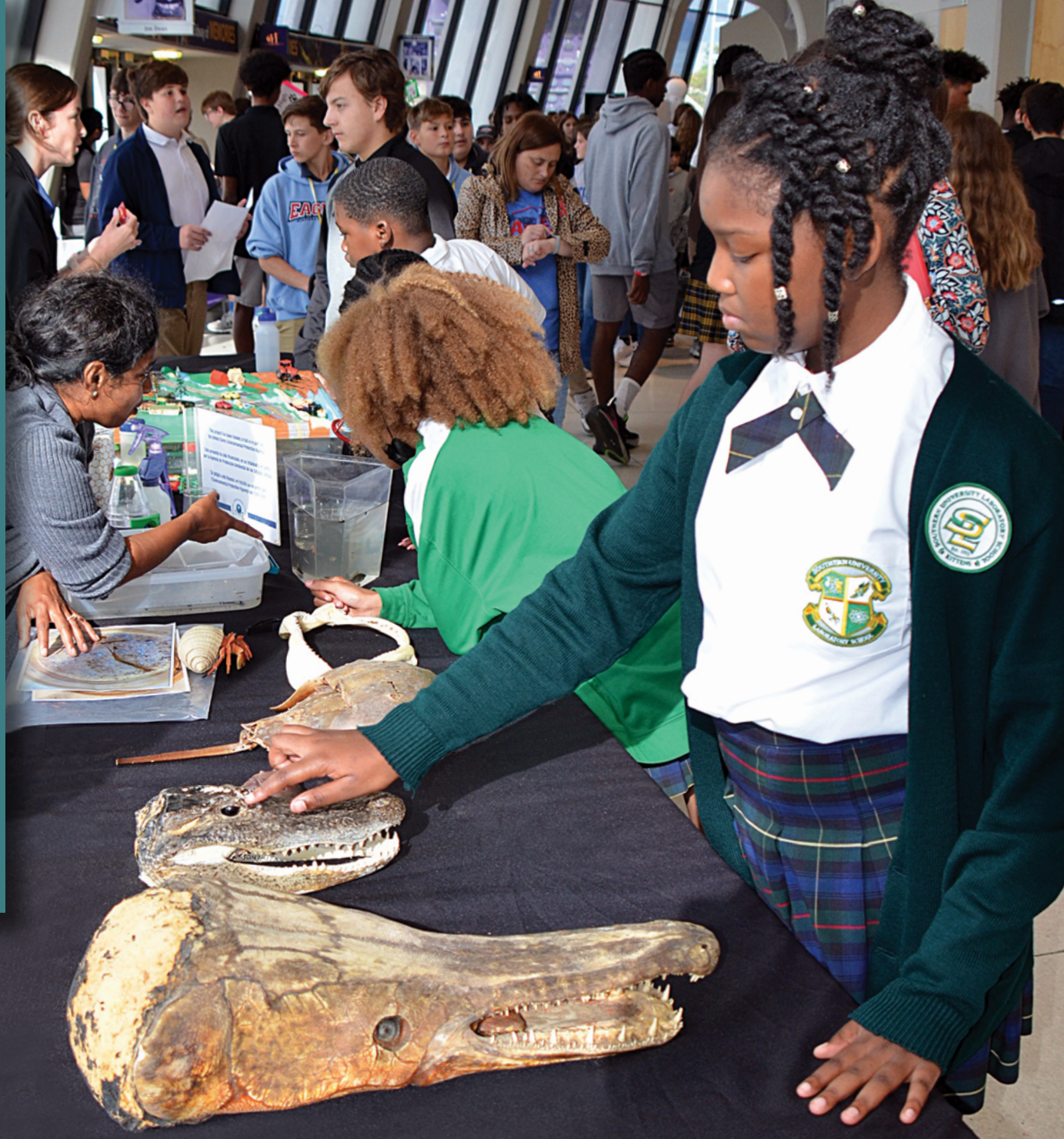
NUMBER 59
FALL 2022

Coastal Clips

A quarterly publication of the Louisiana Sea Grant College Program at Louisiana State University, Baton Rouge



Live Ocean Commotion Returns

More than 2,000 students and teachers from K-8 schools attended the 24th Annual Ocean Commotion this October at Louisiana State University's Pete Maravich Assembly Center (PMAC). The one-day educational fair is hosted by Louisiana Sea Grant (LSG).

Ocean Commotion offers students an opportunity to learn about a host of issues that range far beyond ocean-exclusive themes in a lively, hands-on learning environment. Exhibit topics included coastal marshes and wetlands, invasive species, local ecosystems, boating safety and Louisiana geology and wildlife. More than 50 presenters from private business; universities around the state; government agencies; and public, non-profit and private educational organizations participated as exhibitors.

"Many of the students may have never been to the beach or even seen a swamp or marsh," said Dani Dilullo, LSG's education director. "This may be their first experience with seeing fish and other animals up close. It also benefits the presenters by highlighting how important it is to effectively communicate their work to all audiences."

Due to COVID, Ocean Commotion was a virtual event in 2020 and retooled into small, local fieldtrips for coastal community schools in 2021.

For more photos, visit *www.flickr.com/photos/88158121@N00/albums/72177720303187776*.

LaSSO Project Makes a Surprising Discovery

A LaSSO-funded undergraduate research project made a bombshell discovery about ocean acidification,

Yusra Soorya, the student researcher at Nicholls State University, and Enmin Zou, professor in Nicholls' Department of Biological Sciences, found that CO2 acidification of seawater speeds up the hardening of blue crab shells. "This discovery is contrary to our initial working hypothesis," said Zou.

"We hypothesized that CO2-induced acidification would forestall postmolt shell mineralization, disrupting post-molt shell hardening. But our key finding was that CO2 seawater enrichment speeds up shell hardening in blue crabs through increased shell mineralization," he said.

Zou and Soorya worked on the LaSSO-funded project – *Impact of Carbon Dioxide Enrichments in Seawater on Post-Ecdysial Shell Calcification in the Blue Crab,* Callinectes sapidus – for nine months. A peer-reviewed article about their findings was recently published in the Society of Environmental Toxicology and Chemistry's journal *Environmental Toxicology and Chemistry*.

The Louisiana Space and Sea Grant Opportunity (LaSSO) program is a Louisiana Sea Grant/Louisiana Space Grant (LSG/LaSPACE) collaboration modeled after similar, long-established undergraduate research programs at both LSG and LaSPACE. Each nine-month project receives $4,000 in funding. LaSSO is directed at science and engineering students who are working on projects in research areas deemed a priority by both the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA). The intent of LaSSO is to supplement and enhance the undergraduate academic curriculum by providing science/engineering students with a hands-on, mentored research experience relevant to space, earth, coastal and/or marine sciences.

"The LaSSO program is wonderful for those wanting to fund their research to expand on horizons that are untouched or understudied in science," said Soorya. "From this grant, I was able to have funding for my project, which allowed us to make this discovery. We expected detrimental effects from the decreased pH, but instead found something completely different. None of it would be possible without the funding from LaSSO," Soorya added.

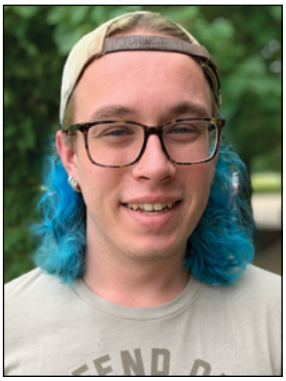
For more information on LaSSO, visit *https://laspace.lsu.edu/lasso-la-space-sea-grant-opportunity/*.

Two Undergraduate LaSSO Research Projects Funded

A Louisiana Sea Grant/Louisiana Space Grant (LSG/LaSPACE) collaboration began funding two undergraduate research projects in September. The joint program, called Louisiana Space and Sea Grant Opportunity (LaSSO), is modeled after similar, long-established undergraduate research programs at both LSG and LaSPACE.

LSG will fund a project that is titled:

Exploring the Possibility of Using Bdellovibrio and Like Organisms (BALOs) to Reduce Vibrio Coralliilyticus *Associated Disease in Marine Environments* at Louisiana State University (LSU). The principal investigator is Aixin Hou, professor and Shell Professor in Oceanography/Wetland Studies in the Department of Environmental Sciences. Caleb Cavness, an applied coastal environmental studies major, is the student researcher.



Caleb Cavness

The project will test the hypothesis that predatory BALOs can be used as a biological preventive as well as control measure for *Vibrio coralliilyticus* in marine environments – particularly on eastern oyster larvae – and determine its efficacy in reducing larval mortality. The results could help build a foundation for developing novel, environmentally friendly measures to control Vibrio infection in marine environments.

The project funded by LaSPACE is:

Does Post-ecdysial Exoskeletal Calcification in the Blue Crab, Callinectes sapidus*, Occur in Vitro?* at Nicholls State University. Enmin Zou, an instructor in the Biological Sciences Department is the principal investigator. Hailey Domingue, majoring in biology pre-medicine, is the student researcher.

Each nine-month project will receive $4,000 in funding. LaSSO is directed at science and engineering students who are working on projects in research areas deemed a priority by both the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA). The intent of LaSSO is to supplement and enhance the undergraduate academic curriculum by providing science/engineering students with a hands-on, mentored research experience relevant to space, earth, coastal and/or marine sciences.

Coastal Restoration Economics: A Granular Look at Project Performance

The Key Resource

From the smallest of vegetative plantings to large-scale diversions of the Mississippi River, Louisiana's coastal restoration efforts all focus directly or indirectly on a single, critical resource - sediment. The capture and retention of sediment is of paramount importance to a coastline that has lost nearly 2,000 square miles of land in the past century, and one expected to lose an additional 4,000 square miles in the next 50 years without sufficient action.

For this reason, Louisiana's portfolio of sediment-focused coastal restoration projects is increasing. Among such projects, dedicated dredging has emerged as the largest single category of restoration spending. The Louisiana Coastal Protection and Restoration Authority (CPRA) estimates the cost of its 50-year Coastal Master Plan at $50 billion. Of that amount, $22 billion is slated for projects involving the mechanical extraction and placement of sediment. Most of these projects will play out on the state's seaward shorelines and barrier islands, where sediment sourcing is largely driven by the availability and cost of sand.

Rethinking Benefits

The economic assessment of coastal dredging has historically centered on project construction, with the largest factor being the costs per unit of sediment used to fill a given restoration template. A recent paper in the *Journal of Environmental Management*, however, expands on this approach by examining how sediment quality affects the economics of project performance. The paper derives from a three year study sponsored by the Bureau of Ocean Energy Management (BOEM).

The idea for the study originated with Mike Miner, a geologist by training, and since 2018, director of Applied Geoscience for the Water Institute of the Gulf. In a prior life, Miner worked with the Marine Minerals Mining Program at BOEM where he represented the bureau on dozens of barrier restoration projects in Louisiana and the broader Gulf region. According to Miner, it was a period in which the economic realities of project performance were sometimes slow to materialize,

"Geomorphologists had long noted the resiliency advantages of larger diameter sands, but the nearshore availability of smaller grain, lower-cost sediments was often the deciding factor in project sourcing."

Miner believed that a more formal analysis of project costs versus project performance could be achieved through a combination of physical and economic modeling. For the geomorphic analysis, he recruited Ioannis Georgiou, a coastal engineer at the University of New Orleans (UNO) who would later become the Water Institute's director of Coastal and Deltaic Systems Modeling. On the economic side, he contacted Rex Caffey, a resource economist with the Louisiana State University (LSU) Agricultural Center and the Louisiana Sea Grant College Program. In turn, Caffey recruited fellow resource economists Hua Wang of LSU and Daniel Petrolia of Mississippi State University. Funding for the study was provided in 2016 by an award administered through the Louisiana State University Coastal Marine Institute.

An Offshore Trip

Year one of the study included numerous meetings at UNO, with the team brainstorming diagrams and terms on a white board. Caffey recounts that period as one with some translation challenges,

"When we first started out, the economists and physical scientists were struggling to understand each other's language."

Team communications eventually improved, especially in the wake of a field trip arranged later that year in cooperation with CPRA. The trip was to Ship Shoal, an ancient, submerged delta of the Mississippi River. This elevated area of sandy seafloor on the Outer Continental Shelf (OCS) lies 30 miles offshore of Port Fourchon. The purpose of the trip was to observe a large-scale dredging operation underway at the Shoal in support of the Caminada Headland Beach and Dune Restoration Project. Accompanying the team was Brad Miller, CPRA's project manager on Caminada.

Miller describes the Caminada project as, "ambitious and very complex."

The Caminada Headlands project was primarily constructed using a three-stage process of sediment transport. In the first stage, sediment from Ship Shoal was harvested with a large cutterhead dredge and deposited into a series of eight marine transport "scow" barges. In the second stage, each sediment-laden barge was transported by a tugboat across 30 miles of open ocean to a shallow-water relay station located just offshore of the project template. In the final stage, the contents of each barge were mixed with sea water and pumped onshore. Once ashore, the slurry would dewater, with the deposited sediment maneuvered into place using bulldozers. Through this process, nearly seven of the project's approximately nine million cubic yards of sediment was conveyed, renourishing a 13-mile span of barrier shoreline.

Dredge disposal operations at the Caminada Headland (Photo courtesy CPRA)

The research team spent that day offshore following the route of a single load of sediment - from filling of the scow barge at Ship Shoal, to 30 miles of oceanic transport, to nearshore staging and onshore pumping. Given the total volume of sediment relayed on Caminada between 2012-2017, it was a route that would play out more than 2,600 times during the project's two phases of construction. The trip allowed the physical scientists on the team to conduct a field seminar on the mechanics and semantics of OCS dredging. And it allowed team economists to begin formulating the quantitative approach that would be used for measuring cost and performance tradeoffs of coastal dredging projects.

Model Development

In the second year of the project, the team agreed on a conceptual model for the analysis - a simulated nourishment project within a barrier system based on the historical footprint of the Isle Dernieres Island chain. The corresponding numerical model, a variation of Benefit Cost Analysis (BCA), would require the development of separate sub models of project benefits and costs.

The Delft3D software suite was used to create coupled sub models of sediment transport with flow and waves to help determine sediment pathways,

including sediment accumulation at the nourishment site and the system level, for both surface and subsurface environments. Cumulative deposition and erosion of sediment was simulated over a 50-year horizon for a no-action scenario, and for a project constructed using nearshore (NS) and OCS sediments of various quality (grain size and fines content). A sub model for project cost was developed using dredging attribute data derived from 93 commercial bids representing 35 NS-sourced and OCS-sourced barrier renourishment projects constructed in coastal Louisiana from 1997-2018.

Study Results

The final year of the project involved integrating the physical and cost sub models into a BCA framework. Team economists had developed a method to estimate the break-even value (BEV) of ecosystem services, that is, that value at which project costs were just offset by project benefits. This metric would be used to evaluate project efficiency and economic tradeoffs associated with sediment quantity, quality and transport distance. Results indicate that even small increments in sand diameter can yield significant economic advantages over long time horizons. Moreover, OCS-sourced projects constructed with much highest quality sands were found to be more cost-effective (lower BEV) than all smaller grained, NS-sourced projects at common cut-to-fill ratios. In some comparisons, the larger grain sizes yielded lower BEVs for projects with transport distances exceeding 30 miles – a finding consistent with sediment sourcing from remote locations like Ship Shoal.

Critics of dedicated dredging, however, often focus on the vulnerability of shoreline renourishment projects to hurricanes - asserting that a multi-million-dollar project can be wiped out overnight by a single storm. To address this issue, a final set of simulations was developed to examine the performance implications of a Category 2 hurricane occurring at two points in the simulated project trajectory. Under storm-punctuated simulations, the advantages of higher quality sands were found to be more pronounced, with greater economic implications for earlier (Year 5) versus later (Year 20) occurring storms. This finding would be somewhat tested in 2021, when Category 4 Hurricane Ida made direct landfall on Caminada Headlands, five years after project construction. While impact surveying by CPRA is ongoing, initial assessments of the project's post storm condition have been positive.

Program Implications

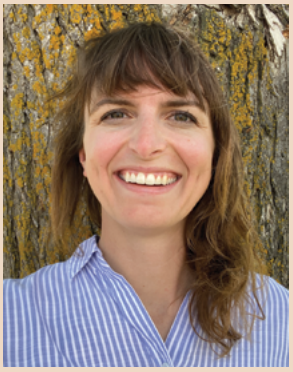
The evolution of Louisiana's response to coastal land loss has been one in which the availability and cost of sediment has emerged as the most critical factor. Sediment inventory maps estimate the total volume of Louisiana-adjacent OCS sand at nearly 2.6 billion cubic yards, with 60 percent of this material considered recoverable under current technological and regulatory constraints. Until recently, access to these offshore deposits was considered economically infeasible in comparison to lower quality, proximal sources.

Previous approaches to project budgeting have centered on the value of sediment as a commodity, with a focus on placement cost. The findings of this study, however, appear to provide economic confirmation to the longstanding notion of geomorphologists that "grain-size matters." At a minimum, the study indicates that a more comprehensive accounting of project performance (beyond construction) is required to maximize the return on coastal restoration spending.

To view the article online, see: Caffey, R. H., Petrolia, D. R., Georgiou, I. Y., Miner, M. D., Wang, H., & Kime, B. (2022). The Economics of Sediment Quality on Barrier Shoreline Restoration. *Journal of Environmental Management*, 319, 115730.

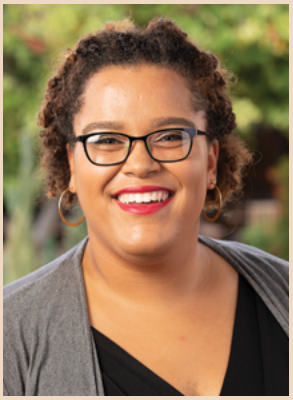
Five Louisiana Knauss Fellowship Finalists Announced

Two graduate students at Louisiana State University (LSU), two from the University of Louisiana-Lafayette (ULL) and one from Loyola University have been named 2023 Knauss Fellowship finalists. All were nominated for the fellowship by the Louisiana Sea Grant College Program.



Ashley Booth
LSU School of Renewable Natural Resources

Booth is a doctoral student concentrating in wetland ecology. She anticipates graduating in December 2022. She earned a master's degree in marine and environmental biology from Nicholls State University and a bachelor's degree in animal and veterinary science from Clemson University in South Carolina. "My research, extension, and education experiences are products of my appreciation for coastal wetlands and how they shape communities and culture," said Booth. "While living in Louisiana, I have delved into environmental and cultural experiences in the region, including countless hours spent fishing, hunting, foraging and exploring in the coastal landscape. My interest in the fellowship is driven by awareness of the gap in communication between scientists, policymakers and the public," said Booth. "The discrepancy between research and application negatively impacts ecosystem management, particularly in fields like coastal ecology where science outpaces policy. Policy formation is also negatively impacted by poor public understanding of coastal issues. This disconnect was evident during my research and consulting work in deteriorating coastal environments. Driven by these experiences, my career goal is to work in a position that combines generating actionable science with disseminating knowledge to ecosystem managers, policymakers and the public," she added.



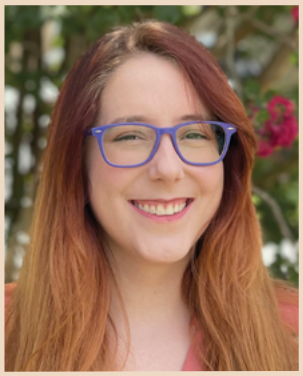
Nicole Hammond
LSU Department of Oceanography and Coastal Science

Hammond is completing her master's degree and anticipates graduating in December 2022. She earned her Bachelor of Science degree in biology from Salisbury University in Maryland. "The Chesapeake Bay is part of my identity growing up near Baltimore. It has taught me, fed me and been my place for recreation," said Hammond. "There, I directly experienced how human actions, and inaction, force surrounding communities to live with deteriorating water quality. I distinctly remember being told 'don't eat anything' that comes from the water and smelling a constant, foul odor. The poor water quality impacted the social and economic well-being of my family and friends, showing me that environmental health and public health go hand-in-hand. My love for my community and the health of our environment drives my pursuit of research that directly supports management decisions for environmental restoration. My current research provides a greater understanding of the physical drivers behind harmful algal blooms and how major environmental disturbances, such as hurricanes, may induce toxic cyanobacteria blooms. To maintain healthy coastal ecosystems in Lake Pontchartrain, we must understand the factors that trigger blooms," she added. "Seeing

firsthand the interplay between coastal issues and community inspires me to connect coastal science and policy. My goal remains to connect research with the community, and I will take the experience I gain through the fellowship back home to my native Chesapeake region or adopted Gulf Coast home."

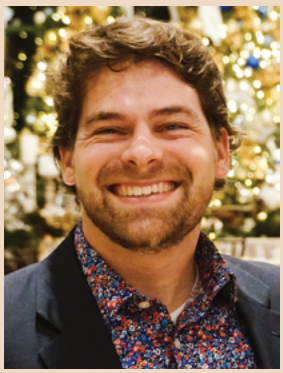
Juita Martinez
ULL Department of Biology

Martinez is a doctoral candidate with a focus in environmental and evolutionary biology and expects to graduate in Spring 2023. She earned a Bachelor of Science degree in zoology from Humboldt State University in Arcata, CA. "Growing up in California, I was immersed in a melting pot of human experiences, diverse landscapes and came to value protecting our natural resources," said Martinez. "Those formative years inspired me to pursue a career in biology. My doctoral research focuses on the consequences of restoration across Louisiana's barrier islands – an ideal seabird breeding ground. Restoration decisions have wide-reaching effects on both wildlife and humans as intact barrier islands help buffer storm impacts for coastal communities. Witnessing the restoration process from policy to planning and evaluating the results of multiple projects has reinforced my career path in environmental policy," she said. "During my doctoral journey, I've pursued leadership and policy opportunities that affirmed the value of working at the intersection of solving coastal issues, building resilient communities and increasing environmental literacy," she added. "I am eager to use my first-hand experience and perspective on coastal issues to be a liaison between scientific research and communities who rely on the coast, in part by informing and influencing coastal management and policy decisions."



Sarah Morgan
Loyola University New Orleans College of Law

Morgan earned her Juris Doctorate degree from Loyola in May 2022, and she anticipates completing her Master of Law (LL.M) degree in December. She earned her Bachelor of Science degree in ocean and coastal resource management from Texas A&M University-Galveston. "I have always been interested in science. Growing up, my favorite Christmas presents were always the science kits from Toy-R-Us. Family trips to Galveston later made me realize my absolute love for the ocean. These loves eventually led me to the marine biology program at Texas A&M," said Morgan. "But after taking an environmental law class, I realized I truly wanted to work in environmental policy," she added. "After graduating with my bachelor's degree, I regrettably learned that science alone cannot fix the problems our communities face. So, I pushed myself further and gained knowledge and experience in law to accomplish my goals. After studying the scientific aspects of resource management and the legal regulations that allow for the protections of those resources, I want to put my skillset and knowledge to use and gain experience in completing assignments that cannot be taught in a classroom. I truly believe that I can one day help create policies that aid coastal communities, especially in the coming years, where the very existence of these communities is at risk due to changing climate."



Zachary Topor
ULL Department of Biology

Topor successfully defended his dissertation and will graduate with a Ph.D in environmental and evolutional biology in August 2022. He earned his Bachelor of Science degree from the University of Maine in Orono. "I love the interdisciplinary nature of marine science. Throughout my program, I've seen how organisms interact with their environment and how those interactions impact the ecosystem. Everything is connected, and that is endlessly fascinating," Topor said. "Those connections extend to us, people who interact and depend on the coast. I've grown a great passion for communicating science in a way that is accessible. I like to relate research to good food; best shared with others." Topor added, "I believe that bringing scientists and policy makers to the same table is the most effective way to make a difference for our coast and for the people who live there. This fellowship will introduce me to the world of federal policy and open a network for collaboration, pushing me towards my goal of becoming a National Oceanic and Atmospheric Administration (NOAA) scientist." Topor's doctoral research focused on the impacts of hurricanes on coastal zooplankton communities in the northern Gulf of Mexico.

Sponsored by the National Sea Grant College Program, the John A. Knauss Fellowship matches graduate students with an interest in ocean and coastal resources and national policy affecting those resources with hosts in federal legislative or executive branch offices for one year. In November, 86 finalists from across the country will travel to Washington, D.C., to determine in which offices they will work. Fellowships will begin Feb. 1, 2023.

Students to Learn about Parade Plastics, Marine Debris

Everyone enjoys a parade. But what kind of impact does a parade have on the environment?

Louisiana Sea Grant (LSG) public engagement specialist Emily Maung-Douglass and education coordinator Jennifer Cook will begin working with Title 1 middle and high schools in January, providing insight on how discarded parade throws often end up downstream as marine debris. Title 1 schools are federally funded schools that help provide fair and equal opportunities to children. The project – titled *Plastics on Parade: Cultivating Responsible Parade Culture in Louisiana* – is being funded by a $74,000 U.S. Environmental Protection Agency (EPA) grant.

The LSG team will work with partners to develop four educational resources for students and their educators. They include:

- A video following the journey of an abandoned parade throw from the parade route to the Gulf of Mexico.
- A board game so students make mental connections to the consequences of human behavior related to plastic parade throws on the natural environment.
- A social change campaign and design challenge to promote responsible parade behaviors.
- An in-class discussion guide for educators to promote students' critical thinking on the topic.

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Puddles to Floods: Learning to "Read" Flood-Prone Landscapes of the Lower Mississippi River

Louisiana Sea Grant (LSG) is a co-lead in one of six projects funded by the Gulf Research Program (GRP) of the National Academies of Sciences, Engineering and Medicine that engage underserved children and youth in place-based educational activities.

The $224,000 project is titled *Puddles to Floods: Learning to 'Read' Flood-Prone Landscapes of the Lower Mississippi River*. Claire Anderson, executive director of the New Orleans-based Ripple Effect Water Literacy Project, is principal investigator. Dani DiIullo, LSG education director, is co-principal investigator.

Through a two-part learning journey, upper elementary and middle school students will build their understanding of the scientific and social dimensions of flooding through investigations centered on two sites — their schoolyards, and an off-campus flood control location in Southeast Louisiana.

"Understanding flooding is critical for all residents in Louisiana — whether the flooding comes from the river, the sky or the Gulf," said DiIullo. "Having the students explore their local vulnerability and then participate in field trips that show flood control or mitigation will help make this education tangible and relevant. All the partners are excited to share these experiences with the students."

"Puddles to Floods is designed to support a more seamless 'handoff' between the teacher and field-based environmental educator, where student learning begins in the schoolyard and gradually ramps up to a field-based excursion that is co-led by a teacher and informal environmental educator," said Anderson. "Through this model, we are not only building teachers' capacity to integrate field-based investigations into their everyday science teaching, we are also providing students with a deeper learning experience that blurs the boundary between their classroom and the 'real world', all while methodically building specific knowledge and skills that we know are fundamental to student science achievement.

The project will begin in January 2023, first with the teachers. Work with students is set to begin at the beginning of the 2023-2024 school year.