



# MISSISSIPPI-ALABAMA SEA GRANT 2020 IMPACTS AND ACCOMPLISHMENTS

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## Focus Area: Healthy Coastal Ecosystems

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31834

## Early detection of changes in submerged aquatic vegetation in Coastal Alabama

### **Recap:**

Low cost, annual, in-water visual surveys of submerged aquatic vegetation provide resource managers a closer look at the health and status of this vital coastal habitat so that protection and conservation management efforts can occur before negative changes become irreversible.

### **Relevance:**

Aerial mapping of submerged aquatic vegetation is often costly, (>\$100,000 per survey), and provide limited information on the health and condition of SAV. While these maps can be used to look at changes in extent, because they are spaced many years apart, they do not provide resource managers information to protect SAV against irreversible losses. This project set out to determine adequate survey parameters that will improve resource management at a lower cost.

### **Response:**

This project conducted a detailed in-water submerged aquatic vegetation survey following the Gulf of Mexico Alliance's Seagrass Community of Practice tiered monitoring strategy based from the National Park Services methods. Using a grid of tessellated hexagons for selecting sampling locations in the mesohaline and polyhaline portions of coastal Alabama waters, we will 1) test the ease of these protocols and 2) determine the adequate hexagon size. Additionally, this survey provides a baseline for future work.

### **Results:**

Analysis will occur in Phase II of the project, and will provide more detailed information to resource managers at a lower cost than aerial mapping and will detect negative changes before losses become irreversible.



Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31864

## Using microbial markers to identify human and non-human sources of fecal bacteria in shellfish growing areas

### **Recap:**

Applying DNA-based molecular methods to identify human and non-human sources of fecal contamination enhances water quality measurements and monitoring of shellfish growing areas.

### **Relevance:**

Current regulatory methods for monitoring fecal contamination in shellfish harvesting areas cannot differentiate between human and non-human sources. Microbial source tracking (MST) is a molecular-based approach that utilizes specific microbial sequences and PCR techniques to identify the species-specific contamination source. The information gathered through this approach could enhance watershed and water quality assessments for stakeholders and decision-makers and provide baseline data for future watershed comparisons.

### **Response:**

Through the many challenges associated with the Covid-19 Pandemic and the 2020 Hurricanes, progress was accomplished. We have generated a complete set microbial source tracking (MST)-specific plasmid vectors based on human and non-human microbial sequences and confirmed the sequences of the plasmid vectors which will be used in quantitative PCR measurements with Fowl Bay and West Fowl River water samples.

### **Results:**

The number of closures of shellfish harvesting areas could be reduced if microbial source tracking methodologies to differentiate between human and non-human sources pollution sources were to be added to current water quality monitoring approaches.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31863

## Landward migration of coastal wetlands helps mitigate loss of the habitat under sea-level rise

### **Recap:**

We study the historical pattern of landward migration of coastal wetlands and current vegetation productivity of the transects from salt marsh to ecotone to pine savanna. The data gained will guide development of a landscape model that predicts landward migration of coastal wetlands accounting for sea-level rise and fire management in the future. The findings will help resource management in land acquisition, fire regulation, and coastal wetland conservation.

### **Relevance:**

Coastal wetlands provide a variety of important ecosystem services but have been disappearing quickly for the last half century. Landward migration of coastal wetlands provides an important mechanism to mitigate loss of coastal wetland under sea-level rise. Understanding spatial pattern of landward migration of coastal wetlands can help better protect the valuable habitats. The project is directly relevant to the strategies of sea grant in promoting healthy ecosystems.

### **Response:**

The project studies land migration of coastal wetlands at the landscape. The main partners include Grand Bay National Estuarine Research Reserve (NERR) and Forest Service Southern Station. The main elements are how change of elevation and salinity driven by sea-level rise, coupled with fire management, affect spatial pattern of landward migration of coastal wetlands. T

### **Results:**

We compared land use/land cover change between Pascagoula Delta (PD) and Grand Bay National Estuarine Research Reserve (GB) estuaries over two time intervals. We found that overall rates of transition (ha/yr) for forest transitioning to marsh and marsh transitioning to forest were higher for the PD than GB. However, during the first time interval, GB had higher rates of marsh transitioning to water (8.48 ha/yr) than PD (8.23 ha/yr). The landward migration of marshes into forest could not keep up with the marsh area lost to water and forest in either time interval. With relation to elevation, we found that the greatest percent of marsh transitioning to forest was occurring at elevations at mean high water level and above. Conversely, GB has higher percent of forest transitioning to marsh as it has higher salinity levels.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31862

## Monitoring restoration sites for biological diversity and ecosystem function is needed for sound management decisions

### **Recap:**

Sediment nutrient cycling (C and N) may take decades to approach natural marsh conditions as stable isotope data indicate the restored sites are not yet functionally equivalent to natural marsh.

### **Relevance:**

To inform and improve the management and conservation of natural resources in MS and AL, as well as to provide a greater awareness and understanding of ecosystem functions and services provided by these regionally important *Juncus*-marsh coastal systems. The results of this research on Deer Island suggest that restoration design and construction techniques may have long-lasting ecosystem consequences and delay recovery of full natural marsh function.

### **Response:**

Data on structural attributes such as the biodiversity and abundance of relevant wildlife (macroinvertebrates) and plants (coastal marsh vegetation and BMA) are not enough to assess restoration status. Functional attributes describing ecological processes such as nutrient cycling and stable isotope are critical to understanding long-term restoration success. Both structural and functional metrics are needed to provide valuable information for adaptive management planning necessary to protect coastal habitats.

### **Results:**

Data obtained in this project provided important trophic web information on *Juncus*-dominated marshes in the northern GoM function. The key ES related to elemental (C, N) and isotopic ( $\delta^{13}C$ ,  $\delta^{15}N$ ) cycling as restored sites using BU mature over time, and the role of the development of C and N cycles will help to inform future restoration and living shoreline projects in the region.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31853

## Benthic Invertebrates are key indicators of restoration progress

### **Recap:**

A graduate student has been trained to use stable isotope techniques to determine trophic linkages within restored sites of different ages and determine their progress towards healthy coastal marsh.

### **Relevance:**

Healthy coastal ecosystems provide not only habitat (sediments, vegetation), but also food resources for resident and transient organisms (invertebrates, fish, birds). Restoration often neglects to assess progress beyond appropriate sediment elevations and presence/absence of vegetation, potentially failing to document progress towards fully functional ecosystems. Trophic connections are key in sustainable and resilient mature marsh habitats. Using stable isotope signals these trophic connections can be tracked from the sediment carbon and nitrogen pools.

### **Response:**

A graduate student is being trained by two scientists as a future expert in coastal ecosystem restoration assessment using trophic web analysis and tracking through stable isotope signatures.

### **Results:**

Samples from six seasons (spring and fall of 2017, 2018, and 2019) were collected and processed. Stable isotope measurements from sediment, plant tissue, and invertebrate samples from all three years were processed for analysis. Results of these data are being written up as an MS Thesis for defense in March 2021. The results suggest that restoration design and construction techniques may have long-lasting ecosystem consequences and delay recovery of full natural marsh function.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31841

## Evaluating tidal creeks and salt marsh resident fish communities in relation to urban development

### **Recap:**

Through this research, the impact of residential urban land use on tidal creek habitats is demonstrated and potential measures to reduce aquatic habitat impacts are investigated.

### **Relevance:**

Urbanization is known to increase runoff and stream flashiness while reducing the water quality. In coastal areas, this may ultimately change creek conditions detrimental to native fish. Information is needed to determine how changing runoff related to urban land use may reduce suitability of salt marsh habitat for resident fish. By better understanding watershed runoff impacts on tidal habitats, we can improve stormwater policy and identify urbanized tidal creeks that might be enhanced.

### **Response:**

A research project is being conducted to examine 12 creeks in Alabama/west-Florida influenced by a range of urban conditions to evaluate resident fish, water conditions, and fish diet/condition. Partners are from AU Fisheries and SFWS along with municipalities and natural resource management organizations along the coast. Target audience are coastal municipalities who use/develop stormwater ordinance and restoration groups involved with tidal creeks.

### **Results:**

Hourly and ongoing water monitoring (stage level, conductivity and DO) was conducted at 12 tidal creeks (May 2019- Oct 2020). Three resident fish sampling events occurred in Oct 2019, Jul 2020 and Oct 2020. Analyses of resident fish communities and water quality data are ongoing. Preliminary results indicate that more urbanized tidal creeks experience "flashier" salinity regimes. Variability in salinity regimes (characterized using a modified Richard-Baker index) increased with the proportion of watershed that was developed. The abundance of the dominant resident salt marsh fish, *Fundulus grandis*, increased with the proportion of the watershed that was covered by wetlands. The variability in salinity regimes also appears to be associated with changes to ecosystem metabolism, with gross primary production in urbanized tidal creek decreasing with increased daily salinity amplitude.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31840

## Stakeholders learn about coastal runoff while guiding the research plan for an MASCG funded project focused on tidal creeks

### **Recap:**

Eighteen invited stakeholders, including coastal managers and researchers, attended a workshop to learn about coastal runoff and inform the final design of a research project focused on urban impacts to tidal creeks.

### **Relevance:**

Urbanization is known to increase runoff and stream flashiness while reducing the water quality. In coastal areas, this may ultimately change creek conditions detrimental to native fish. Using past and current research, guidance is emerging on the nature of these impacts and how to minimize them.

### **Response:**

Efforts are underway to reach target audiences including coastal managers who use/develop stormwater ordinance and restoration groups involved with tidal creeks. Based on our current Sea Grant research project, 12 creeks in Alabama/west-Florida influenced by a range of urban conditions are being evaluated for resident fish, water conditions, and fish diet/condition. Partners are from AU Fisheries and SFWS along with municipalities and natural resource management organizations along the coast.

### **Results:**

A total of 18 attendees met for a 1-day coastal creek workshop and project kickoff meeting conducted at the 5 Rivers Delta Center in Spanish Fort, AL on May 17, 2019. Several presentations regarding coastal creek and urbanization were made and engagement with attendees elicited information about the designated tidal creek research sites to inform the research plan.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31839

## Getting rid of PFAS does not appear to cost oysters a lot of energy

### **Recap:**

Oysters may be able to eliminate PFAS from their bodies without using up a lot of energy that could otherwise go towards growth and reproduction.

### **Relevance:**

This means some of the impacts of PFAS exposure to oysters in the wild and in off-bottom aquaculture may not be as severe as initially suspected. This is good news for oyster conservation as well as oyster fisheries and oyster farmers.

### **Response:**

No response yet as the project is still in early stages.

### **Results:**

Previous studies have shown that although some bivalve species are very good at getting rid of contaminants like PFAS once it enters their bodies, this process (depuration) can require a lot of energy and have negative impacts on growth and reproduction. Our initial experiments are showing no detectable energetic cost of PFAS depuration to oysters.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31836

## The GoM MCoP provides a forum for sharing knowledge among regional restoration, monitoring, and mapping practitioners

### **Recap:**

State and federal water quality and habitat monitoring and mapping programs are more knowledgeable of regional Gulf monitoring and mapping needs, common practices, and information gaps. Their programs contributed to GoM regional resource monitoring through input into CMAP's Gulf Coast Monitoring and Assessment Portal (GCMAP), informing watershed gap analyses, and beginning to apply CMAP synthesis outputs into their programs.

### **Relevance:**

The Gulf of Mexico MCoP aims to increase collaboration and effectiveness of regional water quality and habitat monitoring and mapping programs. The MCoP accomplished this by providing structured forums for sharing and documenting best practices and protocols used by restoration and monitoring practitioners. With this community input, the CMAP developed a searchable web-based database of Gulf monitoring programs, metadata, commonly monitored attributes and methodologies, and developed a framework for identifying information gaps using the GCMAP..

### **Response:**

Through continued partnership with USGS, NOAA, and GOMA's robust network of regional partners, the GoM MCoP successfully reached 273 individuals during two webinars and a GCMAP tool-use survey during this reporting period, as well as multiple smaller outreach opportunities on GOMA priority issue team calls. Participants represented federal, state, and local governments, as well as, representatives from academic, NGO, and industry sectors.

### **Results:**

The GoM MCoP members contributed significantly to a robust monitoring and mapping program inventory, which resulted in the Gulf Coast Monitoring and Assessment Portal. The community provided valuable insight into their monitoring program's guidelines and attributes, information gaps, as well as, targeted watershed assessments which will shape future discussions aimed to increase cross-program comparability and coordination.



Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31835

## Reducing power consumption of underwater gape measurement system

### **Recap:**

The goal of this project is to reduce power consumption of an Oysters's; Gape Measurement System that has been developed at Jackson State University (JSU). The system measures the gape of an oyster 10 times per second and reports that gape size to a server in the cloud. This system can be used to detect oyster-spawning activities, which can be used to directly impact the oyster population.

### **Relevance:**

Reducing the system's power consumption is vital to the effectiveness of underwater sensor systems.

### **Response:**

The DAQ6510 was used to get the current readings (mA). Several approaches were explored to reduce power consumption. First, all the LEDs on the microcontroller board were removed. Second, a low power library code was utilized to make the system sleep between readings. Also, the supply voltage terminal of the HAL 2425 was connected to the Nano (D1 - D6). Finally, we replaced the single 12V power source by a set of parallel 18650 batteries.

### **Results:**

It was found that the average power consumption after all the modifications was less than 5 mA. The battery will therefore last for a total of 5000/5 hours, or 41 days. This is a marked improvement over the initial operation period of 28 days, using the same battery system, creating an improvement of 46%. Using the new battery system (6 X 18650 @3,000 mAh per battery) will allow this system to operate for 5 months.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Impact  
PIER ID Number: 31793

## The Mississippi Coastal Cleanup Program removes 13.9 tons of marine debris

### **Recap:**

The Mississippi Coastal Cleanup Program, coordinated by Mississippi-Alabama Sea Grant extension specialists, removed over 13.9 tons of litter from the coastal environment while educating more than 1,039 youth and adult volunteers about marine debris.

### **Relevance:**

Litter is an issue that impairs the environment, stormwater infrastructure, tourism and industry along coastlines.

### **Response:**

In 2016, a Mississippi-Alabama Sea Grant-funded extension specialist took over coordination and training duties for the long-running Mississippi Coastal Cleanup Program with the mission of preventing and removing litter from the coastal environment through education, outreach, research and cleanup events.

### **Results:**

Sea Grant organized or facilitated 10 cleanup events during 2020. The events attracted 1,039 volunteers who contributed 4,156 volunteer hours and removed 13.9 tons of litter, which carries a conservative ecosystem service impact of \$45,870. Volunteers also collected data on the types of litter to identify sources and design targeted prevention methods, a value that exceeded \$113,043.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Impact  
PIER ID Number: 31792

## Mississippi-Alabama Sea Grant living shorelines outreach efforts lead to protection of over 2.2 miles of shoreline

### **Recap:**

Living shorelines education and extension efforts led to the protection of 124 acres of marine habitat with an annual ecosystem service value approaching \$8.2 million.

### **Relevance:**

Erosion is a common issue for most shoreline property owners and resource managers. To combat erosion, property owners often harden their shorelines with bulkheads or seawalls. While these methods are somewhat effective at reducing erosion, they also are associated with continual maintenance and a loss of intertidal habitat. This intertidal habitat is extremely important for producing the ecosystem functions and services necessary to maintain a healthy coastal ecosystem.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium's Living Shorelines Program seeks out and evaluates alternatives to hardened shorelines, such as living shorelines, for environmental and economic benefits. This program gathers information to produce outreach materials for a range of stakeholders, such as environmental managers, contractors and property owners, about the pros and cons of different methodologies. The program provided 62 presentations, routine site visits and 23 publications on improving the effectiveness and ease of implementing living shorelines.

### **Results:**

Extension specialists informed decision-making on protection, restoration or enhancement of more than 2.2 linear miles of shoreline in Mississippi and Alabama. Their efforts led to protecting about 124 acres with an annual ecosystem service value approaching \$8.2 million (based on ecosystem service values from Costanza et al. 2014).

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Impact  
PIER ID Number: 31790

## Sea Grant-trained master naturalists provide 2,801 volunteer hours, improve 6,792 acres

### **Recap:**

The Mississippi Master Naturalist Program increased awareness of environmental issues in Mississippi and Alabama, provided 2,801 volunteer service hours (valued at \$76,187), educated 2,861 people and improved 6,792 acres during this reporting period.

### **Relevance:**

Lack of environmental knowledge often promotes poor stewardship of natural resources. Additionally, many environmentally conscious individuals are eager to provide volunteer service, but these opportunities are often difficult to find.

### **Response:**

The Mississippi-Alabama Sea Grant-supported Mississippi Master Naturalist Program was formed with the mission of developing an organization of knowledgeable volunteers to help promote conservation and management of Mississippi's natural resources through education, outreach and service within their communities. Master Naturalists must complete a 40-hour course of field and classroom instruction. They must also complete 8 hours of advanced training and 40 hours of volunteer service each year.

### **Results:**

In 2020, program participants documented 2,801 volunteer service hours valued at \$76,187. Through these volunteer hours, participants reached or educated more than 2,861 people and directly or indirectly improved 6,792 acres through stewardship activities.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31789

## Northern Gulf of Mexico Sentinel Site Cooperative develops training to increase capacity for natural resource management in the face of rising seas

### **Recap:**

The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative developed and piloted a successful training that will increase capacity among natural resource managers to address climate change in their work.

### **Relevance:**

Natural resource management has traditionally managed to historical baselines; however, as climate change continually shifts baselines and creates a more dynamic environment, natural resource managers are forced to develop novel approaches for managing in a changing system. This requires understanding the available science, the related uncertainties, potential management options and frameworks for connecting all this information while considering stakeholder needs and values.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative developed and piloted a training to increase natural resource managers' capacity to address climate change. It leveraged existing research, its sea-level rise communication and extension products, and a novel management framework. Participants navigated climate scenarios, accessed and interpreted model predictions and trend data, and implemented the RAD (Resist-Accept-Direct) framework. This was the first time RAD was operationalized and tested as a practical framework.

### **Results:**

The pilot was successful with knowledge gains and identified improvement opportunities among the seven participants. Participants included resource managers, a researcher, and an outreach professional, all of whom are employed by the Florida Department of Environmental Protection. The feedback, lessons learned and best practices have been communicated and used by other climate resilience specialists in other states (Maryland, North Carolina) and allowed the workshop to be further refined. It will be applied again moving forward.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Impact  
PIER ID Number: 31788

## NOAA makes significant changes to online tool based on input gathered by Gulf of Mexico Sea Grant Science Outreach Program

### **Recap:**

Developers at NOAA's National Centers for Environmental Information are improving the Harmful Algal BloomS Observing System (HABSOS) data tool based on input gathered by the Gulf of Mexico Sea Grant Science Outreach Team, who informed NOAA of information requests from key target audiences and helped NOAA access relevant data to include in the update.

### **Relevance:**

NOAA's National Centers for Environmental Information (NCEI) wished to update and refine the Harmful Algal BloomS Observing System (HABSOS). They collaborated with the Gulf of Mexico Sea Grant Science Outreach Team to gain feedback from target audiences to understand ways the tool could be improved and identify new federal and non-federal partners to access relevant data.

### **Response:**

Sea Grant reported that individuals from the tourism industry and recreational fishing community in the northern Gulf expressed that HABSOS should include data about large areas of Sargassum identified by satellite or other means. Knowing this would help them advise both fishers and beachgoers as to whether any might be in the area. The team also researched other data tools that include this information to find potential sources of data that developers could utilize.

### **Results:**

NCEI developers are adding a layer of Sargassum data from the University of South Florida, a source identified by the team, to the HABSOS map viewer. In the previous year, NOAA developers used audience input and a data source provided by the team to begin HABSOS updates as part of the ongoing project.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Impact  
PIER ID Number: 31787

## Volunteer Oyster Gardeners produce 80,824 oysters for restoration in Mississippi and Alabama

### **Recap:**

Mississippi-Alabama Sea Grant Consortium (MASGC) specialists worked with volunteers in Mississippi and Alabama to produce 80,824 oysters for restoration projects.

### **Relevance:**

Oyster reefs have decreased in Mississippi and Alabama as a result of a variety of stressors. Oysters and oyster reefs provide many benefits to the local ecosystem including habitat for over 300 species of animals, filtration of the water and reducing coastal erosion.

### **Response:**

In Mississippi and Alabama, MASGC staff conducted in-person and virtual oyster gardening volunteer trainings and worked with interested volunteers to grow oysters that were used to re-seed historically viable reef sites and supplement existing restorative projects.

### **Results:**

In 2020, 301 volunteers at 133 sites produced 80,824 oysters with a restorative potential of 4.03 acres and an economic value of \$88,257.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Impact  
PIER ID Number: 31786

## The SETs & Stuff virtual meeting increased understanding of how to use R software to analyze and visualize sediment elevation table data

### **Recap:**

Participants of Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative's virtual workshop on how to use RStudio to analyze data for changes in marsh surface relative to local sea-level rise and how to visualize the change graphically to increase their ability to communicate observed changes used the training to improve their ability to analyze and visualize data.

### **Relevance:**

Sediment elevation tables (SETs) are vital tools for measuring marsh surface change relative to local sea-level rise, but the data from SETs can be difficult to analyze and to communicate to wide audiences. A partner at the Grand Bay National Estuarine Research Reserve developed code for RStudio that allows SET data users to easily analyze and visualize their data. Stakeholders in the region requested training on how to use this code for their own datasets.

### **Response:**

The Northern Gulf of Mexico Sentinel Site Cooperative, supported by Mississippi-Alabama Sea Grant, planned a virtual workshop and coordinated with the Grand Bay NERR to deliver training on utilizing RStudio to stakeholders interested in using the data from SETs. The workshop represented one of the first in the region that adapted technical training to a virtual format. Ten participants from academic, non-profit, federal and state organizations spanning the East and Gulf coasts attended.

### **Results:**

Six months after the completion of the workshop, 50% (n= 8) of respondents to a follow-up survey indicated that they have used the training to improve analysis of their datasets and felt that this training improved their ability to visualize and understand their SET data. A post-workshop survey distributed immediately following the training demonstrated that 100% of workshop participants considered the training a good use of their time and indicated that their knowledge was increased.



Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31783

## Project two-pager to increase understanding of marsh modeling project

### **Recap:**

A project two-pager on marsh modeling, made as part of the extension, outreach and education portion of the Mississippi-Alabama Sea Grant Consortium-funded project, simplifies the complex mapping and ecohydro-vegetation-fire model methodology into an engaging summary that will widely increase the understanding of the project.

### **Relevance:**

Upland migration will be a primary pathway for marsh survival as sea levels rise; however, many factors influence their ability to migrate. The project team will model the effects of hydrology, vegetation, fire and climate changes on marsh migration. This modeling is complex and can be difficult to understand, but it is critical information for those managing marsh systems.

### **Response:**

To facilitate understanding of this model and its potential applications, the Mississippi-Alabama Sea Grant Extension, Outreach and Education Team created an engaging two-pager to explain this modeling effort. It used simplified language and graphics to explain the project background and the methodology associated with the modelling. Researchers and extension professionals helping with engagement and communication efforts during and after modeling efforts will use it.

### **Results:**

The published two-pager is available on the Mississippi-Alabama Sea Grant research project's webpage ([http://masgc.org/assets/images/Upland\\_Migration\\_Summary.pdf](http://masgc.org/assets/images/Upland_Migration_Summary.pdf)). The project team will distribute it in the future to increase understanding of the modeling project.

Focus Area: Healthy Coastal Ecosystems  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31782

## Legal program develops specialized online charts of invasive species rules related to bait, clarifies rules affecting fishers

### **Recap:**

The Mississippi-Alabama Sea Grant Legal Program researched complex state laws and regulations on controlling invasive species via bait, developed state regulatory charts with hyperlinks to sources and shared the results with state wildlife officials in the Southeast and Gulf of Mexico.

### **Relevance:**

Invasive species are a concern to Gulf of Mexico fisheries. Invasive plants can overwhelm tidal marshes that are the nursery to many marine species, and white spot, an invasive pathogen, can kill shrimp. Invasive species are regulated by multiple state agencies (agriculture and natural/marine resources) making it difficult to identify relevant rules. The Mississippi-Alabama Sea Grant Consortium identified an information gap regarding invasive species regulation and the use of bait, which can spread invasives.

### **Response:**

The Mississippi-Alabama Sea Grant Legal Program researched rules in Southeast and Gulf of Mexico states regarding how using bait can spread invasive species. The data was sorted into charts and shared with state wildlife officials. After consulting with them to determine priorities, the legal program developed a new resource: publicly available online charts (<https://masglp.olemiss.edu/projects/modelbaitregulation/index.html>) for nine coastal states and Puerto Rico summarizing invasive species rules related to bait.

### **Results:**

The legal program produced publicly available online charts for nine coastal states in the Southeast and the Gulf of Mexico with links to laws and regulations. The resource sorts the complex rules of each state's multiple agencies with jurisdiction over regulating the introduction of invasive species via bait. It is the only online resource with direct links to this information for these states.

## Focus Area: Sustainable Fisheries and Aquaculture

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 32010

## Elimination of the nursery (raceway) phase by stocking megalopae directly into ponds

### **Recap:**

Availability of high salinity (>18 ppt) water to fill ponds on the Thomas Seafood property allowed for direct transfer of megalopae from the hatchery to fertilized seawater ponds. The need to acclimate megalopae in raceways to lowered salinities was eliminated, a step necessary for rearing of juveniles to be stocked in low salinity ponds in Mississippi and one that would be needed to stock hardwater natural ponds in North Carolina.

### **Relevance:**

Direct stocking of megalopae from the hatchery to the pond eliminates costs associated with raceway grow-out and has the potential to reduce overall production mortality. Prepared foods for grow-out of early crab stages are expensive and mortality is high in raceways. Average production of juvenile crabs from raceways in the Mississippi studies was 16%.

### **Response:**

Transfer of megalopae over long distances was not successful in previous studies in Maryland and Mississippi. The close proximity of the North Carolina hatchery to the industry ponds may prove to be effective as the travel time would be reduced. Hatchery-reared megalopae were stocked directly into ponds and monitored to determine survival.

### **Results:**

A survival rate of approximately 7% (mix of peeler and hard crabs) was observed based on recovery of 723 megalopae from an initial stocking density of 10,000. Time in the pond was 65 days.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 32009

## Successful transfer of blue crab culture and production methodologies and economic potential for industrial development

### **Recap:**

Economic data acquired as a result of the current project identified areas for improvement and change that will lead to the profitability of hatchery-produced blue crabs for peeler production and provide an industry-driven solution to dwindling domestic supply and unfilled market demand for soft shelled blue crabs.

### **Relevance:**

Continuing downward trends in juvenile crab populations have led to more risk-averse management policies. These policies may eliminate harvest of undersized peeler crabs from the wild and close maturation areas to commercial fishing. For the soft-crab fishery to remain viable, alternatives to sourcing peeler crabs from the wild must be developed. Cultured blue crabs can expand production with little impact to the wild fishery.

### **Response:**

Study participants, using a multi-disciplinary team approach successfully transferred hatchery technology, identified new areas for research that would reduce labor and increase profits for pond production of peeler crabs, and produced economic data to guide future research and development of the industry.

### **Results:**

Initial rearing and stocking procedures provided industry partners and project personnel an opportunity to review and evaluate past and current protocols. This review led to changes in those protocols that have the potential to increase efficiency and profits. Site specific parameters in North Carolina allowed for elimination of the hatchery and nursery phases with experiments developed to test larviculture methodologies. If successful, cost of production would be greatly reduced. The belief in the future of the industry led to the development of a business proposal in concert with the scientific team.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 32008

## Past research on culture of blue crabs foundational to development of experimental work in Project Year 1

### **Recap:**

North Carolina pioneered the work on use of natural hardwater to produce blue crabs in ponds and Sea Grant specialists in Alabama were successful in using Mississippi hatchery-reared crabs to produce blue crabs in hardwater ponds in that state. Field and laboratory experiments in North Carolina and Mississippi identified key water quality and crab stocking practices to improve harvest success. The synthesis of these data was instrumental in setting initial project priorities and objectives. In all of these studies, rapid growth, multiple harvests per year, and value of soft crabs suggested profitability in this type of aquaculture endeavor.

### **Relevance:**

Low salinity pond culture allows for expansion of the industry inland. Prevalence of low salinity ponds in North Carolina and Mississippi rural areas and the need to diversify crops and income fostered research into the culture of blue crabs in those areas. In areas without access to seawater, grow-out of hatchery-reared blue crabs in low salinity ponds, whether natural hardwater or minimally salted, provides a means to diversify farm family incomes and takes pressure off wild stock, particularly those undersized crabs harvested for the soft-shell industry.

### **Response:**

Stocking experiments in Year 1 were thoroughly reviewed and discussed by project participants and the scope of the project was revised to investigate the feasibility of using high salinity ponds to produce soft shell crabs. Protocols specific to the conditions at Thomas Seafood were discussed and a series of experiments was carried out to examine the efficacy of in-pond spawning, larval development, and juvenile growth.

### **Results:**

Development of production options to address site specific needs (natural hardwater, low and high salinity) for blue crab culture was an unexpected outcome of the Year 1 efforts. For high salinity ponds, larviculture may prove successful, eliminating the costly phases of hatchery and grow-out operations. For low salinity facilities, economic studies determined areas for research to achieve increased profitability. Shared expertise facilitated development of innovative approaches to move blue crab aquaculture forward under a variety of conditions.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 32007

## Proof of concept for extensive larviculture of blue crabs by stocking ovigerous females in fertilized saltwater ponds.

### **Recap:**

Proximity to clean seawater allowed for high salinity rearing of larvae and juveniles in the North Carolina industry ponds. Initial protocols were designed for low salinity pond rearing methodologies that involved hatchery and early grow-out phases. Larviculture would eliminate those phases. Spawning and larval/juvenile development would all take place in the pond, thus eliminating the need for hatching and raceway systems.

### **Relevance:**

Intensive hatchery methods of production can be inconsistent and expensive. Production of live feeds for larvae (rotifers and Artemia) is costly and there are risks in maintaining successful cultures over the 25-30 day period of larval development. Extensive larviculture methods as described above, could prove to be a financially viable alternative.

### **Response:**

A pilot run for larviculture production of blue crabs was conducted in fall 2020 by stocking fertilized saltwater ponds at Thomas Seafood with ovigerous female blue crabs.

### **Results:**

In fall 2020, 14 ovigerous female blue crabs were stocked in industry ponds. Ponds were fertilized to maintain phytoplankton blooms and zooplankton as a food source for larval crabs. Two of the 14 crabs released their eggs. Plankton tows were conducted regularly and blue crab zoea and megalopae were observed. Water temperatures dropped below 50°F before observation of any early crab stages. Ponds will be sampled in spring 2021 to determine survival to advanced stages.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31983

## Genetic markers of fecundity in *Acartia tonsa*.

### **Recap:**

Genetic markers for fecundity will assist during selective breeding to improve egg production in culture systems.

### **Relevance:**

Genetic markers of fecundity would facilitate genetic improvement of egg production (fecundity) which can directly enhance the productivity of *Acartia tonsa* cultures.

### **Response:**

Females displaying high and low fecundity were identified during series of controlled matings and were genotyped using the dd-RAD sequencing protocol to identify potential markers of egg production.

### **Results:**

dd-RAD sequences were obtained from 36 mating pairs displaying high fecundity and 36 displaying low fecundity; the obtained data will allow scanning the genome for markers of fecundity.



Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31982

## Library preparation protocols for genome sequencing and high density genotyping of single individuals of the copepod *Acartia tonsa*

### **Recap:**

A protocol for the preparation of genomic libraries from the DNA of single individuals of *Acartia tonsa* was developed and successfully applied to genome sequencing and high density genotyping of specimens

### **Relevance:**

Genetic improvement can help bring commercial-scale production of *Acartia tonsa* to feasibility. High density genotyping and genome sequencing of single individuals are precious tools in order to implement modern approaches to selective breeding based on genomic selection. However, DNA yields in microscopic planktonic crustaceans such as *Acartia tonsa* are far too low to implement these analyses when common DNA extraction methods are used.

### **Response:**

A simple DNA extraction protocol based on chelex-proteinase K digestion in the presence of Dithiothreitol was combined with commercial genome amplification kits to generate genomic libraries from single individuals of *Acartia tonsa*.

### **Results:**

The extraction method yielded up to 20 ng of high quality DNA from a single individual which could be amplified to libraries containing over 4.5 µg of DNA. The produced libraries were successfully sequenced on both short read (Illumina Novaseq) and long-read (Nanopore promethION) sequencing platforms with high sequencing yields used for reference genome assembly. Libraries were also used in genotyping by sequencing protocols to produce high-density genome scans of single individuals for linkage mapping.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31981

## Scaling up production of *Acartia tonsa* and *Parvocalanus crassirostris* from the laboratory-scale

### **Recap:**

Laboratory-scale protocols for production of copepods were successfully applied at a larger scale to demonstrate the scalability of copepod production.

### **Relevance:**

Efficient copepod production depends on the ability to apply laboratory findings to real-world production scenarios.

### **Response:**

Using 15 L buckets, we compared production of *A. tonsa* using our previous standard protocol and environmental conditions (25C, 25ppt, 1.0 ind./ml growout and 0.5 ind/ml production) to production in conditions identified as optimal in laboratory experiments (25C, 25pp, 3.0 ind/ml growout and production). For *P. crassirostris*, there was no standard protocol, therefore, we reared them only at what experiments indicated as optimal (27.5 C, 30ppt, 7 ind./ml growout and production).

### **Results:**

Egg production for *A. tonsa* was higher using the new culture protocol vs the previous standard protocol. Egg production for *P. crassirostris* was comparable to that from laboratory-scale experiments. The potential for scalability of efficient copepod production was demonstrated.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31980

## Impact of culture density on growth and reproduction of *Parvocalanus crassirostris*

### **Recap:**

Understanding the effect of stocking density on life history traits will facilitate optimization of production.

### **Relevance:**

One of the limitations of efficient production of copepods is the relatively low density at which negative effects on life history traits are recognized. Optimization of these traits in culture will improve production.

### **Response:**

Cultures at four densities (1.0, 3.0, 5.0, and 7.0 individuals/mL) were monitored in three replicated experiments for developmental time, mortality at maturity, sex ratio, egg production, and egg hatch. Also, we evaluated the effect of changing the density at the time of maturity on reproduction.

### **Results:**

Development time was slightly faster at the lower densities. Egg production per female was negatively related to culture density, but total egg production in the population was highest in the highest density culture. Switching from low density growout systems to high density systems for the egg production phase increased egg production compared to continuous high density culture.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31979

## Optimization of copepod nauplii harvest/separation from biofloc mass production units

### **Recap:**

Previous trials demonstrated excellent *Apocyclops panamensis* nauplii production and quality resulting from biofloc mass production units.

### **Relevance:**

Work from previous years identified biofloc as a significant hindrance to nauplii harvesting from biofloc mass production units.

### **Response:**

*Apocyclops panamensis* were stocked at the density of 4000/L in 300 L tanks, and applied techniques were tested in an attempt to elucidate improved harvest techniques for *Apocyclops panamensis* nauplii from flock production units. We tested anecdotally different copepod production tank designs, different screening materials, as well as redesign of internal and external screening units.

### **Results:**

None of the applied techniques to improve separation and subsequent harvest improved significantly the harvest process. A 10-minute settlement period did result in a better separation, unfortunately many of the nauplii settled with the solids, and were thus unable to be filtered out. Everything did resuspend well after return of aeration/circulation patterns. None of the plastic, nylon, or manufactured stainless steel screens, nor screen reconfigurations tested provided any improved results. While the biofloc worked very well as a culture method, for viable application in commercial hatcheries, future research needs to be conducted with an emphasis on particle to particle interaction, to resolve the screen clogging issues.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31978

## Cost analysis of *Oithona colcarva* and *Parvocalanus crassirostris* nauplii production

### Recap:

Economic analysis indicates that nauplii production requiring live algal production as copepod feed is considerably more expensive than rotifer production on a per unit basis due in large part to labor costs associated with algal production. *O. colcarva* production is considerably less expensive than *P. crassirostris* production and could be a viable option for high value aquaculture species that require copepod nauplii for success.

### Relevance:

Evaluating the costs associated with nauplii production is vital for aquaculturists to examine the economic feasibility of employing copepod nauplii as a feeding option in their operations. This analysis examined both capital costs associated with starting nauplii production and production costs per 100,000 nauplii based on production trials conducted at the Tropical Aquaculture Lab.

### Response:

Production budgets (capital and production cost estimates) were developed from data collected from demonstration copepod systems. System start up equipment and costs for each system including nauplii production, algal production, and water mixing as well as annual expenses (labor, electricity, salt, and other production inputs) were estimated along with batch production rates for each species.

### Results:

Capital costs and production costs associated with greenhouse production of *O. colcarva* were only 72% and 53%, respectively, of the same costs associated with *P. crassirostris* produced indoors. Nauplii production costs were still significantly higher than costs associated with marine rotifer production on a per unit basis due largely to labor requirements associated with nauplii production.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31977

## Demonstration of a pilot-scale batch culture of *Oithona colcarva* will facilitate future mass-scale production

### Recap:

This experiment demonstrates the ability of *O. colcarva* to thrive in greenhouse conditions with naupliar production numbers and longevity comparable to *Parvocalanus crassirostris*, a staple live feed species in aquaculture.

### Relevance:

*Oithona colcarva* is a potential live feed candidate for aquaculture. Costs associated with laboratory cultures include lighting, a biosecure infrastructure, and climate control. Due to *O. colcarva*'s natural thermal tolerance, omnivorous ambush predation habits, and tolerance to ciliate blooms, it may be suitable for greenhouse production. Greenhouse production would reduce the cost of culturing this copepod and facilitate its use as a feed candidate.

### Response:

Three pilot scale 200-liter cultures were established in a greenhouse and exposed to a natural photoperiod and minimal biosecurity. They were maintained at ~30 °C using submersible aquarium heaters. Cultures were fed a 1:1 carbon-equivalent mix of live *Tisochrysis lutea* and *Tetraselmis chuii*. Water changes were carried out once per generation (1-2 weeks), and daily naupliar production was enumerated for the entire production cycle.

### Results:

*O. colcarva* can thrive in greenhouse conditions with naupliar production numbers comparable to other commercially produced calanoid copepod species. Pilot scale tanks produced an average of 2.56 million nauplii/day for 10 consecutive days.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31976

## Water treatment effects on naupliar production efficiency of *Parvocalanus crassirostris* in batch culture

### **Recap:**

Results suggest that while water treatment does result in improved water quality, a commensurate increase in nauplii production was not observed. The use of a water treatment system for copepod culture does not appear to be beneficial for nauplii production at this time. However, the use of such a system should not be ruled out for conservation of water resources.

### **Relevance:**

*Parvocalanus crassirostris* is a widely-used copepod species in the aquaculture industry. Increased daily naupliar production and an extended naupliar production period with decreased production costs and labor could improve the ease of production and potentially improve marine larval fish production.

### **Response:**

An experiment compared 400-liter static production tanks to 400-liter production tanks with daily water treatment (n=3). Experimental methods were refined and a fourth trial was conducted.

### **Results:**

Water quality was better, with lower nitrite and unionized ammonia levels, in the water treatment tanks. However, nauplii production was not significantly affected by water treatment. The use of a water treatment system for copepod culture does not appear to be beneficial for nauplii production at this time.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31975

## The use of algal concentrates in production of *Oithona colcarva*

### Recap:

A diet consisting exclusively of algal concentrates is not sufficient to allow *O. colcarva* to survive until adulthood and be reproductively viable. A partial algal concentrate diet is sufficient to allow growth to the adult stage but not reproduction. Algal concentrate diets are not recommended for *O. colcarva* culture.

### Relevance:

Partial or complete replacement of live algae with commercially-available algal concentrates is of high value to commercial copepod culture due to the reduced associated production costs. Algal concentrates can be purchased and easily stored, eliminating the need to grow live algae. Culturing live algae requires specialized equipment, trained personnel, and biosecurity infrastructure. Elimination of these costs would substantially reduce the cost of copepod culture and increase ease of culturing, facilitating commercial copepod culture.

### Response:

A control diet of 1:1 live *T. lutea*:*T. chuii* was compared to a 1:1 *T. lutea*:*T. chuii* algal concentrate diet (Reed Mariculture), a mixed diet of live *T. lutea* and *T. chuii* algal concentrate, and a diet of live *T. lutea*. Nauplii were stocked at 8 nauplii/mL into 3 L mesocosms (30°C, 12L:12D photoperiod). Mesocosms were fed daily. At least 10 copepods from each mesocosm were photographed for development and growth.

### Results:

Nauplii fed exclusively on concentrated algae exhibited delayed development and did not survive to adulthood. Nauplii fed the partial concentrate diet or monoalgal live diet, both exhibited delayed development and neither population reproduced before termination of the experiment. These results suggest a potential deficiency in the nutrition provided by the algal concentrate and monoalgal diets.



Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31974

## Optimization of the photoperiod for *Oithona colcarva* will increase production efficiency

### **Recap:**

*O. colcarva* naupliar production is greatly affected by their photoperiod. A light cycle consisting of 6-12 hours of light per day is recommended.

### **Relevance:**

Photoperiod control for *O. colcarva* culture is a cost associated with mass-scale production because it requires investments in both infrastructure and electricity. *O. colcarva* are phototactic and require a light cycle. Stock cultures maintained in a greenhouse were exposed to a natural light cycle, which ranged from 12L:12D to 14L:10D. Use of a natural or abbreviated photoperiod would reduce costs associated with maintaining an artificially protracted period of light.

### **Response:**

Three photoperiods (18L:6D, 12L:12D, and 6L:18D) were evaluated. All cultures were fed a 1:1 carbon equivalent diet of *T. lutea* and *T. chuii* at 400,000 cells/mL. Daily separation of adults allowed for enumeration of produced nauplii.

### **Results:**

Naupliar production was significantly greater in the 6L:18D and 12L:12D treatments than in the 18L:6D treatment. This indicates that reduced photoperiods are preferred to improve naupliar production and thus production efficiency.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31973

## Optimization of live algal diets for *Oithona colcarva* will increase production efficiency

### Recap:

While a mixed diet is required for adequate naupliar production, a mixture of two species is sufficient and more practical for production than the original three species reference diet.

### Relevance:

Live algae is a major cost associated with mass-scale production of *O. colcarva* because of the personnel and biosecurity infrastructure required. *O. colcarva* stock cultures are currently fed with a mixture of three live algal species, according to Broach et al. 2017. A transition to a diet composed of fewer algal species would decrease production costs associated with *O. colcarva* feeding requirements by limiting the cost of labor and resources associated with maintaining algal cultures.

### Response:

Three experimental live algal diet mixtures and a control diet were evaluated under a 12L:12D photoperiod. All diet mixtures were equivalent based on carbon and fed at a concentration of 400,000 cells/mL. The experimental diets were: *T. lutea* and *T. chuii*, *T. lutea* and *C. muelleri*, and *T. lutea* only. The control diet was a mixture of *C. muelleri*, *T. lutea*, and *T. chuii*. Daily separation of adults allowed for enumeration of produced nauplii.

### Results:

Naupliar production was significantly greater in the 1:1 *T. lutea* and *T. chuii* diet than in any other treatment, suggesting that this diet is preferred for maximizing reproductive output of *O. colcarva*. The only monoalgal diet performed poorly with limited naupliar production.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31972

## Improvement of culture density for *Oithona colcarva* will increase naupliar production and production efficiency

### **Recap:**

Higher culture densities appeared to produce greater numbers of copepod nauplii in the first stocking density experiment, however density dependent inhibition was observed at the higher stocking densities tested in the current experiments. A stocking density of 8 adults/ml is recommended as the ideal stocking density for this species.

### **Relevance:**

Copepod nauplii are of suitable size and nutritional composition for many marine finfish larvae. Optimization of culture density will maximize production of *O. colcarva* nauplii while driving down the cost per nauplius. Twenty-four nauplii/ml produced the most nauplii. To reduce variability within treatments, the experimental protocol was modified to reflect stocking densities of adults. The experiment first established the theoretical maximum and then refined the results to align with new control conditions.

### **Response:**

Four rearing densities (8, 12, 16, and 24 adults per ml) were evaluated under a 12L:12D photoperiod. Copepods were fed a 1:1 carbon-equivalent mix of live *Tisochrysis lutea* and *Tetraselmis chuii* at 400,000 cells/mL/day. Daily separation of adults allowed for enumeration of produced nauplii.

### **Results:**

Mean cumulative nauplii production was not significantly different at any stocking density tested in the first or second experiment. This suggests that a density of 8 adults/mL will yield the the best efficiency for production of this species.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31962

## High school students operate commercial oyster farm, develop skills in Mississippi-Alabama Sea Grant-supported program

### **Recap:**

Mississippi-Alabama Sea Grant provided technical assistance and training to help high school students from Moss Point High School (MS) and Bryant Career Tech Center (AL) operate a student-operated commercial oyster farm in Grand Bay, Alabama, and four high school students and one graduate student acquired skills and knowledge that better prepared them to enter the industry.

### **Relevance:**

Commercial oyster farming has provided new economic opportunities in rural coastal communities in the northern Gulf of Mexico. High school students expressed interest in this industry and sought training to improve their skillsets.

### **Response:**

In partnership with Mississippi-Alabama Sea Grant and Auburn University Shellfish Lab, Bonus Point Oyster Company, a 501(c)(3), was established in Alabama to provide a vocational platform for local high school students. Mississippi-Alabama Sea Grant extension professionals provided technical assistants and training, and students learned the basics of growing oysters using off-bottom aquaculture methods on the oyster farm.

### **Results:**

Four high school students gained valuable practical experience on the oyster farm.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31852

## Sea Grant initiates bi-weekly aquaculture meetings in response to COVID-19

### **Recap:**

The National Sea Grant Office and the Sea Grant Aquaculture Liaison initiated bi-weekly regional aquaculture virtual meetings to identify needs of the aquaculture industry and best practices to respond to those needs.

### **Relevance:**

The COVID-19 pandemic caused significant economic hardships to the aquaculture industry. Extension staff, who are front-line responders to for the industry needed a means of rapid and regular communication within the Sea Grant Network and to the NOAA Fisheries Office of Aquaculture.

### **Response:**

In April 2020 the National Sea Grant Office and the Sea Grant Aquaculture Liaison initiated bi-weekly virtual meetings with the Sea Grant Network focusing on aquaculture and seafood resources. More than 90 1-hour Google Meets or Zoom meetings have been held. The chats were initiated as a means of exchanging information regarding grant opportunities and relief programs in response to the COVID-19 pandemic. Currently scheduled every two weeks, these one-hour chats involve four separate regions.

### **Results:**

More than 90 1-hour Google Meets or Zoom meetings have been held. Input from the meetings these meetings led to identifying prioritized needs of the aquaculture industry which provided guidance for the National Sea Grant Office to respond to the needs identified through COVID-19 rapid response funding to Sea Grant programs. The meetings are a good example of a community of practice which has resulted in effective communication better respond to stakeholder needs.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31851

## Sea Grant conducted a research, education and engagement needs assessment

### **Recap:**

An internal Sea Grant Network stakeholder needs assessment identified research, education and engagement needs of the aquaculture industry including the need to develop a comprehensive aquaculture literacy program.

### **Relevance:**

The COVID-19 pandemic caused significant economic hardships to the aquaculture industry. Sea Grant invests around \$20 million in federal funds annually to support aquaculture, research, education and engagement. It is important that Sea Grant addresses the high priority needs of the aquaculture industry and other stakeholder groups.

### **Response:**

To better respond to industry needs in these functional areas, Sea Grant is developing a research, education and engagement plan. The plan is being developed using information collected from multiple sources including an internal needs assessment of the Sea Grant Network and an external needs assessment of the industry, non-governmental organizations and federal agencies, and the use of existing planning documents which identify research, education and engagement needs.

### **Results:**

To date, the internal Sea Grant survey has been completed and included 66 detailed response providing 868 lines of useable data. A significant finding was the need to create a national aquaculture literacy program connected directly to address specific literacy needs at the at the national, regional and local levels. The external stakeholder survey is being analyzed along with the aquaculture needs from more than a dozen state and regional aquaculture plans.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31850

## Training the future of aquariums and aquaculture

### **Recap:**

The future of the world's aquariums and aquaculture should no longer be dependent on nature's stocks and are in the hands of today's youth because depletion of wild caught product has not been able to keep up with demand in many cases, creating the need for a knowledge base assembled by world biologists to maintain usable healthy stocks of animals available to aquariums and aquaculture through the efforts of internship programs.

### **Relevance:**

The Internship program is important to train the future aquaculture and aquarium managers in the best practices available to create viable stocks and supplies while increasing the knowledge base for the future managers.

### **Response:**

Two biology students have been trained by senior aquarium personnel, during the extent of this internship, in the methods and processes of aquarium stock management and aquaculture methods.

### **Results:**

Two internship students successfully complete the syllabus given to them as well as completing a mini-project related to the field of aquaculture or aquarium fishkeeping, advancing the knowledge base of aquarium staff and managers. One of the interns was later hired full-time into the aquarium field.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31849

## Scared oysters resist predators and survive more often

### **Recap:**

Oysters built stronger shells when exposed to blue crabs and oyster drills in a nursery. Oysters with stronger, more predator-resistant shells survived significantly more than oysters raised without predators in 3 different field sites. This finding suggests that incorporating predator cues into hatchery/nursery techniques can improve oyster restoration and aquaculture when using spat-on-shell.

### **Relevance:**

To improve oyster restoration and aquaculture, we are preadapting oysters to predation risk in a nursery by exposing them to predator exudates. If we can increase survival of nursery-raised oysters, oyster restoration and aquaculture can be enhanced.

### **Response:**

Oysters were grown as spat-on-shell and reared in a flow through seawater system at the Dauphin Island Sea Lab. Oysters were grown with caged blue crabs, caged oyster drills, or empty caged controls. After 5 weeks, oyster shell strength and size were measured, oysters were transplanted into the field, and their survival monitored.

### **Results:**

Oysters created significantly stronger shells when grown with caged blue crabs and caged oyster drills as compared to controls without predators. Pairwise differences among oysters grown with blue crabs vs. oyster drills were not observed. When placed in the field in oyster farms in Grand Bay and Portersville Bay, and on natural reefs on Dauphin Island, oyster survival was significantly higher when oysters were grown with predators (regardless of predator type) as compared to controls.



Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31848

## Small blue crabs were evaluated to identify characteristics or signs that indicated they were ready to molt or shed

### **Recap:**

Juvenile crabs were held in recirculating systems at CCC and photographed frequently. The visibility of the new shell forming within the swimmerets was the most reliable sign a crab was a "peeler"

### **Relevance:**

Aquacultured crabs could take advantage of marketing opportunities for smaller soft crabs, or "cocktail crabs"

### **Response:**

Juvenile crabs were held in recirculating systems at CCC and photographed frequently.

### **Results:**

The visibility of the new shell forming within the swimmerets was the most reliable sign a crab was a "peeler". Pink and red line stages were the most visible; the earlier white line stage was more difficult to see visually.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31838

## Hot spot of red drum activity identified for fine-scale tracking study

### **Recap:**

We will deploy a fine-scale array to track the movements of red drum in various microhabitats associated with a restored shoreline, and our assessment of which features are most often inhabited by red drum will be used to maximize restored shoreline benefits to fisheries species in the future.

### **Relevance:**

Despite nearly \$30 million being spent to restore Alabama shorelines in the past 15 years and plans to spend another \$30 million more, our understanding of how restoration initiatives benefit fisheries species is limited.

### **Response:**

We used acoustic telemetry to track the habitat selection of red drum in Little Bay, which is protected by a restored peninsula guarded from wave action by a series of concrete breakwater pyramids, and along Point aux Pins Peninsula where oyster reefs were previously built to reduce shoreline erosion and concrete breakwater pyramids have recently been installed.

### **Results:**

We identified a hot spot of red drum activity at Point aux Pins. This location includes breakwater pyramids, an oyster reef, seagrass, and fringing marsh. This is an ideal location for a fine-scale array, which can triangulate the position of fish within ~1m, and assess how red drum use various features of the restored shoreline. Understanding which features are most frequently inhabited by this fishery species can be used to inform future shoreline protection initiatives.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31837

## Red drum can carry tracking tags weighing more than 2% of their body weight

### **Recap:**

Red drum implanted with tracking tags that historically would have been considered too large for them behaved similarly to conspecifics implanted with appropriately sized tags, so the habitat selections of smaller fish, previously considered too small to track, can be assessed using acoustic telemetry in the future.

### **Relevance:**

The size of red drum that could be tracked using acoustic telemetry has historically been limited by large tag sizes and the "2% Rule." Accordingly, red drum tracking studies generally have focused on fish larger than 35 cm, and studies of pre-slot-sized fish are lacking. This is problematic because the growth and survival of smaller individuals has the greatest impact on population sustainability.

### **Response:**

We tagged two under-slot red drum with tracking tags weighing more than 2% of their body weight and compared their movements and habitat selection to red drum carrying tags weighing 2% or less than their body weight.

### **Results:**

Red drum implanted with tags that were historically considered too large behaved similarly to their conspecifics implanted with "appropriately" sized tags. This means smaller red drum can be implanted with larger tags in the future, and we can increase our understanding of the movement patterns and habitat selection of this previously under-studied size-class. Larger tags have longer battery lives such that fish can be tracked over multiple years as they grow and enter the fishery.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31832

## MASGC economist assessed economic yield gaps in producing softshell blue crabs

### **Recap:**

MASGC economist developed economic simulations to guide decision-making concerning the management and operation of commercial softshell blue crab ponds grow-out to maximize harvests and improve profitability.

### **Relevance:**

The pond management decisions; potential costs and benefits were weighed in advance before implementing any planned changes. In each of these simulations, the yield gaps were measured to enable prospective growers to make softshell blue crab farming a profitable enterprise.

### **Response:**

Working with crab scientists, specialists, and producers in Mississippi and North Carolina, the MASGC marine economist conducted economic simulations to determine yield gaps toward the economic feasibility of producing softshell blue crabs. In making these simulations, the current information and data on softshell blue crab production in North Carolina were used for brackish water production. For freshwater ponds, the Mississippi historical data on pond preparation, stocking, feeding, and survival were used in simulations.

### **Results:**

The MASGC marine economist estimated the optimal stocking, operational, and harvesting parameters of feasible soft blue crabs in brackish and freshwater ponds. The economic yield gap was measured as the difference between current experimental yields and optimal yields in different pond grow-out systems. The economic feasibility of commercial pond grow-out systems depends on the narrowing of this yield gap in either freshwater or brackish water environment.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Impact  
PIER ID Number: 31830

## Estimating the Absolute Abundance of Age-2+ Red Snapper (*Lutjanus campechanus*) in the U.S. Gulf of Mexico

### Recap:

This project involved a unique sampling design that incorporated novel sampling technologies, which builds on our scientific knowledge base and improves our understanding of Red Snapper abundance in a non-contentious and constructive approach to federal assessments. This project also included a high-reward tagging program that engaged recreational fishery stakeholders and generated estimates of exploitation and fishing effort in eastern and western regions of the U.S. Gulf of Mexico.

### Relevance:

The U.S. Gulf of Mexico Red Snapper fishery stock assessment is hindered by a lack of robust data, especially at structured habitat areas. To address this need, a \$12.5 million research program, unprecedented in scale, was launched, and Congress made available \$10 million in funding for a 2-year research project designed to independently estimate Gulf Red Snapper abundance using best available technologies. The absolute abundance estimate determined within this project will bolster future assessments and afford other stock evaluation and management options.

### Response:

A team of 21 leading scientists from 12 institutions across the Gulf and beyond assembled to design and implement a large-scale population survey to independently estimate the abundance of age-2+ Red Snapper in the northern Gulf across 3 habitat types, 3 depth zones, and 5 regions on the continental shelf.

### Results:

A suite of methods, including habitat classification, direct visual counts, depletion surveys, and a high-reward tagging study were used to calculate an overall absolute abundance estimate of 110 million age-2+ (CV 11%) Red Snapper across the continental shelf of the U.S. Gulf of Mexico during late 2019. While large numbers of fish occurred over well-known habitat features such as artificial reefs and natural hard bottom, we estimated that uncharacterized bottom habitat harbored the majority of Red Snapper. These new data will be incorporated into the management process. During Spring 2021 the Gulf of Mexico's Science and Statistical Committee deemed the study as appropriate for management advice and began the process of integrating these fishing into the assessment process by increasing the Allowable Biological Catch (ABC) as a short-term measure. The full extent of the newly discovered fish from this study will be incorporated at the next Red Snapper Stock assessment that will be performed during 2021-2022. However, the results from the project led to increasing the 2021 overfishing limit (OFL) for red snapper to 25.6 million pounds (2019 OFL was 15.5 million pounds) at the March 2021 Gulf of Mexico Fisheries Management Council's Science and Statistical Committee meeting.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31829

## Fishermen join continuing effort to measure costs of marine debris in shrimping industry

### **Recap:**

Mississippi-Alabama Sea Grant continued to measure daily economic impacts of marine debris on Mississippi commercial shrimping operations.

### **Relevance:**

Commercial shrimping is a significant portion of the Mississippi commercial fishing industry in sales, job creation, income generation and tax revenues. Many commercial fisheries report that marine debris has lowered catch, increased fishing effort, caused additional repair and maintenance costs of fishing assets and made fishing time longer. Quantitative estimates of the direct and indirect impacts of marine debris on the commercial shrimping industry should be derived and utilized to inform management decisions.

### **Response:**

Mississippi-Alabama Sea Grant Consortium-supported specialists compiled, analyzed and reported the daily shrimping activities of the 20 captains or owners of Mississippi commercial shrimping vessels/boats selected to participate in the economic impacts of marine debris on the commercial fishing study. The commercial shrimpers submitted a total of 393 daily summaries. The daily summaries covered shrimping activities, marine debris encounters, damages and impacts.

### **Results:**

Logit and regression analysis evaluated the frequency of the marine debris encounters, levels of damage to fishing assets and impacts on fishing hours and shrimp catch associated with marine debris encounters. The daily reduction in shrimping time (hours) was significantly different by shrimping date, county, gear type and number of days per trip. The daily reduction in shrimp catch (%) was very different by county, gear type and occurrence of Bonnet Carre Spillway opening.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31828

## Economist creates models to determine COVID-19's potential impacts on seafood industry

### **Recap:**

An economist continued to measure the economic impacts of disasters and the COVID-19 pandemic on the seafood industry in Mississippi, the Gulf of Mexico and beyond.

### **Relevance:**

A Mississippi-Alabama Sea Grant-supported marine economist received several inquiries and requests for assistance in estimating the economic impacts of the natural, technological and human-made disasters and global pandemics to the seafood industry. This economic information provided organizations potential economic damage estimates to support their requests for federal assistance.

### **Response:**

A Mississippi-Alabama Sea Grant Consortium (MASGC)-supported specialist developed several economic models that measured the potential impacts of the COVID-19 pandemic on Mississippi's and region's seafood industry in 2020. The results of this economic modeling were relayed to organizations through social media and YouTube presentations.

### **Results:**

Mississippi-Alabama Sea Grant provided Mississippi's commercial fishing organization with estimates of potential impacts of the pandemic on state commercial fisheries in 2020. The shrimp processors association asked for impacts on ex-vessel and wholesale prices of Gulf shrimp products. Economic models dealing with other major fish and shellfish species consumed in the U.S. were developed and posted as YouTube presentations.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Impact  
PIER ID Number: 31827

## Training program teaches basics of starting, improving off-bottom oyster aquaculture operations

### **Recap:**

This program taught potential and current commercial Mississippi oyster farmers the basics of off-bottom oyster aquaculture and provided a foundation of knowledge for them to start or improve their oyster farming operations.

### **Relevance:**

The natural reef harvests of the native eastern oyster (*Crassostrea Virginica*) has been in decline for the last few years in part due to wild harvest and environmental impacts. Culturing oysters spawned from broodstock in hatcheries is a sustainable resource for food supply and has a beneficial economic impact in the community.

### **Response:**

Sea Grant extension personnel worked with the Mississippi Department of Marine Resources to develop and conduct a training program for off-bottom oyster aquaculture. The course consisted of two sessions that included classroom and field activities. Due to COVID-19 restrictions, an additional training was held remotely.

### **Results:**

Over 20 people participated in the course, and many are expected to move forward to participate in the training area of the oyster park, where they will raise 10,000 to 12,000 oyster seed to market size. It is expected that some of these students will move forward with a commercial oyster aquaculture operation, which will be the third time this training has been conducted in Mississippi. In the last three years the program has trained 64 students, and 27 have gone on to start a commercial oyster farm.



Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31826

## Branding efforts, Extension products support commercial and charter-for-hire fishers impacted by the COVID-19 pandemic

### **Recap:**

Mississippi-Alabama Sea Grant Consortium specialists worked with the Mississippi Department of Agriculture and Commerce to incorporate wild caught seafood into Genuine MS branding efforts that supported direct market activities for the fishing industry and created a fishing fact sheet that encouraged the public to book fishing trips with charter-for-hire fishers from Mississippi and Alabama.

### **Relevance:**

Commercial and charter-for-hire fisheries are vital to the coastal communities of Mississippi and Alabama. Unfortunately, the COVID-19 pandemic negatively impacted both of these fishing sectors through decreased seafood sales and cancelled charter fishing trips. Given the regional importance of fishing, along with the magnitude of economic loss experienced by the commercial and charter-for-hire industries, Extension efforts were needed to help mitigate some of the COVID-19 impacts on these sectors.

### **Response:**

Mississippi-Alabama Sea Grant Consortium specialists contacted commercial and charter-for-hire fishers to solicit input regarding how COVID-19 had impacted their businesses. In response to those needs, Sea Grant specialists worked with the Mississippi Department of Agriculture and Commerce to incorporate wild caught seafood into Genuine MS (a program that markets Mississippi products) branding efforts and created and distributed a two-page fishing fact sheet that encouraged the public to book fishing trips with charter-for-hire fishers.

### **Results:**

Genuine MS personnel added a "caught wild" section to the Genuine MS website to help promote the state's wild caught fisheries. They also waived first-year membership fees for select seafood marketers who completed a Mississippi-Alabama Sea Grant survey prior to joining Genuine MS, with three seafood marketers joining to date. In addition, the two-page fishing fact sheet was promoted by coastal tourism groups and has reached over 3,800 people across various social media platforms.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31825

## Sea Grant specialists author new book, extend practical, science-based information about fisheries-related topics

### **Recap:**

After recognizing a need for an up-to-date, user-friendly synthesis of fisheries-related information specific to the north-central Gulf of Mexico region, Mississippi-Alabama Sea Grant Consortium (MASGC) specialists wrote a 10-chapter book titled "FISHES: Fishermen Invested in Science, Healthy Ecosystems, and Sustainability."

### **Relevance:**

Mississippi-Alabama Sea Grant Consortium specialists possess valuable knowledge of fisheries-related topics. Additionally, these specialists recently recognized a need for an up-to-date, user-friendly synthesis of fisheries management, fisheries science and sustainability information specific to the north-central Gulf of Mexico region.

### **Response:**

Specialists wrote a book titled "FISHES: Fishermen Invested in Science, Healthy Ecosystems, and Sustainability" (MASGP-20-053). This 72-page publication was designed to extend practical, science-based information in a straightforward format. The book consists of 10 chapters across three categories: fisheries management; fisheries science; and ecosystems and sustainability. The editor and authors distributed this work as a PDF (<http://coastal.msstate.edu/sites/coastal.msstate.edu/files/files/drymon/fishes.pdf>) through the Sea Grant Fisheries Extension Network and social media platforms.

### **Results:**

Since publication and distribution of the book in late 2020, the editor and authors have received resoundingly positive feedback from various Sea Grant Fisheries Extension Network personnel, Mississippi State University Extension faculty and staff and members of the general public. This success prompted the specialists to begin developing an in-person course of the same name to teach commercial and recreational fishers about the topics discussed in the book.

Focus Area: Sustainable Fisheries and Aquaculture  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31824

## Survey shows increased satisfaction with red snapper populations, management due to Sea Grant-funded engagement efforts

### **Recap:**

Survey data suggest that Great Red Snapper Count stakeholder engagement efforts enhanced angler satisfaction with Gulf of Mexico red snapper populations and management; moreover, respondents who had seen videos depicting the component methods of the project possessed the highest levels of satisfaction with management.

### **Relevance:**

Red snapper is one of the most valuable and culturally relevant fisheries in the Gulf of Mexico. A team of researchers recently completed a complex, three-year Mississippi-Alabama Sea Grant Consortium (MASGC)-funded study, termed the "Great Red Snapper Count," to independently estimate the absolute abundance of red snapper in the U.S. Gulf of Mexico. Given the complexity of the project and the controversial nature of the fishery, stakeholder engagement was a critical component of the project.

### **Response:**

To engage stakeholders, MASGC specialists created and distributed five videos and five fact sheets detailing the project's rationale, goals and methods. Then, the specialists and social scientists developed an electronic survey to measure public awareness of the Great Red Snapper Count and public satisfaction with current Gulf red snapper populations and management. The team surveyed a total of 1,000 individuals (200 per Gulf state) who saltwater fish in the Gulf of Mexico.

### **Results:**

Angler awareness of the Great Red Snapper Count was associated with up to three times higher satisfaction with red snapper management. Additionally, an in-survey video experiment demonstrated that anglers who were presented a video about a component of the Great Red Snapper Count reported higher management satisfaction than those presented a project overview video or no video. This indicates that anglers may desire in-depth, yet understandable, insight regarding scientific methodologies for assessing fish populations.

## Focus Area: Resilient Communities and Economies

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 32704

## Knowledge regarding the resilience of MS-AL coastal communities is improved by accounting for hazard and local context

### **Recap:**

Scientists developed and applied a scorecard, which enhanced short-term community resilience by allowing community and business leaders to take ownership of their risk.

### **Relevance:**

The ability to measure resilience to climate-induced hazards is increasingly being identified as a key step towards disaster risk reduction. Improving methods and metrics aimed at measuring resilience is vital to evaluate and benchmark conditions that make coastal communities resilient, to help coastal communities understand the factors that can lead to adverse impacts and differential recovery following hazard events, and to capture local processes for decision-making that are representative of local knowledge, practices, and conditions.

### **Response:**

We implemented methods to address how characteristics that affect the resilience of MS-AL coastal communities: a) change over time, b) vary by hazard, c) differ within and across hazard zones, and c) change due to community and livelihood contexts. By combining hazard and risk assessments with resilience metrics, a monitoring and evaluation tool that leverages existing NOAA and Sea Grant products was developed to better understand context specific gaps in MS-AL coastal community resilience.

### **Results:**

Community leaders better understand the status, achievements attained, and gaps within key dimensions of resilience to climate-induced hazards. Here, results using "top-down" and "bottom-up" measures of resilience were achieved considering hazard context. These metrics were validated using stakeholder participation and the short and long-term recovery from Hurricane Katrina. Gaps and drivers of resilience within the region's livelihood sector were captured via a Resilience Performance Scorecard that was sent to more than 4500 coastal businesses.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31961

## Extending green infrastructure planning beyond the local: Considering regional landscape networking and clustering

### **Recap:**

Using advanced GIS and OLS regression analyses to model stormwater runoff in this project's watershed region, several landscape patterns demonstrated significantly relevant reductions in stormwater runoff. Namely, an increased proportion of, and more connected, wetlands and vegetation are significantly associated with a reduction in stormwater runoff. As a green infrastructure strategy, these landscape patterns should be planned and protected - locally and regionally - as important tools for mitigating the risks associated with development and climate change.

### **Relevance:**

Growth and development can threaten the ecosystems of a city and its surrounding areas as undeveloped land is converted into impervious surfaces. This is an issue particularly for coastal cities as their location makes them susceptible to natural disasters, such as flooding and hurricanes. When coastal cities' locational vulnerability is coupled with land development and the expansion of urban areas, their vulnerability and risk of damages increases while making them less resilient to natural disasters.

### **Response:**

In order to analyze the association between landscape patterns and stormwater runoff, advanced GIS and OLS regression analyses were conducted for over 1200 sub-basins in the project's watershed. This included using the Soil and Water Assessment Tool (SWAT) to model watershed discharge and GIS/Fragstat to analyze landscape ecology metrics; as well as analyzing regional watershed characteristics (i.e., mean annual peak runoff depth, precipitation, soil permeability, floodplain area, natural drainage density, wetlands, and impervious rate).

### **Results:**

Key findings from the stormwater runoff analysis of landscape patterns include: increased proportion and more connected wetlands are significantly associated with a reduction in runoff; increased proportion and more connected vegetation are highly significant and associated with reduced runoff; and proximity of development has a significant positive association with runoff. These findings suggest that wetland and vegetation landscape patterns should be planned and/or protected as a tool for mitigating the risks associated with climate change.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31960

## Planning for green infrastructure along the Gulf Coast: Successes and constraints

### **Recap:**

As climate change is experienced in coastal cities and as they continue to develop, planning has an important role to play. Green infrastructure planning is one tool that planners and cities have to mitigate the associated risks. This project found that while green infrastructure is integrated into Mississippi-Alabama coastal cities' comprehensive plans and planning practice, there are several barriers as they relate to leadership, comprehensive plan oversight and implementation, collaboration, and resources.

### **Relevance:**

The Mississippi-Alabama coastal region has seen increases in population density and the number of housing units in their coastal counties, disrupting natural landscape patterns and reducing wetlands and vegetation. Between 1960 and 2008, population density increased on average by approximately 72%. The number of housing units also increased with Mississippi's total housing units located along the coastline increasing from 9% to 12%, while Alabama's increased from 11% to 13% (Wilson and Fischetti, 2010).

### **Response:**

'Green infrastructure' (GI) - multifunctional networks of open space and nature-based multi-scalar stormwater management projects - is a tool for minimizing the negative impacts of growth and development. While GI is gaining traction in planning practice and research continues to document its effectiveness, this project examined - via an evaluation of comprehensive plans, a survey, and interviews - if/how coastal cities are incorporating GI into their comprehensive plan's goals and policies, and if/how such practices are being implemented.

### **Results:**

The comprehensive plans collectively represent a high level of quality and GI engagement, which was supported by survey and interview data. However, based on the comprehensive plan analysis, survey, and interviews, there are a number of recommendations: 1.) more focus on the implementation, monitoring, and evaluation, as well as the public participation, planning processes is needed; and 2.) greater political leadership, more effective collaborations, and increased resources are desired with respect to GI planning.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31865

## Project research leads to enhanced knowledge on pre-disaster mitigation options

### **Recap:**

The Fortified Homes Program can reduce damages to homes during a wind storm and can save homeowners money on insurance; however, Fortified Homes do not appear to fetch a premium at resale.

### **Relevance:**

Wind damage from coastal storms is a major hazard that coastal homeowners face. Mitigating for wind hazard can be a daunting task for many homeowners, and the FORTIFIED Homes program provides a means to streamline this process, thus making it more likely that homeowners will adopt mitigation measures and be more prepared.

### **Response:**

In partnership with Smart Home America, and relying on a variety of datasets, including Zillow's ZTRAX dataset, we were able to estimate the benefits and costs associated with FORTIFIED Homes designation, by monetizing the benefits associated with reduced damages, insurance discounts, and home resale.

### **Results:**

We find that a FORTIFIED designation has the potential to provide two streams of benefits: annual wind insurance premium cost savings and periodic reduced cash outlays on insurance claim deductibles. We do not find evidence that a FORTIFIED designation increases home re-sale value. Also, the avoidance of damage and the subsequent claims and repairs process is undoubtedly a major hassle for homeowners, but costs of these inconveniences were not monetized.



Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31847

## Florida homes are raised out of the floodplain by providing homeowners and contractors financial and technical knowledge

### **Recap:**

Preparing contractors through certification and homeowners with financial and technical workshops increases the odds that both benefit through a skilled workforce and more homes elevated out of the floodplain..

### **Relevance:**

Storm surge has played a major disruptive role in the Florida Keys. Even in good weather, flood insurance increases and FEMA remapping have greatly affected the affordability of our homes, especially low income homeowners, who mostly live in ground level, slab on grade homes that flood easily. Focus groups found that most low-lying property owners are very interested in getting out of the flood plain, they just don't know where to start.

### **Response:**

The Keyswide Home Elevation Education and Organization project fulfills three goals of the City's Adaptation Team: #2) Increase Financing Options for Adaptation; #4) Continue Collaboration with Others; and #5) Decrease Insurance Burdens by Reducing Risk. The City of Key West and its Keyswide partners collaborated to 1) Create summaries of recent home elevations, 2) Host Workshops Keyswide, 3) Train Contractors, 4) Organize Cooperative Bidding and 5) Document and Disseminate Project Info statewide.

### **Results:**

- 1) Recent home elevations: Have more than a dozen great interviews with contractors, but financial details are hard to get.
- 2) Keyswide workshops: Not scheduled yet, but more than 40 homeowners on waiting list.
- 3) Train contractors: Great course trained 10 contractors and provided technical info to all six local governments.
- 4) Cooperative bidding: Have three professional elevation companies interested.

Disseminate project info statewide: Have presented two Florida webinars and consulted with three local governments outside the Keys.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31846

## Coast community has improved knowledge of local climate impacts and how to build resiliency

### **Recap:**

Four short videos and infographics that highlighted local climate stories improved community members understanding of projections and actions for resiliency.

### **Relevance:**

A survey of Sarasota-Manatee organizations identified a need for unified ways to communicate climate projections and solutions. Tourist destinations and local scientific organizations wanted to better coordinate on how climate impacts and resilience are communicated throughout the region while centering story telling from diverse community member perspectives.

### **Response:**

In coordination with five local scientific organizations, four professionally filmed short videos and four digital/print infographics were created to relay Sarasota-Manatee climate projections and clear paths to build resiliency.

### **Results:**

Over 1000 community members and visitors reached with local stories of climate change impacts and information on mitigation solutions they can pursue. Data gathered through social media postings, video views, rack cards distributed, and press shared among local scientific and environmental organizations.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31845

## Researchers work with cities to identify cost-effective green infrastructure to reduce storm runoff on small sites

### **Recap:**

MASGC-funded researchers are exploring the expense of green infrastructure used to offset post-construction stormwater runoff increases through two case studies in Biloxi, MS and Orange Beach, AL. In discussing the initial findings following computer modeling, the researchers and the cooperating municipalities addressed the maintenance and enforcement cost limits of green infrastructure on small building sites in the Northern Gulf.

### **Relevance:**

Communities can be resilient economically if they take steps to mitigate the impacts of stormwater and flooding. Acting with grant funds from MASGC, the researchers are assessing the economic practicality of using green infrastructure on sites smaller than 5 acres in Northern Gulf of Mexico municipalities. Green infrastructure can improve water quality, resilience, and habitat, but if ordinances require too much, the expense may inhibit development.

### **Response:**

The researchers coordinate regularly with municipal staff for two communities in the Northern Gulf. Two problems with green infrastructure were identified as the lifetime maintenance costs and limits controlling heavy rainfall. The researchers are testing different types of green infrastructure using computer modeling to find better alternatives to meet the goal of reducing stormwater runoff. Additionally, the team is considering regulatory adjustments to permit easier enforcement of stormwater requirements considering maintenance costs.

### **Results:**

The researchers and their municipal partners explored the practical limits of using green infrastructure to control stormwater on a site-by-site basis. Communication with engineers and planners leads to better data on providing more cost-effective stormwater resilience. The shared communication helped focus the research efforts on how to improve existing programs to be financially feasible for small sites in small communities. The communication between the municipalities and the researchers informs development of more responsive regulations.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31844

## Monitoring shelf response to a large-scale anthropogenic river diversion

### **Recap:**

Rapid response monitoring collected and archived hydrographic and dissolved oxygen data on the shelf during the summer of 2019 in order to capture any potential impacts of the unprecedented double opening of the Bonnet Carre Spillway on water quality in the Mississippi Bight.

### **Relevance:**

Large amounts of river water from the Mississippi River were released through the Bonnet Carre Spillway in the spring and summer of 2019. This was the only time in the Spillway's history that it was opened twice in the same calendar year. The layering of fresher water over saltier bottom water as well as the excess nutrients associated with Mississippi River discharge have the potential to negatively impact water quality on the shelf.

### **Response:**

A rapid response effort was organized and conducted to collect monitoring data across the Mississippi and Alabama coastal zone. The monitoring effort consisted of 10 surveys from June to August during which water column data on temperature, salinity, and dissolved oxygen were collected from up to 17 stations depending on the field conditions.

### **Results:**

Extensive areas of hypoxia were observed on the shelf during much of the summer season. During the event, maps of bottom dissolved oxygen were produced and sent to several state agencies interested in coastal water quality. Finally, data from this survey was package and submitted to the NOAA National Center for Environmental Information (NCEI) so that scientists and stakeholders have access to data for this unprecedented event.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31878

## Santa Rosa County, Florida, utilizes enhanced flood risk engagement capacity

### **Recap:**

Due to funding and technical support from the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative, Santa Rosa County, Florida, developed a new flood vulnerability assessment tool for informing residents and helping the county better address flood risk.

### **Relevance:**

Santa Rosa County, Florida, is a fast-growing county that has been severely impacted by extreme weather and flooding, has been included in over 13 disaster declarations since 2004, and is facing accelerating sea-level rise. The county, aware of its flood vulnerabilities, has been working to improve its coastal resilience, identifying through this process that county staff, residents and businesses have a common need for a "one-stop shop" of flood vulnerability information and resilience efforts.

### **Response:**

Santa Rosa County partnered with their regional planning council and universities to develop a flood vulnerability resource. It pulled together social vulnerability, repetitive loss structure, FEMA flood zone, and base flood elevation data to create a tool for county staff and citizens. The tool can further be built upon with future flood risk data and mitigation-cost estimation capabilities. Funding and support were provided by the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative.

### **Results:**

Santa Rosa County used their newly-developed tool at a virtual community engagement event, allowing citizens to use the tool and learn their vulnerability to floods, being provided with vulnerability scores ranging from 0-5 for each quarter square mile (0.25 mi<sup>2</sup>). Armed with understanding of their flood vulnerability, citizens can now respond accordingly. With this tool, the county also can now more effectively address flood risk, which will create additional impacts in the future.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31823

## Mississippi-Alabama Sea Grant gathers data for fisheries hurricane damage rapid appraisal

### **Recap:**

Mississippi-Alabama Sea Grant Consortium staff surveyed marinas and seafood processing facilities to determine that Hurricane Sally caused major damage and shared the damage information with NOAA Fisheries.

### **Relevance:**

Hurricane Sally's eye made landfall on Sept. 16, 2020, slamming Gulf Shores, Alabama, as a Category 2 hurricane, according to the National Hurricane Center. The area experienced high winds and flooding. Major damage occurred to marinas and impacted seafood processors, causing disrupted seafood processing. Mississippi-Alabama Sea Grant was asked to assist NOAA Fisheries to determine damage to fishing businesses to determine if federal assistance was needed.

### **Response:**

Sea Grant staff surveyed a number of marinas to determine damage to their facilities. In Baldwin County alone, over 50 percent of marinas were not operational at the end of September. Sea Grant staff also surveyed three seafood processing facilities in Baldwin County that were open but with limited operations.

### **Results:**

Sea Grant determined that there was major damage to the fishing industry due to Hurricane Sally. The information was provided to NOAA Fisheries for planning for a possible fisheries disaster declaration response. As of reporting time no fisheries disaster was declared but NOAA fisheries has the information and data from the immediate aftermath of the storm if one is declared later.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31822

## Mississippi-Alabama Sea Grant develops COVID-19 guidelines for commercial fishing and for-hire vessels

### **Recap:**

The Mississippi-Alabama Sea Grant Consortium, in conjunction with the Gulf Shores & Orange Beach Tourism, developed a fact sheet for commercial fishing and for-hire vessels to help protect crew and passengers during the pandemic, and Sea Grant also assisted the tourism organization with a website containing information on COVID-19 for residents and tourists.

### **Relevance:**

Mississippi-Alabama Sea Grant worked with Gulf Shores & Orange Beach Tourism to help local commercial fishing vessels and for-hire vessels deal with the economic instability and beach closures due to COVID-19. During last spring and early summer, there were large numbers of hotel and condo cancellations due to the pandemic. Assistance was needed to assure the general public and tourist that boating was safe.

### **Response:**

Sea Grant addressed the safety concerns of visitors and locals concerning the COVID-19 by creating a fact sheet and website that addressed these issues. Guidelines were developed to ensure the health and well-being of passengers and crew on commercial and for-hire vessels, including dolphin cruises, sightseeing cruises and dive boats.

### **Results:**

Sea Grant developed the guidelines (Mississippi-Alabama Sea Grant Publication No. MASGP-20-020), a website and signage for local marinas to make it easier for tourists and locals to get information on the virus and help commercial fishing and for-hire vessels recover from the economic downturn from COVID-19.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31821

## Sea Grant staff leads regional effort to support NAACP Sea-Level Rise Certification Program

### **Recap:**

In partnership with the NAACP and Climate Central, Mississippi-Alabama Sea Grant Consortium led Sea Grant's efforts in a nine-state virtual event to assist leaders in local NAACP chapters with sea-level rise planning and development of actions for their individual chapters.

### **Relevance:**

Vulnerable populations are often also resource limited and therefore find it challenging to address growing needs associated with the impacts of climate change. For communities in Mississippi and Alabama the struggle to earn a living, feed their families and create safe and stable homes is made more difficult due to the compounding effects of coastal storms, economic downturn, oil spills and the recent pandemic.

### **Response:**

In response to a request from the NAACP, Mississippi-Alabama Sea grant Consortium (MASGC) staff identified climate science and resource needs, gave local examples of what is being done in their states, addressed challenges of sea-level rise and coastal flooding, and detailed planning efforts municipalities have undertaken to address future climate conditions (successes, challenges, lessons learned). In addition, MASGC staff walked state chapter participants through the development of a sea-level rise action plan.

### **Results:**

Over 60 participants in nine states completed "A Just and Equitable Sea Level Rise Response Training." At least three communities in Mississippi and Alabama started a Sea Level Rise Action Plan for their chapter of the NAACP.



Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31820

## Shared position with the Gulf of Mexico Alliance produces 'Governors' Action Plan IV' during COVID-19 pandemic

### **Recap:**

Mississippi-Alabama Sea Grant's staff shared position with the Gulf of Mexico Alliance led the development of the "Governors' Action Plan IV," including conducting a survey to identify needs and gaps, analyzing data and leading calls and webinars where partners from five Gulf states outlined the 5-year plan of action.

### **Relevance:**

Governors' Action Plan IV is the fourth in a series of action plans to address issues common to all five Gulf States in a voluntary and cooperative way. Action Plan IV is an aggressive 5-year plan combining new and ongoing regional priorities including coastal resilience, data and monitoring, education and engagement, habitat resources, water resources and wildlife and fisheries.

### **Response:**

With in-person meetings no longer possible during the COVID-19 pandemic, Mississippi-Alabama Sea Grant staff quickly switched all six priority issue teams and three cross teams to virtual platforms that could be accessed by all partners (local, state, federal, non-profit, business and academia). Staff also led the development of the "Governors' Action Plan IV," a 5-year plan for the regional ocean governance of the Gulf of Mexico, through survey development and implementation, team calls and virtual webinars.

### **Results:**

Mississippi-Alabama Sea Grant's shared employee with the Gulf of Mexico Alliance organized and facilitated 188 calls and webinars over a 6-month period between six priority issue teams and three cross team initiatives to write the "Governors' Action Plan IV." In addition, this shared extension position analyzed data from 252 survey responses from participants across all five Gulf of Mexico states to identify gaps, needs and emerging priority issues to be addressed in the plan.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31819

## Mississippi-Alabama Sea Grant leads professional development series during COVID-19 pandemic

### **Recap:**

In response to limited professional development opportunities due to COVID-19, Mississippi-Alabama Sea Grant organized, hosted and facilitated a total of eight online webinars between June and November of 2020 for floodplain managers and planners to obtain Continuing Education Credits.

### **Relevance:**

In March 2020, the COVID-19 pandemic forced stay-at-home orders across the country and the world. Local government planners and floodplain managers were not given permission to travel to professional development conferences where they usually receive continuing education credits. In addition, many professional development providers were not equipped to easily move to an online platform. This left local officials without opportunities to complete requirements for professional development to keep their certifications current.

### **Response:**

Mississippi-Alabama Sea Grant Consortium staff with the Climate and Resilience Community of Practice filled the need for virtual professional development opportunities. They quickly moved trainings to online platforms and offered webinars on a variety of topics including neighborhood resilience, sea level rise, Fortified building standards, hurricanes and global warming, and environmental justice. They were specifically targeting municipalities, and the webinars were recorded and made available after the events.

### **Results:**

Eight webinars reached 482 participants on coastal resilience issues providing 10 hours of professional development credits. An average of 94.62% of participants agreed or strongly agreed the webinars were a good use of their time, and an average of 73% said they learned something they will apply to their work. The videos are available on the Mississippi-Alabama Sea Grant YouTube channel, and a total of 771 people registered for the webinars and received the recordings.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31818

## Mississippi-Alabama Sea Grant forges partnership with the National Severe Storms Lab VORTEX-SE Program

### **Recap:**

The National Severe Storms Laboratory and the Mississippi-Alabama Sea Grant Consortium partnered on a new outreach venture to build an extension program centered around community severe weather preparedness and resilience that aims to create Weather Ready places and people who have the confidence to get involved and take action.

### **Relevance:**

In the Southeast, there is a disproportionately large number of tornadoes resulting in fatalities compared to the rest of the country. Researchers have attributed this to several factors, including tornadoes that occur at night across rugged terrain and tornadic activity that persists throughout the year with no defined season. Prior research identified lack of adequate shelter, high number of people in vulnerable conditions and lack of visibility of tornadoes as contributing factors to higher fatality rates.

### **Response:**

In order to address some of these gaps and needs, a new pilot outreach program was created to identify and connect social networks that can assist neighborhoods in building skills to prepare for, respond to, and recover from severe weather events. The VORTEX-SE Outreach Program places particular emphasis on identifying options for safe spaces for vulnerable populations, putting mechanisms in place for ongoing engagement, learning and action.

### **Results:**

Expected outcomes include better understanding true risk, strengthening social networks, building trust between partners and increased community connectedness. The program will provide learning opportunities for severe weather preparedness and will build greater self and group efficacy with the aim of helping to save lives and reduce the impacts from tornadoes.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31817

## Sea Grant professionals use peer-listening training to help others through COVID-19 mental health stresses

### **Recap:**

Mississippi-Alabama Sea Grant Consortium personnel provided peer-listener training to 124 Sea Grant professionals, who used the information to help others dealing with mental health impacts from the COVID-19 lockdown.

### **Relevance:**

COVID-19 changed the lives of Americans in March of 2020, when most of the country instituted a lockdown in response to the virus, elements of which would exist in various forms throughout the year. Many people experienced increased feelings of anxiety at the prospect of catching or spreading the virus and heightened feelings of isolation from working at home, a fact that was noted by mental health professionals around the country. Often, people do not feel comfortable reaching out to mental health professionals but will seek council from co-workers, friends and colleagues.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium (MASGC) adapted a program used after the 2010 Deepwater Horizon oil spill to train attendees to serve as active listeners for peers struggling emotionally with the disaster. The group adapted the curriculum to address issues initiated by the isolation of quarantine. They also shortened the training and offered it in an interactive online format to Sea Grant audiences internally amongst MASGC professionals and also throughout the Sea Grant network.

### **Results:**

Team members presented training in four online modules, with a total of 124 attending one or both sessions, 512 viewing web resources and 156 watching videos of the training afterward. In a follow-up internal evaluation of Sea Grant professionals 73% of respondents stated that they applied what they learned in the training. They used the training to help people cope with COVID-19 and hurricane-related stresses in both professional and personal settings. Respondents reported spending an average of 18 hours each providing peer listening since the training.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31816

## Independent evaluation confirms success of two-year project on human impacts of oil spills

### **Recap:**

An independent evaluation confirmed the success of a Sea Grant-led national workshop series that focused on socioeconomic and human health aspects of oil spills.

### **Relevance:**

A 2017 workshop co-hosted by the National Academies of Sciences, Engineering, and Medicine's Gulf Research Program (GRP) identified that more work was needed to understand the human health and socioeconomic impacts of oil spills. GRP and the Gulf of Mexico Research Initiative supported Sea Grant programs around the country to host a workshop series to determine ongoing needs and assess three areas pertaining to oil spills: public health, social disruption and economic impacts.

### **Response:**

The Sea Grant programs coordinated a national workshop series on oil spill impacts and preparedness, producing five events held in Alabama, Alaska, California, Louisiana and Virginia, where workshop attendees made recommendations specific to their region. The team produced five regional reports and a summary report of commonalities across the workshops. Later, a third-party evaluator contacted workshop participants to understand the events' usefulness, and Sea Grant produced a final report outlining the results.

### **Results:**

The independent team conducting the survey found that an overwhelming majority of respondents indicated that the workshop(s) helped them network, raised their knowledge of the human dimensions of oil spills and response and identified priorities that would improve oil spill preparedness.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31815

## National Water Extension Program review recommends continuation of program to build on early successes

### **Recap:**

An external review found the National Water Extension Program highly successful and recommended continuation of the program in order to build on the successes to date.

### **Relevance:**

In the United States and around the world, water security is at risk. Too much water, too little water or water of poor quality endangers life, property, economies and ecosystems. Unfortunately, these threats are intensifying, and risk is difficult to predict. Stakeholders across the U.S. have revealed the need for consistent, high spatiotemporal resolution, integrated water data to address critical unmet information and service gaps.

### **Response:**

In 2017, the National Oceanic and Atmospheric Administration, The University of Alabama and the Mississippi-Alabama Sea Grant Consortium created the National Water Extension Program, based at the National Water Center in Tuscaloosa, Alabama. The goal of the program is to facilitate the delivery of resources that will allow communities and organizations to accurately and efficiently make vital short- and long-term planning decisions regarding the safety and security of their citizens and water resources.

### **Results:**

The National Water Extension Program successfully completed a programmatic review to assess its impact and value. The review confirmed that the program increases "access to NOAA data, tools, products and services and contributes to addressing water issues and bridging gaps." Further, the program was found to augment "the application of NOAA research within the Sea Grant network and end-user communities and enhancing the relevancy of NOAA research to address societal needs."

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Impact  
PIER ID Number: 31814

## Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative advances dialogue around sea-level rise resilience

### **Recap:**

The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative's development of research synthesis and skills building around communicating the complex science of sea-level rise, along with relationship building, advanced the way sea-level rise is considered and addressed.

### **Relevance:**

Sea-level rise (SLR) is a ubiquitous stressor and negatively impacts nearly all aspects of coastal ecosystems and communities. To adequately adapt to these changes, it is vital that coastal stewards of the built and natural environments have the tools, products and services needed to understand and address changing conditions as accurately as possible. These resources come in a variety of formats and levels of accessibility, making it difficult for coastal stewards to find and utilize them.

### **Response:**

A partnership spanning local, state, regional and federal agencies, organizations, non-profits and researchers worked together to support the transition and translation of SLR information into coastal decision-making. The Northern Gulf of Mexico Sentinel Site Cooperative, a Mississippi-Alabama Sea Grant-supported program, conducted trainings, developed extension and outreach products, conducted research projects and successfully obtained funding to fill SLR needs and gaps.

### **Results:**

The cooperative increased accurate consideration of SLR among Gulf municipal, state and federal entities for planning, restoration and infrastructure investments. An illustrative example is when the Jackson County Utility Authority used the cooperative-developed risk-tolerance approach to determine if they should plan for 6 feet of SLR in an upcoming critical infrastructure project. They would have considered much less SLR without this approach, which was built on the years of work from the cooperative.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31813

## Northern Gulf of Mexico Sentinel Site Cooperative builds capacity for delivering culturally competent trainings among underserved communities

### **Recap:**

The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative increased internal and external capacity for engaging with underserved communities.

### **Relevance:**

The northern Gulf of Mexico is facing disproportionate impacts from sea-level rise (SLR) in part due to the high rate of underserved and under-resourced communities that dominate the landscape. It is critical that frontline communities have access to the information, services and resources they need to adequately adapt to a changing coast. Unfortunately, without culturally competent provision of these services and information, these communities will continue to face greater resilience challenges.

### **Response:**

The Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative staff participated in a series of dialogues, trainings, professional development workshops, literature reviews and internal discussions to increase its capacity to effectively create and deliver culturally competent extension programming to underserved and under-resourced communities.

### **Results:**

In addition to increasing its capacity, the cooperative successfully participated in the generation of a diversity series for coastal Mississippi science professionals that will be implemented in the coming reporting year, developed content for and served on a panel for a Gulf-wide effort known as "Fully Serving the Underserved" and contributed to a literature review known as "Enhanced Engagement and Risk Communication for Underserved Communities: Research Findings and Emerging Best Practices."



Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31812

## Mississippi-Alabama Sea Grant-led team expands local sea-level rise product, further enhances coastal resilience

### **Recap:**

Expanding the local sea-level rise two-pagers produced by a Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative-led team further enhanced local and regional capacity to access and apply locally relevant sea-level rise projections, enhancing the accuracy and effectiveness of community resilience planning and coastal habitat management.

### **Relevance:**

The Local Sea-Level Rise two-pagers represented a significant increase in capacity to access and apply locally relevant projections of sea-level rise (SLR) reducing barriers for federal and state decision-makers and extension and outreach professionals to integrate this information into their work. However, the software package was cumbersome, and users requested the development of an interactive webpage to further enhance access.

### **Response:**

A team of extension professionals, outreach specialists and researchers, led by the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative, adapted the already existing materials into an online interactive webpage ([www.LocalSLR.org](http://www.LocalSLR.org)).

### **Results:**

The enhanced usability of the interactive webpage increased the capacity to access and apply the locally relevant SLR projections. An illustrative example includes a specialist from Louisiana Sea Grant who requested assistance developing two-pagers each time he needed one. The interactive website allowed him to easily generate his own materials and share the data.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31811

## Northern Gulf of Mexico Sentinel Site Cooperative increases technical capacity to address sea-level rise among coastal professionals

### **Recap:**

The Mississippi Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative gave several high-impact talks to technical audiences increasing knowledge of how to interpret and apply sea-level rise science.

### **Relevance:**

Sea-level rise (SLR) is a ubiquitous stressor, negatively impacting nearly all aspects of coastal ecosystems and communities. To adequately adapt to these changes, it is vital that coastal stewards of the built environment have the tools, products and services needed to understand and address changing conditions as accurately as possible. These resources come in a variety of formats and levels of accessibility, making it difficult for coastal stewards to find and utilize them.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative gave four high-impact presentations to technical audiences to increase awareness, knowledge and capacity on how to integrate SLR impacts into project planning and design.

### **Results:**

Over 325 people were reached across four presentations: Florida Department of Transportation Seminar Series, SAFE-T Seminar Series, Mississippi-Alabama Fast and Easy Continuing Education Units Resilience Series, and Gulf of Mexico Climate and Resilience Community of Practice Seminar Series. Presentations covered relevant information, but were tailored for specific audiences. When evaluations were available, 100% of participants indicated knowledge gain and satisfaction with the presentation; an average of 80% intended to utilize the information in their work.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31810

## Northern Gulf of Mexico Sentinel Site Cooperative enhances deliberations on flood protection measures

### **Recap:**

By providing critical technical support and data synthesis, the Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative provided critical data that were instrumental in gaining consensus among decision-makers on the need for flood protection measures and were integrated into a multimillion-dollar wastewater treatment facility design to increase resilience.

### **Relevance:**

The Jackson County Utility Authority (JCUA) is undertaking an effort to build a new wastewater reclamation facility that will consolidate three existing facilities. After experiencing extreme impacts from Hurricane Katrina, the staff at JCUA wanted to take measures to protect their new facility against future storm surge but were unsure of how best to accomplish this and how cost-effective flood protection would be.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative worked with the JCUA staff and other experts on the following: facilitating JCUA applying a risk-tolerance approach to determining how much sea level rise they would like to plan for, accessing and synthesizing available data on future storm surge as seas rise, and conducting the cost-benefit analyses on no flood protection, protection for current risk and protection for future risk.

### **Results:**

It was determined that flood protection of either kind is more cost-effective than no flood protection. Cooperative staff presented the results to the JCUA Board of Directors who were compelled by the data. Previously, they had been disinclined to plan for a "500-year storm" and after the presentation agreed that flood protection was important. These data are now being integrated into the ongoing design and planning process, which is anticipated to take several more years.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31809

## Dauphin Island stewards participate in sea-level rise adaptation strategy research, risk awareness

### **Recap:**

The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative enabled productive dialogue between coastal engineering researchers and stewards of Dauphin Island to ensure an infrastructure protection research project is responsive to their needs and will produce implementable end products.

### **Relevance:**

The Town of Dauphin Island, located on a small coastal barrier island in Alabama, is on the front lines of sea-level rise (SLR) impacts, with even small intensity storms now generating significant flood damage costs. There has already been comprehensive and strategic planning for Dauphin Island along with studies on how to best adapt the island for natural resources; however, there have not been investigations into how to best protect critical infrastructure on Dauphin Island from SLR.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative partnered with University of South Alabama researchers and town stewards (e.g., mayor, water and sewer, planning commission) to generate an adaptation pathway. The pathway consists of various adaptation strategies arranged from least intensive/costly to most with tipping points identified based on when SLR will render a strategy ineffective. This approach allows the town to implement resilience actions based on observed SLR.

### **Results:**

The stewards of Dauphin Island engaged in comprehensive dialogue around current and future flood risks. They shaped the scope of the research by identifying the locations critical for analysis, adaptation strategies to consider, risk tolerance and planning horizons. Additionally, conversations have been ongoing with residents of Dauphin Island to further expand the awareness and buy-in around the project. These efforts are complementing and enhancing existing efforts on Dauphin Island to enable robust resilience activities.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31808

## Northern Gulf of Mexico Sentinel Site Cooperative enhances virtual training efforts in the face of COVID-19

### **Recap:**

Through intentional and thorough external and self-evaluation, the Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative enhanced the design and delivery of remote trainings across the country to ensure continued progress on critical topics despite face-to-face restrictions.

### **Relevance:**

COVID-19 cascaded through every aspect of our professional and personal lives, cutting off standard approaches for conducting business and interacting with our families and friends. For extension, many of our approaches for trainings, networking, relationship building and collaboration were built upon the trust and rapport that is much more easily generated in person. With the ability to meet in person removed, creative use and new applications of existing tools and resources had to be developed.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative developed and implemented three highly technical trainings via remote platforms on how to use R for processing SET data, on how to consider sea-level rise in natural resource management, and on advanced use of Gulf TREE, a search engine designed to identify the best climate tools for specific needs. After each training, evaluations were administered via survey and/or open dialogue, and staff conducted internal reviews.

### **Results:**

Based on 10 trainings with 108 participants, key improvements to enhance remote training were identified, including redesigning how materials were introduced and explored, small-group formats and independent and group-work balance. Cooperative staff synthesized and translated this information to other outreach and extension professionals conducting virtual trainings. The professionals implemented it in their work, which led to enhanced delivery and allowed them to meet knowledge-gain objectives.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31807

## Mississippi-Alabama Sea Grant Consortium, partners develop coast models of existing Watershed Game for adults, students

### **Recap:**

The Mississippi-Alabama Sea Grant Consortium and partners developed and refined a coast-specific version of the Watershed Game that shows adults and students the connections between water quality, land use management and the ability of a community to prepare for and respond to flooding.

### **Relevance:**

Land use has significant impacts on water quality, natural resources and the ability of a community to prepare for and respond to flooding, both locally and across a watershed. It is challenging to communicate the connections between land management and resulting impacts on water quality and resilience. However, a gaming approach increases engagement and understanding, reduces conflict, encourages discussion and collaboration, and is more likely to lead to beneficial policy and behavioral changes.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium, in collaboration with partners, developed a coast model of the Watershed Game, a proven engagement tool. The coast versions of the game demonstrate how land uses impact water quality and increase players' knowledge of tools to reduce these impacts. The new coast versions include a gameboard illustrating five coastal land uses and new tool cards that include common best management practices that address aspects of water quality and resilience.

### **Results:**

The development team conducted two pilot workshops to test the initial game board design, which represented a generic coastal community allowing players to find connections with their specific community, and the new tool cards featuring plans, practices and policies to address key challenges experienced by communities along America's coastlines. Refinement of the game board, tool cards and gameplay processes have resulted in a local leader model ready for production.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31806

## Sea Grant promotes regional cooperation and connectivity on Community Rating System (CRS) in the face of pandemic challenges

### **Recap:**

The Mississippi-Alabama Sea Grant Consortium employed virtual webinars and other online resources to facilitate information sharing and maintain Community Rating System (CRS) user groups as valuable sources of information on flood mitigation and the CRS.

### **Relevance:**

The Community Rating System (CRS) is a national program of mitigation activities communities can pursue to reduce the cost of flood insurance. Participation in CRS encourages communities to go beyond state and federal requirements to pursue better flood management practices. By engaging with CRS communities, the Mississippi-Alabama Sea Grant Consortium is able to foster local government success in coastal resilience while also addressing the continuing education needs of floodplain managers and other local officials.

### **Response:**

During the pandemic, Sea Grant staff quickly transitioned to virtual meetings. Sea Grant provided direct technical assistance to the Coastal Hazard Outreach Strategy Team (CHOST) by organizing virtual webinars and lining up speakers. Online contact was maintained to notify members of new tools and to assess community information needs during the pandemic. Sea Grant also engaged with the South Alabama Flood Engagement Team (SAFE-T) to develop virtual workshops for floodplain managers and promote coastal resilience.

### **Results:**

Sea Grant led CHOST facilitation using online resources, such as PowerPoint and calendar invites, to structure online meetings and track attendance. Input from CRS user groups was critical in expanding online education opportunities for local government officials.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31805

## Sea Grant, Smart Home America share benefits of FORTIFIED building standards through training local government staff

### **Recap:**

By partnering with Smart Home America, Mississippi-Alabama Sea Grant developed an outreach program for coastal jurisdictions in Alabama and Mississippi that provided guidance on FORTIFIED construction standards and on the level of protection FORTIFIED provided from hurricanes, high wind and hail.

### **Relevance:**

In promoting FORTIFIED building standards, Sea Grant encourages communities to adopt construction standards that go beyond basic disaster mitigation. Communities can save \$11 to every \$1 invested by phasing out old building codes and adopting new ones. Smart Home, with codes tailored to specific natural hazards, is uniquely suited to offer a full range of mitigation tools. Properties built to FORTIFIED specifications have generally withstood coastal storm events better than comparable properties without FORTIFIED.

### **Response:**

In partnership with Smart Home America, Mississippi-Alabama Sea Grant Consortium extension specialists developed a comprehensive outreach plan to highlight the benefits of the FORTIFIED building program. The primary target audiences of this outreach included planners, floodplain managers and other local government officials. Outreach was accomplished through in-depth virtual webinars and online presentations given at state conferences. In addition to providing information on FORTIFIED, the online outreach also highlighted Smart Home resilience projects like the "Don't Goof, Flood Proof" website.

### **Results:**

By organizing workshops, Sea Grant provided .5 continuing education credits to 30 floodplain managers and 2.5 credits to 40 planners. Sea Grant also provided technical assistance to coastal jurisdictions on pre-disaster mitigation and planning, such as helping create a Program for Public Information (PPI) in Mobile County, Alabama. Professionals with Smart Home and Sea Grant also partnered with Sea Grant-funded researchers to highlight new research involving FORTIFIED.



Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31804

## Mississippi-Alabama Sea Grant hosts webinar series, shares science to meet stakeholder need for information on human impacts from oil spills

### **Recap:**

The Mississippi-Alabama Sea Grant Consortium helped to share information related to human health and oil spills through the development and delivery of a three-part webinar series focused on real and perceived impacts to people and communities and through sharing the science of oil spills during events hosted by partner agencies.

### **Relevance:**

More than 10 years after the Deepwater Horizon oil spill, many questions remain about the potential human health impacts of spilled oil and the use of dispersants in response to spills. Perceptions of risk to community members as well as limited access to data on human health impacts have led to increased anxiety and distrust of some sources of publicly available information.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium (MASGC) developed and led a three-part webinars series addressing specific public health questions related to the impacts of oil spills and spill response. The webinars were aired live on multiple digital platforms and posted online. Participants were encouraged to submit questions to speakers in advance and during the live broadcasts. MASGC also shared oil spill science and stakeholder concerns during seminars hosted by partner agencies.

### **Results:**

The three-part human health series was attended by 330 participants during the live broadcasts with 420 additional views of the recordings. Audience questions were answered live and in follow-up, and the answers were posted online. Additionally, MASGC-supported professionals gave separate presentations on human health, which 445 individuals attended, at events hosted by partner agencies.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31803

## Mississippi-Alabama Sea Grant develops digital game to increase support for resilience decisions

### **Recap:**

In response to needs identified by coastal Extension practitioners, MASGC developed Plan for It!, a digital game for use in outreach and education settings with the purpose of improving support for resilience decisions at the local level.

### **Relevance:**

Although many resources exist that increase knowledge of the need for resilience actions in the Gulf, many are not interactive, and are at a high education level or tied to the need for internet access for use. A gap in educational products exists for interactive educational resilience tools at a lower, introductory knowledge level, particularly that can occur in a short time without access to internet, which is lacking in many rural areas.

### **Response:**

Mississippi-Alabama Sea Grant Consortium and Alabama Cooperative Extension staff developed Plan for It! with input from Sea Grant and Extension resilience professionals, in partnership with the Alabama Cooperative Extension System. For use by ages 5th grade through adult, target audiences include general public, municipal board members and local decision-makers. It is available for use with no internet connection once it has been downloaded, and gameplay is short, making it ideal for all outreach settings.

### **Results:**

Plan for It!, a digital serious game with the goal of increasing support for resilience planning decisions at the community level, is now available for extension, outreach and education activities. The player virtually assumes the role of a community planner and explores the complex results of planning decisions through resilience-based decision scenarios. This short game is ideal for outreach events or classroom discussion and will be made widely available throughout the Gulf.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Impact  
PIER ID Number: 31802

## Santa Rosa County, Florida, gains capacity for more effective community engagement

### **Recap:**

With assistance from the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative, Santa Rosa County, Florida, and partners hosted a Community Voices Informed Choices training that enabled practitioners to better perform community open dialogue events and interact more effectively with their citizenry.

### **Relevance:**

Engaging with stakeholders about the increasing risks to their communities is vital to developing an informed citizenry and resilient society. However, this kind of communication and engagement is a significant challenge for many resilience practitioners and can result in confusion or, at its worse, mistrust. As a public-facing and public-serving government entity, Santa Rosa County is especially aware of the importance of the quality of its engagement and sought to improve its capacity.

### **Response:**

As part of a project funded by the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative, Santa Rosa County brought together a team of internal staff and external organizations whose work overlaps in the community resilience sector. Facilitators from the University of Florida/Institute of Food and Agricultural Sciences Extension's CIVIC program trained the practitioners on deliberative engagement, using an advanced two-part training and resources to enable effective communication and engagement on resilience issues.

### **Results:**

Santa Rosa County and its local partner organizations now feel that they have the capacity to better engage with their communities. This was put into practice when, after taking the training, the team led a virtual community engagement meeting and dialogue in Santa Rosa County. The county was able to use their CIVIC training to effectively introduce a new flood vulnerability assessment tool to their residents and successfully navigate concerns, questions and feedback.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31801

## Magnolia River project considers constructed wetlands for flood mitigation

### **Recap:**

With assistance from the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative, the Baldwin County Soil and Water Conservation District and local partners have performed an analysis of potential constructed wetland designs and site options with the intention of applying for funding to transform a borrow pit into a regional detention site, thus mitigating flooding and improving water quality.

### **Relevance:**

The Magnolia River, a primarily agricultural sub-watershed in Baldwin County, Alabama, has identified flood mitigation as a need for many years. Community members consider flooding a high concern - and an increasing one - as land cover changes, sea levels rise and heavy rain events occur more often. Further, the increasing risk of flooding is a double-edged sword as residents are also noting a growing concern with pollution in their river and streams.

### **Response:**

Inspired by an idea co-developed with community members and local specialists, the Baldwin County Soil and Water Conservation District (BCSWCD) partnered with the Town of Magnolia Springs and Friends of Magnolia River Committee to obtain funding and support from the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative. Consulting firm Volkert assessed multiple borrow pit sites for constructed wetland design, assessed flood detention capacities and considered the options' feasibility, costs and benefits.

### **Results:**

Now finalizing an in-depth report of multiple constructed wetland design options and their associated costs and benefits, BCSWCD has information vital for implementation funding applications. The analysis results find multiple positive cost-benefit options for constructed wetland designs that would provide increased resilience to current and future flooding along the Magnolia River sub-watershed, protecting multiple communities from the dangers of flooding and reducing pollution.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31800

## Biloxi, Mississippi, collects data integral to flood resilience

### **Recap:**

As a result of funding and support from the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative, the city of Biloxi, Mississippi, is advancing its understanding of parcel-level flood vulnerability in their Economic Development Corridor, enabling the city to accurately and effectively address flood risk and emergency preparedness.

### **Relevance:**

The economic development district of Biloxi, Mississippi, is already at risk to flooding during severe storm events. As sea levels continue to rise, that risk is increasing, and flooding is beginning to happen more during smaller-scale events. Knowing the elevations of homes and businesses in flood-risk areas is vital information to enable effective flood prevention and emergency preparedness in the city, but unfortunately many of these historic buildings do not have known first-floor elevations.

### **Response:**

With funding and technical support from the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative, this needs gap is being filled. To collect first-floor elevation data, the city of Biloxi partnered with researchers and extension professionals. A novel technique of integrating historic flood events is being coupled with field measurements of first-floor elevations for nearly 50 structures. Stakeholder engagement by the MASGC legal program helped promote this project across the city.

### **Results:**

Initial first-floor elevation data and data from 33 historic local flood events was gathered for Biloxi. A flood-impact analysis of building elevations found that only 43% of the buildings were above the 50-year flood level and 19% were above the 100-year flood level. Project results were shared via a webinar and a city newsletter. In the coming year, sea-level rise will be added to the analyses, and the data will be integrated into Biloxi's decision-making.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31799

## City of Apalachicola, Florida, completes innovative plans for increased resilience of vulnerable historic structures

### **Recap:**

With assistance from the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative, the City of Apalachicola, Florida, has completed a project focused on preservation of its historically and economically valuable resources via an in-depth vulnerability and cost assessment of innovative floodproofing techniques for 10 structures.

### **Relevance:**

Flooding during extreme events has long been a problem for Apalachicola, but as sea levels continue to rise, flooding occurs more often and with smaller events. The city's most at-risk area, its downtown district, also happens to be its economic heart, which is valuable for its shops, restaurants and inns - most of which are historic structures. These buildings are increasingly vulnerable to routine flooding, but traditional floodproofing measures often do not maintain the structures' historical integrity.

### **Response:**

Building on a previous sea-level rise vulnerability assessment, the City of Apalachicola and the Apalachicola National Estuarine Research Reserve partnered with historic preservation and floodproofing experts to consider flood protection for 10 historic buildings. Focused on maintaining building function while ensuring historical preservation, the effort analyzed risk of exceeding a 1% annual chance flood event and appropriate protection measures. The Northern Gulf of Mexico Sentinel Site, a Mississippi-Alabama Sea Grant-supported program, provided funding and technical support.

### **Results:**

Armed with detailed cost estimates for resilience upgrades, Apalachicola has applied, and continues to apply, for funds to implement flood protection measures - something they were unable to do without these analyses. These analyses provide capacity vital to the city's ability to address its increasing vulnerability to flooding of its historically and economically important buildings. Now in a better position to obtain funding, the city's capacity to protect its community is heightened.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31798

## Alligator Point, Florida, assesses its vulnerability, opportunities for resilience

### **Recap:**

Due to funding from the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative, Alligator Point, Florida, is gaining a thorough understanding of its vulnerabilities to sea-level rise, storms and routine flooding, as well as what resilient alternatives are viable for the community.

### **Relevance:**

Alligator Point, Florida, is an unincorporated community entirely located within the Special Flood Hazard Area. The only access and evacuation route for the community is a road that has experienced severe, repetitive damage - similar to the rest of the community's critical infrastructure. As seas continue to rise, Alligator Point's critically eroded coastline and persistently flood-damaged infrastructure face increasingly higher risk. However, applying for funds to address vulnerabilities requires analysis that they have had difficulty obtaining.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative partnered with the Florida Department of Environmental Protection to fund and support this project. The project provides a detailed assessment of Alligator Point's current and future vulnerabilities, as well as an analysis of alternative development and evaluation options, considering the most effective resiliency options for limited funds. Community engagement also was included to ensure understanding of the process and analysis results.

### **Results:**

Gearing up for their final engagement and finalizing their resiliency alternatives analysis report, the Alligator Point community will soon have information necessary for obtaining resiliency funds. Franklin County is very interested in the results of this analysis and plans to take next steps to identify funding opportunities when they have the results in hand and understand what next steps will ensure effective protection of the community and its infrastructure while balancing fiscal constraints.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31796

## Training series increases stakeholders' access to climate resilience tools

### **Recap:**

Reaching sectors all across the coastal climate resilience spectrum, the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative obtained Sea Grant funding to run a series of trainings spanning the Gulf region that increased stakeholder access to climate resilience tools, which stakeholders intend to incorporate into their work in various ways.

### **Relevance:**

The Gulf Tools for Resilience Exploration Engine (Gulf TREE), a filter-based search engine for climate resilience tools, is an asset for stakeholders across the Gulf of Mexico who are interested in incorporating resilience into their work. However, since its release in 2018, Gulf-region Sea Grant programs, National Estuarine Research Reserves and other outreach and extension professionals have requested advanced trainings to increase their capacity to support and encourage application of Gulf TREE within their networks.

### **Response:**

Adjusted to virtual trainings due to the COVID-19 pandemic, the Gulf TREE Train the Trainer series consisted of seven trainings focused on different regions of the Gulf Coast. Trainings taught participants about climate resilience tools and how to find them quickly, easily and confidently. Participants were introduced to or re-familiarized with Gulf TREE and tasked with multiple scenarios, all inspired by real situations, to explore in groups and independently, gradually increasing in difficulty.

### **Results:**

Among the total 88 participants, average tool access rose to 4.7 from 3.2 due to the training, with 1 signifying "no access" or "unsure" and 5 "high access." Due to this training, 85% of participants felt their access to climate resilience tools increased (15% maintained a "high" or "good amount" of access). Evaluations demonstrate that 98% of participants found the training a good use of their time, and 90% planned to apply what they learned.



Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31795

## Gulf TREE continues to aid decision-making in the Gulf of Mexico

### **Recap:**

The Gulf TREE search engine, maintained by the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative, continues to provide professionals from various sectors (local, state and federal governments, researchers, non-profits and more) with an opportunity to identify relevant and applicable tools for their climate resilience efforts.

### **Relevance:**

Climate change is a significant problem. As such, many tools have been developed to help stakeholders understand past, current and future conditions; identify vulnerabilities; and adapt and/or mitigate ahead of future climate impacts. However, the sheer volume and complexity of tools present significant barriers to stakeholder tool use. This results in frustration among stakeholders, use of outdated information, misapplication of tools, generation of tools with overlapping functions and underutilization of available resources.

### **Response:**

Gulf Tools for Resilience Exploration Engine (Gulf TREE) is a filter-based search engine explicitly designed to match users with appropriate climate resilience tools quickly, easily and confidently. Mississippi-Alabama Sea Grant specialists with the Northern Gulf of Mexico Sentinel Site Cooperative have continued to maintain and update Gulf TREE to maintain relevance, increase awareness of the resource and to provide training on its use potential applications for new users.

### **Results:**

With at least 555 users this reporting period, professionals across multiple sectors utilized Gulf TREE to aid their work. For example, a University of Florida researcher developing a new tool for her state government first used Gulf TREE to identify whether similar tools existed and consider if they could be adapted. Utilizing Gulf TREE this way followed best practices, ensured her effort would not be duplicative and ensured resources were well spent and clearly addressed needs.

Focus Area: Resilient Communities and Economies  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31794

## Mississippi-Alabama Sea Grant Legal Program develops website of COVID-19 resources relevant to fishing participants

### **Recap:**

Mississippi-Alabama Sea Grant Legal Program created a webpage with state COVID-19 resources in Mississippi and Alabama to help small fishing operations.

### **Relevance:**

Mississippi-Alabama Sea Grant Legal Program worked to help Northern Gulf Coast communities with economic instability and restaurant closures due to COVID-19, which adversely affected fishing participants by significantly lowering demand. Federal legislation, known as the CARES Act, authorized financial aid but guidance was confusing and conflicting. Additionally, little was known about how fishers could sell fish directly to the public once their restaurant client base was closed.

### **Response:**

Sea Grant addressed the economic impacts from COVID-19 business restrictions by creating a new webpage, including information on CARES Act funding: Paycheck Protection Program, Economic Injury Disaster Loans, state links for unemployment filing and fishing-related funding. The site (<http://masglp.olemiss.edu/covid19/index.html>) also included federal, state and local guidance on how to switch to direct sales of seafood and linked to the National Sea Grant Law Center's COVID-19 page for nationwide information. Updates were announced via social media.

### **Results:**

The webpage made it easier for members of Alabama and Mississippi fishing communities experiencing financial difficulties during the COVID-19 pandemic to locate resources for how to obtain federal and state help. There were approximately 1,550 views of the COVID webpage during the reporting period last year, and 40% of those views were by first-time visitors.

## Focus Area: Environmental Literacy and Workforce Development

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31767

## Organizers successfully move Bays and Bayous Symposium to virtual platform during COVID-19 pandemic, reach hundreds of people

### **Recap:**

Because of restrictions on in-person gatherings and travel, Mississippi-Alabama Sea Grant staff researched online platforms and successfully organized and hosted a virtual 2020 Bays and Bayous Symposium, which reached at least 392 people and increased attendees' coastal science knowledge and skills.

### **Relevance:**

Because of COVID-19-related restrictions, the 2020 Bays and Bayous Symposium could not take place in person. The Mississippi-Alabama Sea Grant Consortium, which organizes the three-day coastal science symposium with its partners, needed to cancel the event or find an innovative way to host it. The symposium highlights Mississippi-Alabama Sea Grant-funded research and other research and projects in the northern Gulf of Mexico and is attended by resource managers, industry leaders, scientists and others.

### **Response:**

Mississippi-Alabama Sea Grant staff serving on the symposium steering committee researched virtual platforms for large conferences and selected the Dryfta platform (<https://dryfta.com/>). They learned to work within the system to design an event website; receive online sponsorships; create registration forms; request, collect and review abstracts; instruct presenters on how to record and upload presentations; develop a schedule of five concurrent sessions; broadcast live panels; set up virtual vendor booths; and communicate with attendees.

### **Results:**

The symposium was held Dec. 1-3, 2020, and featured 124 pre-recorded science presentations and five live panels. A total of 735 people registered for the event, and the online platform showed that at least 392 of them watched one or more sessions or panels. One hundred people completed an evaluation, in which 88% agreed the event was a good use of their time, 84% agreed their knowledge increased and 55% agreed their skills increased.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 33011

## Program provides Gulf-wide, national leadership to address diverse issues

### **Recap:**

Mississippi-Alabama Sea Grant Consortium led nine regional or national efforts that engaged 38 unique communities and 6,400 people throughout the country and focused on human and ecological impacts of various issues, including COVID-19, aquaculture, climate, high-value fisheries, oil spills, storms and water resources.

### **Relevance:**

Alabama and Mississippi experienced a pandemic and the most active hurricane season in history during 2020. Recently, oil spills, sea level rise, harmful algal blooms, freshwater input and many other stressors have impacted the region. State Sea Grant programs help others recover from stressors. To offer this assistance, Sea Grant coordinates and leads programs that address these issues. Although multi-state efforts are complex to manage, they provide additional benefits to the people Sea Grant serves.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium led nine regional or national partnerships. These programs included the Great Red Snapper Count, Greater Amberjack program, Gulf of Mexico Sea Grant Oil Spill Science Outreach Program, National Aquaculture Liaison Program, National Water Extension Liaison Program, NOAA's National Center for Environmental Information/Sea Grant Partnership, Northern Gulf of Mexico Sentinel Site Cooperative, a Sea Grant/National Academies of Sciences, Engineering, and Medicine's Gulf Research Program's workshop series, and a VORTEX-SE partnership.

### **Results:**

Because of these additional regional and national programs, Sea Grant was able to reach more audiences, serve thousands of people and provide additional resources to address issues that are of concern for coastal communities. This included obtaining an additional \$14 million, working with 121 partners throughout the U.S., advancing the state of coastal science, engaging with at least 38 unique communities and interacting with more than 6,400 people through workshops, presentations and educational programs during the 2020 reporting period.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Impact  
PIER ID Number: 32875

## Mississippi-Alabama Sea Grant aids farmers and restores habitat in response to COVID-19 pandemic

### **Recap:**

Mississippi-Alabama Sea Grant created a program that restored critical oyster habitat while compensating oyster farmers for product that had grown out of marketable size due to the COVID pandemic, which resulted in a win-win for the environment and industry.

### **Relevance:**

COVID-19 restrictions decimated the aquaculture industry due to lack of demand. Oyster farmers were unable to sell their product to the the premium half shell market because it had largely ceased to exist and oysters continue to grow—reaching non-market size. This resulted in farmers seeking alternative venues to sell their oysters so that they could obtain any value for the products they raised. Meanwhile, restoration of Mississippi’s and Alabama’s natural oyster habitat had become a major priority due to habitat losses from recent stressors.

### **Response:**

Mississippi-Alabama Sea Grant Consortium developed a program that would purchase oversized oysters for restoration purposes. The Sea Grant program worked with resource agencies in both states to identify oyster reefs for planting farmed oysters and recruited farmers to provide oysters and deploy them on pre-determined restoration sites. MASGC also coordinated logistics and recruited additional partners to support the effort.

### **Results:**

During the reporting period a total of 7 farmers received payments for 70,000 oysters that otherwise would have had no value. Using values from the oyster gardening program, which plants smaller size oysters, planting 70,000 oysters in coastal Alabama and Mississippi represents an economic valuation of \$75,000 in addition to the \$19,600 farmers received for their oysters and deployment costs.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 32872

## Mississippi-Alabama Sea Grant-funded graduate students persevere through pandemic

### **Recap:**

The Mississippi-Alabama Sea Grant Consortium supported 33 graduate students who continued their research despite fieldwork and lab limitations amid the COVID-19 pandemic.

### **Relevance:**

A fundamental component of every science-based graduate student's education is conducting field work or bench-top research. Due to federal and state restrictions, the ability to do this work in 2020 was extremely limited.

### **Response:**

Mississippi-Alabama Sea Grant Consortium provided financial support to 33 graduate students to help them continue their studies and complete their literature reviews so that they would be poised for success in 2021.

### **Results:**

Mississippi-Alabama Sea Grant Consortium-supported graduate students re-entered or expanded their field work and bench-top research when restrictions were reduced. Through Mississippi-Alabama Sea Grant support in 2020, they were able to become more familiar with the background and previous research on their Sea Grant-funded projects, which made returning to the field and lab more productive and fruitful.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31833

## Building collaborations to take an integrative approach to oyster aquaculture research

### **Recap:**

We are building a network of research labs that enhances the scope of current aquaculture research and trains graduate and undergraduate students in specialized skills necessary to tackle current environmental issues.

### **Relevance:**

Many of the environmental issues encountered today are complex and involve multiple fields of study. For example, declines in oyster abundance can be the result of increases in fishing or predation pressure (an ecology problem), rise in disease prevalence (pathology or physiology), decrease in water quality (chemical or physical oceanography), or a combination of factors. Solving these problems therefore often requires integrating specialized equipment and skillsets that are beyond the means of any one lab.

### **Response:**

We built a partnership with the College of New Jersey to examine the crystalline structure of oyster shells at a microscopic level as well as a partnership with the Georgia Institute of Technology to identify the molecules that predators release and act as kairomones for oysters. These collaborations lay the groundwork for pursuing multidisciplinary research on oyster ecology and aquaculture.

### **Results:**

Two undergraduate students were trained in animal husbandry techniques for growing oysters while one undergraduate student was trained in practical electron microscopy and histology. One PhD candidate gained experience in NMR and HPLC for chemical analysis of predator cues. These relationships are being leveraged to pursue broader research questions and acquire additional funding.



Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31781

## Gulf of Mexico Sea Grant Oil Spill Science Outreach Team delivers popular oil spill outreach video series, reaches thousands

### **Recap:**

The Gulf of Mexico Sea Grant Oil Spill Science Outreach Team created a popular series of videos explaining various aspects of the Deepwater Horizon oil spill, products originally requested by audiences wanting a more visual explanation of spill outcomes.

### **Relevance:**

Following the 2010 Deepwater Horizon oil spill, the Sea Grant Science Outreach Team formed to serve as a bridge to those looking for answers to oil spill questions. The team targeted specific audiences who needed information to better do their jobs. These stakeholders represent diverse sectors, ranging from university researchers and emergency responders to commercial fishers and tourism professionals, with each sector expressing different preferences as to the best way to receive information.

### **Response:**

While initially funded to produce in-depth oil spill science publications, the team added new products after certain audiences requested information come in shorter, more visual mediums. In addition to creating one-page fact sheets and expanding web and social media presence, the team began working on educational videos as a means to answer key audience questions. The team created three short educational oil spill science videos answering stakeholders' specific questions

### **Results:**

Two videos, on seafood safety and how fish process oil, received 702 and 497 views respectively. Almost 10,000 have watched the third video on where Deepwater Horizon oil wound up in the environment.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31780

## Federal, state and university stakeholders use science outreach team's oil science publications for emergency response, education

### **Recap:**

The chief of the Bureau of Safety and Environmental Enforcement's Oil Spill Preparedness Division, the newly appointed oil spill coordinator for the Territory of the U.S Virgin Islands, a Florida Fish and Wildlife Conservation Commission emergency response instructor and multiple librarians requested an assortment of the Gulf of Mexico Science Outreach Team's oil spill science publications to use in emergency response planning, as well as awareness, training and education efforts.

### **Relevance:**

Following the 2010 Deepwater Horizon oil spill, the Gulf of Mexico Sea Grant Oil Spill Science Outreach Team formed in 2014 to serve as a bridge to stakeholders in the Gulf region and beyond looking for answers to oil spill questions. In particular, the team targeted specific audiences who needed information to better do their jobs, such as emergency response professionals and university researchers.

### **Response:**

In 2014, the Sea Grant team began synthesizing oil spill science, which involved working directly with researchers in the field. Simultaneously, team members sought inroads with state and federal agencies who focused on oil spill prevention and response in their work. As team members developed relationships within both of these sectors, they worked to produce products, including 35 oil spill science publications, that addressed each group's questions and needs.

### **Results:**

Stakeholders in emergency response and academia requested copies of team publications. A Bureau of Safety and Environmental Enforcement's division chief, a Florida Fish and Wildlife Conservation Commission emergency response trainer and multiple marine librarians indicated they needed them for general education and specific training exercises. Additionally, the newly appointed oil spill coordinator for the U.S Virgin Islands will use these publications to develop the territory's first oil spill contingency plan.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Impact  
PIER ID Number: 31779

## State agency personnel retain certifications due to Sea Grant regional science outreach team's rapid response, support

### **Recap:**

The Gulf of Mexico Sea Grant Oil Spill Science Outreach Team worked with the Florida Department of Environmental Protection and Florida Fish and Wildlife Conservation Commission to provide online training during the COVID-19 pandemic, allowing 24 emergency responders to update mandatory certifications and continue to work in cases involving hazardous materials or animals.

### **Relevance:**

Sea Grant team members reached out to audiences during COVID-19 restrictions to see if anyone needed assistance. Florida emergency responders asked for advice on how to run a training online that would normally be held in person. The training was mandatory for state agents who may come into contact with hazardous material and needed to take place on its original date for agents to legally continue to respond to events requiring contact with hazardous substances.

### **Response:**

Sea Grant team members, who have experience live-streaming seminars, offered to host and facilitate the training rather than simply share guidance or best practices. Team members worked with the course trainers to develop a shortened agenda tailored to online learning and scheduled practice sessions to make trainers comfortable with the web-sharing platform. One team member served as event host, while another ran the web controls and edited videos of the presentation to share afterward.

### **Results:**

As a result of this effort, 24 Florida state employees working in emergency response completed required training to keep federal OSHA certifications. This certification is required for individuals to respond to an oil or chemical spill, and if the training had not been completed, the employees would not have been able to perform their jobs. In addition, there would have been less capacity within the state to respond to disasters.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31778

## Gulf of Mexico Sea Grant Science Outreach Program's communications office assists team, partners in COVID-related shift to virtual programming

### **Recap:**

The Gulf of Mexico Science Outreach Program's communications office used its experience running virtual programming to help its team, state Sea Grant programs and multiple partners make the shift to 100% web-based events, including managing technology on over 20 virtual programs, in response to COVID-19 changes to workplace engagement.

### **Relevance:**

By the beginning of 2020, the Gulf of Mexico Sea Grant Science Outreach Program had been sharing oil spill science through a number of methods, both in-person and online, for six years. The team live-streamed science seminars to allow audiences to attend the events virtually and provided presentation videos after the fact. Therefore, the team was prepared for the paradigm shift when COVID-19 forced offices around the country to eliminate face-to-face engagement with audiences.

### **Response:**

The Gulf of Mexico Sea Grant Science Outreach Program communications office moved the team's planned in-person events fully online, including a focus on ways to amplify the audience by sharing on multiple platforms while protecting the product from online interference, aka Zoom bombing. The team also reached out to partners, both within and outside of the Sea Grant network, to see if members could share expertise or assist directly with virtual events.

### **Results:**

In addition to maintaining the Gulf of Mexico Sea Grant Science Outreach Team's regular operations, the communications office successfully broadcast 15 team webinars live on two online platforms and shared video after the event. Additionally, the communications office supported five more online events for the Mississippi-Alabama Sea Grant Consortium and assisted partners with everything from consulting on virtual best practices to running an online certification course for Florida state-level emergency responders.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31777

## Science Outreach Team hosts five events across Gulf of Mexico honoring contributions of Gulf of Mexico Research Initiative

### **Recap:**

The Gulf of Mexico Oil Spill Science Outreach Program produced five online events celebrating the impact the Gulf of Mexico Research Initiative (GoMRI) had on the world of oil spill science overall and specifically within the five states of the Gulf of Mexico.

### **Relevance:**

Following the 2010 Deepwater Horizon oil spill, the Gulf of Mexico Research Initiative (GoMRI), led by an independent academic research board, launched a \$500 million mission to study the effect of oil spills on the environment and public health. GoMRI began funding the Sea Grant Science Outreach Team in 2014 to serve as a bridge to those looking for answers to oil spill questions. GoMRI ended its research efforts in 2020.

### **Response:**

The Sea Grant regional team began planning a series of events early in 2020 to celebrate GoMRI's work in the Gulf of Mexico states. Originally planned as in-person receptions and presentations, the team moved the events online due to COVID-19, offering them simultaneously on Zoom and Facebook Live. The team invited leaders from government agencies, nonprofit and academia to speak to GoMRI's contributions to science around the Gulf.

### **Results:**

Between September and November 2020, the team hosted five webinars honoring GoMRI via Zoom and Facebook Live. Speakers included notables from multiple organizations like Rear Admiral Tim Gallaudet (National Oceanic and Atmospheric Administration), Jonathan Pennock (Sea Grant), Rita Colwell (GoMRI), Laura Bowie (Gulf of Mexico Alliance), academic leaders within the state, and GoMRI-funded early career scientists. More than 300 joined the events online.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31776

## Regional Sea Grant Science Outreach Team hosts 15 webinars, increases number of science events, attendance during COVID-19 pandemic

### **Recap:**

The Gulf of Mexico Science Outreach Program pivoted its outreach approach by hosting 10 planned in-person science seminars as 15 separate webinars on dual platforms as part of an expanded web presence that allowed the team to continue sharing science with target audiences during the unprecedented national COVID-19 response.

### **Relevance:**

The Gulf of Mexico Sea Grant Oil Spill Science Outreach Team has held seminars to explain key oil spill science findings to target audiences since its inception in 2014. Historically, these seminars were held in-person but included a virtual option for those who could not join the event. Due to restrictions resulting from the COVID-19 pandemic, many audience members still needed access to the latest oil spill science but were unable to travel.

### **Response:**

The team recognized the traditional seminar approach would not work during a pandemic and immediately moved the events solely online. To best suit the virtual format, team members organizing events limited the number of speakers to keep "Zoom fatigue" in check while retaining a robust question-answer period for attendees to get questions answered. The team also began broadcasting events simultaneously on Facebook so that federal partners with Zoom security restrictions could join.

### **Results:**

Between June 2020 and January 2021, the team hosted 15 webinars that reached more than 1,200 people via Zoom, an average of 80 per event, with approximately 10% more joining each event once the Facebook Live option was added. In comparison, during the same period in 2019, the team hosted six events with a combined average of 73 attending in person and online.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31773

## Educators transition environmental literacy efforts to online interactions, training and instruction

### **Recap:**

The cessation of in-person activities at all the Mississippi-Alabama Sea Grant-supported learning centers forced transition to online instruction and activities for all avenues of stakeholder interactions: student instruction, teacher training and public outreach.

### **Relevance:**

With the closure and remote work imposed on all three of Mississippi-Alabama Sea Grant Consortium (MASGC)-supported learning centers, participation in onsite activities dropped to near zero. Educational activities were forced to transition to online learning and instruction. Learning centers developed new models for professional development in the form of virtual workshops and seminars, new programs to reach P-12 students and new methods and avenues for public outreach.

### **Response:**

MASGC-supported informal learning centers developed online camps for P-12 students. Professional development opportunities were adapted to online platforms and incorporated practices that included interactivity using novel software tools, mailed activity supply kits and shared Google drives. Outreach to students and the public included sustained social media activity including live Facebook interviews, prerecorded field-focused videos and sharing of educational resources suitable for home instruction, as well as participation in the NOAA Live! Webinar series.

### **Results:**

By transitioning to online learning and instruction, MASCG education activities reached approximately 4,000 P-12 students and more than 100 teachers with information and activities related to healthy coastal ecosystems, sustainable fisheries and resilient communities. Evaluation data for both camps and workshops indicated that participants valued the opportunity to engage, as well as the content and activities shared.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31775

## Development and implementation of COVID-19 safety plan leads to outbreak-free, in-person summer programs

### **Recap:**

The development and implementation of a COVID-19 safety plan resulted in an abbreviated but outbreak-free schedule of in-person summer programs at the Dauphin Island Sea Lab.

### **Relevance:**

Following a school year operating primarily through remote learning, and with most informal science centers closed and summer programs cancelled, education programs that were able to operate helped stem the computer fatigue, learning slide and increase in mental health issues occurring for P-12 students in 2020. Future research may shed light on additional repercussions of the quarantine on student learning and development.

### **Response:**

With assistance from the county health department and the University of South Alabama, Sea Grant-supported Discovery Hall Programs developed and implemented safeguards to reduce the likelihood of COVID-infected individuals or transmission on the campus of the Dauphin Island Sea Lab thus allowing onsite summer programs. Discovery Hall Programs offered seven sessions of three different overnight summer camps for middle and high school students and a month-long residential class in marine science for high school students.

### **Results:**

A total of 161 middle and high school students participated in a reduced schedule of onsite summer programs at the Dauphin Island Sea Lab. Evaluations by students and comments by parents and counselors included parent appreciation of the efforts that permitted onsite programs, student joy at being able to interact with their peers, relief by students at some sense of normalcy and appreciation by counselors of protocols developed to protect their health.



Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31774

## COVID-19 impacts on learning centers result in Sea Grant educators learning new skills

### **Recap:**

The transition to online instruction resulted in educators becoming proficient in a variety of virtual teaching tools and best practices allowing them to reach more students and educators.

### **Relevance:**

The COVID-19 pandemic and the consequent cessation of in-person teaching at all three Sea Grant-supported informal learning centers forced educators to adopt online instruction in order to continue fulfilling the mission of increasing environmental literacy. Online instruction contrasts markedly with hands-on, in-person instruction requiring different instructional tools and practices that were previously unfamiliar to MASGC Education Team members.

### **Response:**

Through multiple training sessions, webinars, discussion groups and personal communications, educators at all three informal learning centers became familiar with a variety of educational software. Through experience, MASGC-supported educators also honed their online instruction skills resulting in the development and adoption of a series of best online instruction practices -interactivity via polling and breakout groups, a priori and a posteriori contact, continually available and easily accessible resources, and evaluation and synthesis tools listed above.

### **Results**

Marine Education Center and Discovery Hall Program staff led online teacher workshops using Zoom, incorporating interactivity, resource sharing and evaluation using novel software tools. Virtual summer camps used engaging online tools and mailed supplies. The National Ocean Science Bowl student competition transitioned to an online event. Videos were created and shared through social media. New forms of and tools for instruction allowed educators to continue educational activities and will extend their reach in the future.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31772

## P-12 teachers increase environmental literacy and STEM skills through educational programs and workshops

### **Recap:**

A total of 218 P-12 educators increased their knowledge of healthy coastal ecosystems, fisheries and coastal resilience through Mississippi-Alabama Sea Grant Consortium-supported field experiences, five workshops and educational programs.

### **Relevance:**

Direct experience, mentoring students in competitions and professional learning opportunities increase teachers' and informal educators' knowledge and confidence on topics relating to healthy coastal ecosystems, fisheries, coastal resilience and career opportunities for students in coastal areas. Educators who participate in these programs share their experiences, information and activities learned with students indirectly increasing student environmental literacy.

### **Response:**

In FY20, Mississippi-Alabama Sea Grant (MASGC)-supported professional learning workshops for classroom teachers and informal educators covered a diversity of topics including planktonic communities, technologies used in ocean science, oil spills, estuarine ecosystems and resilience. Additional student onsite field experiences guided by MASGC-supported education staff provided teachers with direct experience in coastal environments.

### **Results:**

MASGC educators provided 83 educators with 578 contact hours of professional learning in 5 distinct workshops, numerous field experiences and ocean science student competitions. Single-day and multi-day professional learning opportunities increased content knowledge, provided materials for implementing classroom activities and increased confidence using those activities among participants. Anecdotal sharing through a variety of tools indicated that participants valued opportunities afforded by these workshops despite their virtual nature.

Focus Area: Environmental Literacy and Workforce Development

Impact or Accomplishment: Accomplishment

PIER ID Number: 31771

## Thousands of P-12 students increase environmental literacy through place-based hands-on experiences prior to COVID closures

### **Recap:**

Approximately 5,000 students increased their understanding of healthy coastal ecosystems, fisheries, and resilience, and improved their STEM skills by participating in Mississippi-Alabama Sea Grant Consortium-supported field-based experiential environmental education programs at Discovery Hall Programs, the Environmental Studies Center and the Marine Education Center prior to the COVID-related closure of education facilities.

### **Relevance:**

Place-based, hands-on educational opportunities increase environmental literacy, as well as science, technology, engineering and math (STEM) literacy, through direct experiences in coastal environments. These experiences discussing coastal issues, learning new skills and seeing coastal habitats in person increase student understanding of the need to conserve coastal habitats, ensure the sustainability of coastal resources and make responsible decisions concerning coastal resources.

### **Response:**

Mississippi-Alabama Sea Grant-supported environmental centers in Mississippi and Alabama (Discovery Hall Programs (DHP), the Environmental Studies Center and the Marine Education Center) implemented place-based education programs for P-12 students prior to COVID-related closures. Specific program topics ranged from coastal ecology to marine technology and included the practice of science, technology, engineering and math skills. These experiential programs were developed with explicit reference to national and state educational standards and ocean literacy principles.

### **Results:**

Mississippi-Alabama Sea Grant-supported environmental education programs resulted in 4,774 P-12 students actively engaged in field experiences aboard boats, in coastal habitats with wildlife or studying coastal issues such as marine debris, coastal resilience, ROVs and others, with a hands-on approach. Pre- and post-testing of students participating in these programs demonstrated statistically significant increases in content knowledge (DHP - 6 classes: n=352,  $p < 0.0001$ , average gain of 32%, ranging from 16-44%).

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31770

## Sea-Level Rise in the Classroom curriculum pilot test changes student behavior

### **Recap:**

High school students reported an increase in resilient-minded behaviors after instruction from the Sea-Level Rise in the Classroom curriculum, which a team led by the Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative developed.

### **Relevance:**

Coastal high school students are experiencing sea-level rise (SLR) and do not always have the knowledge to understand the connection of SLR to these impacts. Without this knowledge, these students cannot explain the phenomenon they are seeing and cannot work towards coastal resilience. As students enter the workforce and become business owners, elected officials and serve other community roles, they need to address SLR and other complex socio-environmental issues.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative collaborated with a team of subject matter experts and high school science and social studies educators to pilot-test newly developed curriculum, Sea-Level Rise in the Classroom. The four-module curriculum used science-based lessons to describe causes of, impacts from and solutions to SLR. The curriculum development team supported educators throughout pilot testing, and educators provided student and educator feedback to further enhance the curriculum.

### **Results:**

Comparisons between pre- and post-surveys (n=181) indicated behavior change due to the curriculum. There was an increase in students' frequency of doing sustainable actions and a decrease in students "never" doing sustainable actions. Students also reported an increase in talking to others about sea-level rise and in supporting an environmental cause focused on climate change. These students will graduate and enter the workforce better able to understand and address complex socioenvironmental problems.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31769

## Teachers participate in Sea-Level Rise in the Classroom pilot test, continue to use curriculum after pilot

### **Recap:**

Coastal educators who participated in a pilot test of the Sea-Level Rise in the Classroom curriculum, which was developed by a team led by the Mississippi Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative, continue using the lessons with students after the pilot test period.

### **Relevance:**

Educators expressed interest in connecting classroom lessons to locally relevant sea-level rise and climate change impacts, but they often cited uncertainty in data sources, lack of confidence in climate science fundamentals and minimal available resources as barriers. This gap in education leads to a population of coastal residents that lack a comprehensive understanding of ongoing changes that directly and indirectly impact their well-being.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative collaborated with a team of subject matter experts and high school science and social studies educators to pilot test a newly developed curriculum, Sea-Level Rise in the Classroom. Educators used the four-module curriculum to enhance teacher and student understanding. Educators were supported throughout pilot-testing by the curriculum development team, and the educators provided student and educator feedback to further enhance the curriculum.

### **Results:**

Pilot-test educators continued to apply the curriculum even without fiscal support from the project team. Three educators who did not continue into a beta-test effort still used the curriculum with their students. The educators continuing the use the lessons reached an additional 41 students.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31768

## Educators increase their knowledge in Sea-Level Rise in the Classroom curriculum pilot test

### **Recap:**

Regional high school educators participated in a pilot test of the Sea-Level Rise in the Classroom curriculum, which a team led by the Mississippi Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative, developed. The pilot test supported educators with science-based and hands-on lessons to increase their own and their students' scientific understanding of causes, impacts from and solutions to sea-level rise.

### **Relevance:**

Educators expressed interest in connecting classroom lessons to locally relevant sea-level rise and climate change impacts, but often cited uncertainty in data sources, lack of confidence in climate science fundamentals and minimal available resources as barriers. This gap in education leads to a population of coastal residents that lack a comprehensive understanding of ongoing changes that directly and indirectly impact their well-being.

### **Response:**

The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative collaborated with a team of subject matter experts and high school science and social studies educators to pilot-test a newly developed curriculum, Sea-Level Rise in the Classroom. Educators used the four-module curriculum to enhance teacher and student understanding. The curriculum development team supported educators throughout pilot-testing and provided student and educator feedback to further enhance the curriculum.

### **Results:**

All 12 of the pilot-test educators indicated their own knowledge of sea-level rise and resilience increased. They also commented that there were topics in the curriculum that were illustrative and surprising. In semi-structured follow-up interviews, educators also noted that they felt more confident in teaching the subject matter after using the curriculum. Additionally, 64% of the 12 pilot-test educators indicated that they are very likely to recommend this curriculum to a friend or colleague.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31766

## Legal program's quarterly publication, Water Log, informs hundreds on environmental issues affecting Mississippi and Alabama

### **Recap:**

The Mississippi-Alabama Sea Grant Legal Program's quarterly web publication, Water Log, which included articles by law students and experts, informed hundreds of people about environmental and legal issues affecting the Northern Gulf of Mexico with thematic issues in 2020 that addressed fishery management, shoreline restoration, sea turtles and invasive species.

### **Relevance:**

Environmental legal issues are often complex and require attorneys and other experts to translate information for broader audiences. In addition, there are many coastal high-interest topics with emerging legal questions that need to be shared in layman's terms. Finally, law students have the skills and training to share their research findings broadly yet have limited opportunities to do so.

### **Response:**

The Mississippi-Alabama Sea Grant Legal Program produced a quarterly publication, Water Log, which contained engaging articles explaining complicated legal cases and conservation issues related to Sea Grant's mission. It reached new audiences by cross-promoting the publication via social media and by designing thematic publications across a range of topics, including shoreline restoration, sea turtles, fishery management and invasive species.

### **Results:**

Using outside experts as guest writers expanded Water Log's readership and introduced more people to Northern Gulf of Mexico issues related to habitat conservation, resilient communities and fishery management. There were 38 percent more views of Water Log in 2020 than in 2019, meaning the Mississippi-Alabama Sea Grant Legal Program extended environmental education to a larger audience. By using law students to research and write some articles, Sea Grant also supported workforce development.

Focus Area: Environmental Literacy and Workforce Development  
Impact or Accomplishment: Accomplishment  
PIER ID Number: 31765

## Weekly blogs inform readers, highlight Sea Grant work and research

### **Recap:**

The Mississippi-Alabama Sea Grant engagement and education team's 45 blogs about its diverse areas of expertise reached Twitter and Facebook feeds more than 43,800 times, had 1,620 social media engagements and were viewed more than 5,000 times.

### **Relevance:**

Mississippi-Alabama Sea Grant communications consistently works to increase visibility of the programs and its work. With a large engagement team that specializes in diverse topics, it is important to know what team members are doing in their communities and to share that information with a broader audience. The team has a goal of sharing current research, data and developments with stakeholders in its diverse areas of expertise.

### **Response:**

Outreach and education team members wrote 47 blogs to increase Mississippi-Alabama Sea Grant's visibility and share information about research, outreach efforts, events and new developments. Through social media, the communications team connected stakeholders and MASGC social media followers with the blogs, which were posted on <http://masgc.org/news/category/blog>.

### **Results:**

The 47 staff blogs had at least 5,000 unique page views, 1,018 Facebook post clicks, 1,039 Facebook engagements and a Facebook reach of 18,738. Tweets based on the blogs garnered 25,094 Twitter impressions and 581 Twitter engagements.