. That work includes developing maps that identify suitable off-bottom culture locations across the state.

Sea Grant-Supported Students Graduate

Thirteen graduate students supported by Louisiana Sea Grant completed their degrees in 2012. The list includes:

• **Benjamin Branoff**, master of science, Louisiana State University (LSU) Oceanography and Coastal Sciences. Thesis: Nitrogen Biogeochemistry in a Restored Mississippi River Delta: A Modeling Approach. Major professor: Robert Twilley.

• **Barry James Bleichner**, master of science, LSU Geography and Anthropology. Thesis: An Analysis of Marine Protected Areas Legislation in the Caribbean Lesser Antilles. Major professor: Patrick Hesp.

• **James Chatagnier**, master of science, LSU Civil and Environmental Engineering. Thesis: The Biomechanics of Salt Marsh Vegetation Applied to Wave and Surge Attenuation. Major professor: Guoping Zhang.

• **Shreya Datta**, doctor of philosophy, LSU Food Science. Dissertation: Production and Application of Antibodies Produced against the Flagella and Hemolysin of *Vibrio Parahaemolyticus*. Major professor: Marlene Janes.

• **Benjamin S. Eberline**, master of science, LSU Renewable Natural Resources. Thesis: Population Dynamics of the Eastern Oyster in the Northern Gulf of Mexico. Major professors: Megan and Jerome La Peyre.

• **Glenn Charles Fischer**, master of science, Tulane University Earth and Environmental Studies. Thesis: Quantifying Neotectonic Control of Alluvial River Morphology in a Low Gradient Landscape. Major professor: Matthew Pendergraft.

• **Katherine Garrison-Schilling**, doctor of philosophy, LSU Biological Sciences. Dissertation: Identification of Genetic and Environmental Factors that Control Exopolysaccharide Expression and Phase Variation in the Human Pathogen *Vibrio Vulnificus*. Major professor: Gregg Pettis.

• **Kelly Marie Henry**, doctor of philosophy, LSU Oceanography and Coastal Sciences. Dissertation: Linking Nitrogen Biogeochemistry to Different Stages of Wetland Soil Development in the Mississippi River Delta, Louisiana. Major professor: Robert Twilley.

• **Melissa Monk**, doctor of philosophy, LSU Oceanography and Coastal Sciences. Dissertation: Identification and Incorporation of Quantitative Indicators of Ecosystem Function into Single-Species Fishery Stock Assessment Models and the Associated Biological Reference Points. Major professor: Joseph Powers.

• **Michelle Savolainen**, master of science, LSU Agricultural Economics and Agribusiness. Thesis: Economic and Attitudinal Perspectives of the Recreational For-Hire Fishing Industry in the U.S. Gulf of Mexico. Major professor: Rex Caffey.

• **William Sheftall IV**, master of science, LSU Renewable Natural Resources. Thesis: Factors Structuring Zooplankton Density and Composition within a Louisiana River and Floodplain Tributaries with Emphasis on Hydrologic Processes. Major professors: Mike Kaller, William Kelso, Glenn Thomas.

• **Jared Theriot**, master of science, LSU Oceanography and Coastal Sciences. Thesis: The Effects of Carbon on Nitrogen Transformations in Restored Wetland and Waste Water Soils. Major professor: Ron DeLaune.

• **Hua Wang**, master of science, LSU Agriculture Economics and Agribusiness. Thesis: Economic Assessment of Rapid Land-Building Technologies for Coastal Restoration. Major professor: Rex Caffey.

Persons interested in obtaining copies of the theses and dissertations should contact Jessica Schexnayder at *jsche15@lsu.edu*.

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Johnson Joins Sea Grant Staff

Judy Johnson is the newest member of the Louisiana Sea Grant (LSG) staff. She will provide administrative support to the executive director's office. Her duties are numerous and include purchasing and procurement; processing leave and travel requests; maintaining phone lines, telecommunications equipment and supplies; managing vehicles and office equipment; processing student payroll; and serving as alternate building coordinator.

Immediately prior to coming to Sea Grant, Johnson served as project coordinator for an environmental engineering company, Brown and Caldwell. LSG marks a return to Louisiana State University's Baton Rouge campus for Johnson, who previously spent three and a half years in the Department of Oceanography and Coastal Sciences.

"I regretted leaving LSU. But I'm thrilled to return and look forward to soon becoming an integral part of the LSG team," said Johnson.

After graduating from Baton Rouge's Redemptorist High School, Johnson earned an associate's degree in computer science from Southeastern Louisiana University and a bachelor's degree in business administration at LSU.

Judy Johnson

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