Mississippi-Alabama Sea Grant

2019 Impacts and Accomplishments

MASGP-21-021

Environmental Literacy and Workforce Development

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Impact

Thousands of P-12 students increase environmental literacy in Mississippi-Alabama Sea Grant-sponsored place-based experiences

Recap:
More than 66,000 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 Dauphin Island Sea Lab's Discovery Hall Programs, Mobile County Public School's Environmental Studies Center, and The University of Southern Mississippi Gulf Coast Research Lab's Marine Education Center.

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 and addressing coastal issues. These experiences increase student understanding of how coastal habitats and scientific research enhance quality of life, promote sustainability of coastal resources and help individuals make responsible decisions concerning coastal resources.

Response:
Mississippi-Alabama Sea Grant-supported environmental centers in Mississippi and Alabama (Discovery Hall Programs, Environmental Studies Center and the Marine Education Center) implemented place-based experiential education programs of varying length (1-4 hours) for P-12 students. 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:
MASGC-supported environmental education programs resulted in 66,618 P-12 students actively engaged in field experiences aboard boats, in coastal habitats with wildlife, studying coastal problems or using tools. Pre- and post-testing of students participating in these programs demonstrated statistically significant increases in content knowledge (DHP - 6 classes: $n=2,212$, $p<0.001$, average gain 30%) (ESC - Project SEA ICE: $n=386$, average gain 36%) (MEC - summer camps: $n=331$, average gain 25%).

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant's visual representation of impacts, accomplishments named best practice, replicated

Recap:
Mississippi-Alabama Sea Grant created visual representations of focus area impacts and accomplishments, the 2019 site review team identified these phylogenies as a best practice, and a national aquaculture team used the process to categorize and organize aquaculture impacts and accomplishments from the Sea Grant network.

Relevance:
Each year, the National Sea Grant College Program requires state programs to report their impacts and accomplishments from research, extension, outreach and education programs. These descriptions of state Sea Grant program actions are individual snippets of success, and there is a lack of understanding of how they fit together over time.

Response:
The Mississippi-Alabama Sea Grant administrative office took its impacts and accomplishments from 2014-17 and sorted them by focus area. Then, it categorized them by topics and created a phylogeny (a visual, map-like representation of effort) for each focus area. For example, topics in the Environmental Literacy and Workforce Development phylogeny included formal education, graduate education and fellowships, and informal education.

Results:
This exercise produced four phylogeny posters that visually displayed research and outreach impacts and accomplishments by focus area. The 2019 Site Review Team identified these phylogenies as a best practice, which encourages other Sea Grant programs to undergo the process and create their own. The Sea Grant Aquaculture Liaison also used this process with a group of aquaculture experts to categorize the Sea Grant network's aquaculture efforts over 50 years.

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

Communications team improves Mississippi-Alabama Sea Grant publications, makes information accessible through national library

Recap:
Mississippi-Alabama Sea Grant's communications department edited more than 125 documents and submitted more than 125 publications to the National Sea Grant Library to support education, outreach and administrative efforts.

Relevance:
Mississippi-Alabama Sea Grant Consortium team members produce educational publications, such as fact sheets, journal articles, websites, videos and e-newsletters, to inform stakeholders about research results, best practices, upcoming events and current issues. The National Sea Grant Library also requires that most of these publications are entered into its comprehensive library collection for public access.

Response:
In 2019-20, the Mississippi-Alabama Sea Grant communications department edited more than 125 documents focusing on such things as content, design, grammar and copyright issues. The department also cataloged more than 125 publications in its system and submitted them to the National Sea Grant Library.

Results:
The communications department improved the quality of more than 125 documents. The department also submitted more than 125 publications to the National Sea Grant Library, making them publicly accessible.

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant outreach, education team raises program visibility through staff blogs

Recap:
Mississippi-Alabama Sea Grant outreach and education team's 45 blogs about its diverse areas of expertise reached Twitter and Facebook feeds more than 62,700 times, had 1,534 social media engagements and were viewed more than 1,800 times.

Relevance:
Mississippi-Alabama Sea Grant communications consistently works to increase visibility of its work and program. With a large team that covers diverse topics, it is challenging to know everything that team members are doing in their communities and to share that information with a broader audience. The program's outreach 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 45 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 45 staff blogs had at least 1,825 unique page views, 1,746 Facebook post clicks, 1,042 Facebook engagements and a Facebook reach of 28,559. Tweets based on the blogs garnered 34,160 Twitter impressions and 492 Twitter engagements.

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant develops sea-level rise curriculum, improves educators' capacity

Recap:
Science and social studies educators increased capacity to teach SLR due to participation in development and evaluation of a SLR curriculum.

Relevance:
Sea-level rise (SLR) will have important societal and environmental impacts in the coastal zone. Educators are increasingly wanting to include it in their curricula; however, climate science can be complex and intimidating, which prevents educators from including it in their classrooms. Additionally, the highly politicized nature of and misinformation about climate change and sea-level rise can further impede educators from addressing these topics, despite a desire to include it in their coursework.

Response:
We collaborated with experts in education and SLR impacts and solutions to develop a cross-discipline curriculum specifically for Mississippi and Alabama high-school educators. Designed for science and social studies teachers, the curriculum has four modules: SLR basics, natural solutions, policy and ordinance solutions, and community planning solutions. To ensure comfort with and usability of the curriculum, an advisory panel of educators and two workshops were convened to scope and test the curriculum.

Results:
Working with educators increased confidence in knowledge and ability to teach SLR and related impacts. Workshop evaluations revealed 96% of educators agreed/strongly agreed they learned something and intended to use the curriculum to strengthen content on SLR, impacts and solutions. Workshop pre- and post-tests showed an average 11% increase in test scores. Advisory panel exit surveys indicated classroom educators felt their perceptions of SLR impacts had changed and "felt better equipped to discuss the issue."

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

P-12 teachers increase environmental literacy, STEM skills through Mississippi-Alabama Sea Grant-supported educational programs, workshops

Recap:
A total of 1,250 P-12 educators increased their knowledge of healthy coastal ecosystems, fisheries and coastal resilience through Mississippi-Alabama Sea Grant Consortium-supported field experiences, 12 workshops and educational programs.

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

Response:
Mississippi-Alabama Sea Grant Consortium-supported (MASGC) professional learning workshops for classroom teachers and informal educators covered diverse topics, including fisheries management, human impacts on coastal ecosystems, healthy watersheds, community resilience, aquaculture, reaching ESL students, educational technologies, technologies used in ocean science, marine debris and microplastics, pollinators and ocean exploration. Additionally, MASGC-supported education staff provided teachers with direct experience in coastal environments. MASGC educators provided 1,250 educators with 4,344 contact hours of professional learning in 12 distinct workshops.

Results:
Educators increased content knowledge, direct hands-on experience and increased confidence with classroom activities. Increased content knowledge was demonstrated (Discovery Hall Programs - Fins, Fishes and Fisheries; N=20, average gain 21%). Evaluations indicated participants valued these opportunities (ex. Environmental Studies Center - SEA ICE teacher workshop; n=25, 98% of respondents strongly agreeing that program goals were met).

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant-supported vessel-based education programs engage students, increase understanding of ecosystems

Recap:
Vessel-based field trips effectively engaged more than 6,500 middle- and high-school students and gave them the opportunity to see estuarine habitats, learn about estuarine organisms and reflect on their personal and collective impacts on coastal ecosystems.

Relevance:
Vessel-based field trips make students more engaged and involved in their learning. Vessel-based programs address marine and environmental science and STEM literacy through hands-on experiences in the estuarine environment. The experience increases students' understanding of how coastal sciences and research enhance the quality of their lives, how they can use this knowledge to make responsible decisions concerning coastal resources and promotes discussion of coastal resilience.

Response:
Mississippi-Alabama Sea Grant-supported environmental education centers provided vessel-based educational programs aboard the Alabama Discovery and the Miss Peetsy B in coastal waters of the Gulf of Mexico. Vessel trips included core education concepts, including observation skills, understanding of biotic, climatic and physical attributes of the ocean, conserving and preserving our natural coastal communities through stewardship, the interconnectedness between how ecosystems function and the cause and effect of human actions on natural systems.

Results:
In FY19, 6,556 middle- and high-school students participated in 228 vessel-based field trips, which actively engaged students in tours of estuarine habitats, instruction in the measurement of water quality, collection, observation and identification of estuarine organisms, and discussion of human impacts on coastal ecosystems. Pre and post-testing indicated that students significantly increased their knowledge of the topics covered (Alabama Discovery: $n=354$, $p<0.001$, average gain 37%; Miss Peetsy B: $n=386$, $p<0.001$, average gain 36%).

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant-supported educators participate in public outreach events, increase citizens' environmental literacy

Recap:
More than 21,000 citizens conversed with Mississippi-Alabama Sea Grant-supported educators about information on coastal ecosystems, coastal resources and human impacts on coastal areas at environmental festivals or directed their own learning at nature centers and an aquarium.

Relevance:
Environmental festivals and events are venues where exhibits can serve as important tools for the public to learn more about specific coastal issues. Public aquariums and nature centers permit self-directed learning on these topics.

Response:
Mississippi-Alabama Sea Grant Consortium support allowed educators to participate in regional environmental festivals, open houses at the Environmental Studies Center and Dauphin Island Sea Lab and other public outreach events. Exhibitry and programs at the Environmental Studies Center and at The Estuarium, Dauphin Island Sea Lab's public aquarium, featured coastal organisms and ecosystems. Structured (Science Cafes, Boardwalk Talks) and informal interactions allowed educators to discuss coastal issues with visitors.

Results:
Public coastal science outreach events reached 21,006 individuals of all ages and backgrounds. Though it is difficult to assess the effectiveness of educational outreach at environmental festivals and events, conversations and anecdotal comments reveal that visitors value seeing and learning about coastal ecosystems and coastal issues.

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant-supported science-based competitions increase students' environmental literacy, career awareness

Recap:
Mississippi-Alabama Sea Grant support permitted national and local student competitions that reached more than 200 middle- and high-school students resulting in increased environmental literacy, enhanced STEM and 21st Century skills and career opportunities.

Relevance:
Participation by students in science-based competitions requires development of knowledge and skills beyond those in field-based or classroom-based learning. Through these competitions, students experience a deeper level of engagement in the practice of science and increased content knowledge and skills as well as an increased awareness of career opportunities.

Response:
Sea Grant-supported educators organized and hosted the district science fair for middle school and high school students and served as judges for other school-based, regional and state science fairs. Sea Grant supported educators in Alabama organized and hosted the Northern Gulf Coast regional competition of the international ROV competition supported by the Marine Advanced Technology Education (MATE) program, while those in Mississippi organized and hosted the regional competition for the National Ocean Sciences Bowl.

Results:
Extracurricular activities offered by Mississippi-Alabama Sea Grant-supported education facilities provided opportunities for more than 200 middle and high school students. Discovery Hall Program's (DPH) regional ROV competition involved 218 students, teachers and coaches. The Marine Education Center's Hurricane Bowl involved 155 students and coaches. District and regional science fairs hosted or judged by Environmental Studies Center and DHP educators involved 101 students. Evaluation, where available, demonstrated increased content knowledge and development of STEM and 21st Century skills.

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant-supported educators reach underserved student populations

Recap:
Sea Grant-supported educators at Discovery Hall Programs visited underserved schools reaching students unable to participate in onsite field programs, while the Environmental Studies Center reached underserved students through their Student Enrichment Activities in Coastal Ecology program.

Relevance:
Many students in Mississippi and Alabama are unable to participate in field-based programs at environmental education facilities due to financial or logistical constraints, especially in Title I schools. Demographics of student populations at Title I schools are similar to those underrepresented in the NOAA workforce. Supporting field trips or environmental education programs at these schools increases environmental literacy and awareness of opportunities in coastal science.

Response:
The Mississippi-Alabama Sea Grant Consortium supported two programs that focused on increasing environmental literacy and environmental career opportunities for underserved students. Discovery Hall Programs' BayMobile program visited underserved schools (defined as Title I schools or those with free/reduced lunch percentages above state averages) delivering educational programs on coastal ecosystems and other related topics. Through the Student Enrichment Activities in Coastal Ecology program, Mobile County School District's Environmental Studies Center (ESC) reached high school students.

Results:
Mississippi-Alabama Sea Grant support allowed educators to visit 54 underserved schools and reach 14,837 students across Alabama and Mississippi through Discovery Hall Programs' BayMobile program. This program targets schools that are unable to visit Mississippi-Alabama Sea Grant Consortium-supported education facilities to participate in onsite programs. ESC's SEA ICE program (Special Enrichment Activities in Coastal Ecology) reached 9,653 students across all Title 1 Mobile County, Alabama, high schools.

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

Gulf of Mexico Sea Grant Oil Spill Outreach Team influences Mid-Atlantic Sea Grant programs to join oil spill preparedness exercise

Recap:
Three years of the Gulf of Mexico Sea Grant oil science team's engagement, involvement and trust-building influenced a Mid-Atlantic Sea Grant program to join a full-scale oil spill preparedness exercise with federal and state-level oil spill responders, as well as other members from the region's emergency
Response community, for the first time.

Relevance:
Oil spills are common throughout the United States. However, the large-scale, infrequent spills tend to have disproportionally larger impacts to communities and ecosystems compared to the more common spills. The Gulf of Mexico Sea Grant oil spill science outreach team was formed after Deepwater Horizon and began engaging with and helping prepare Sea Grant programs in other parts of the country who had not experienced a large-scale spill in recent years.

Response:
To better serve audiences outside of the Gulf of Mexico, team members served as a resource for Sea Grant programs in other regions. One specialist developed two events and a post-workshop report in collaboration with Mid-Atlantic Sea Grant programs. These activities helped these programs learn oil spill science and response, as well as network with key local response community members. A team specialist made introductions that sparked interest in collaboration in the Mid-Atlantic.

Results:
A Gulf of Mexico Sea Grant oil spill outreach team member connected Mid-Atlantic Sea Grant programs to a NOAA Scientific Support Coordinator (SSC) assigned to oil spill
Response in the Mid-Atlantic region. The SSC invited the Mid-Atlantic Sea Grant programs to join a full-scale oil spill preparedness exercise run by the U.S. Coast Guard in the Delaware Bay. Delaware Sea Grant participated in the exercise and learned from and networked with others working toward regional readiness.

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant Consortium provides Gulf-wide, national leadership to address diverse issues

Recap:
Mississippi-Alabama Sea Grant Consortium led eight regional or national efforts that engaged 40 unique communities throughout the country and focused on human and ecological impacts of various issues, including aquaculture, climate, harmful algal blooms, high-value fisheries, oil spills, storms and water resources.

Relevance:
Alabama and Mississippi experience numerous stressors that include hurricanes, oil spills, sea level rise, harmful algal blooms and many others. State Sea Grant programs and their partners help coastal communities become better equipped to recover from stressors. To offer this assistance, Sea Grant professionals must coordinate and lead programs that address these issues. Although multi-state efforts are more complex to manage they provide additional benefits to the people sea grant serves.

Response:
Mississippi-Alabama Sea Grant Consortium led eight regional or national partnerships. These programs included the Great Red Snapper Count, Gulf of Mexico Regional Coastal Resiliency Grant 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 and a Sea Grant/National Academy of Sciences, Engineering, and Medicine's Gulf Research Program's workshop series.

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 $30 million, working with 185 partners throughout the US, advancing the state of coastal science, engaging with at least 40 unique communities and interacting with more than 18,500 people through workshops, presentations, and educational programs.

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

External review recognizes extension, outreach and education team's expanding impacts and accomplishments

Recap:
The Mississippi-Alabama Sea Grant Consortium's extension, outreach and education team gains recognition for its impactful work through an independent consortium review and honors that small groups and individuals received.

Relevance:
Mississippi-Alabama Sea Grant Consortium's strategic plan is based on the needs of the communities the program serves. There are four focus areas in the strategic plan: Environmental Literacy and Workforce Development, Healthy Coastal Ecosystems, Resilient Communities and Economies, and Sustainable Fisheries and Aquaculture.

Response:
Extension, outreach and education (EOE) professionals worked directly with the audiences associated with the four focus areas and developed programming to address longstanding and emerging concerns. The team of EOE professionals worked independently and in teams. Webinars, conference calls and two retreats were held within the past 14 months. These activities enhanced interaction across the team and produced greater impacts and accomplishments. The National Sea Grant Office and National Sea Grant Advisory Board also administered an external site review of the consortium during this period.

Results:
During the external site review and within the site review report, the EOE team was recognized for the impactful work they do and the overall program received some of the highest scores possible within all four focus areas. The EOE team submitted a record number of high-quality impacts and accomplishments during the last reporting period. In addition, EOE team members received multiple awards for their individual and team-based work.

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

Mississippi Oyster Gardening Program educates K-12 students, instills environmental stewardship

Recap:
The Mississippi Oyster Gardening Program educated 350 students on the importance of oyster reef habitat.

Relevance:
Oyster reefs help protect coastlines, improve water quality and provide habitat for a variety of species. Natural and human actions have resulted in the decline of reef structure throughout coastal Mississippi.

Response:
In the Mississippi Oyster Gardening Program, individuals and classrooms receive juvenile oysters from hatcheries and volunteer to raise them until they are planted on reef restoration sites. A partnership with the Mississippi-Alabama Sea Grant Consortium, Saint Stanislaus College, Skype-A-Scientist and the Mississippi Department of Environmental Quality allowed the program to share the benefits of oyster reefs and oyster gardening with K-12 students at three local events and two Skype-A-Scientist calls involving students in the Northeast.

Results:
In 2019, 350 K-12 students learned the ecological benefits of oysters in the ecosystem through five educational events supported by the efforts of Mississippi oyster gardeners to produce 48,558 oysters with a restoration potential of 2.4 acres.

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

Sea Grant's Gulf of Mexico Oil Spill Science Outreach Program shares oil spill science with thousands

Recap:
A six-year-old regional oil spill science outreach team created and delivered oil spill science extension products to more than 2,700 people throughout the nation.

Relevance:
In 2010, the Deepwater Horizon oil spill resulted in approximately 172 million gallons of oil and more than 1.84 million gallons of dispersants entering the Gulf of Mexico. Nine years later, questions linger about the impacts of oil and dispersants on animals, ecosystems, coastal communities and human health in the region. Additionally, questions continue to emerge in the Gulf and around the country related to preparation for future large-scale oil spill events.

Response:
The Gulf of Mexico Research Initiative (GoMRI) funded the four Gulf of Mexico Sea Grant programs to develop the Sea Grant oil spill science outreach team in 2014. The multidisciplinary team of extension and communications professionals work throughout the region and nation. The team interacts with audiences to learn their questions about oil spill science. They then write publications, host seminars, and develop other outreach products to answer them.

Results:
To date, the team has collected input from more than 1,100 people and built a network of more than 2,700 people. They have hosted 39 science seminars and given 190 individual talks; produced 45 extension publications and reports, nine translated publications, and two original short videos; and their website has attracted more than 42,000 unique visitors. The original funder renewed its award for a third time and two additional partners have funded the team to expand their work.

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

Oil spill science outreach team communications office streamlines, expands, and evolves as program grows and changes

Recap:
The Gulf of Mexico Oil Spill Science Outreach Program's communications office improved outreach through production of nine new publications and three translations, support for 10 seminar events and an expanded web presence that allowed for evolution to a new iteration as Science Outreach Program.

Relevance:
In 2019, the Gulf of Mexico Research Initiative-funded oil spill science outreach team added two additional grant-funded programs, the National Centers for Environmental Information (NCEI) and the National Academies of Science, Engineering, and Medicine's Gulf Research Program (NASEM GRP). This expansion of efforts required additional communications work to support the expansion of the team's activities while shifting branding subtly to embrace new opportunities.

Response:
The oil spill communicator streamlined publication production, provided consistent seminar/webinar support and amplified the team's web presence for traditional programming and created opportunities to phase in new work. The team housed the NASEM GRP initiative, which produced a total of five workshops and six corresponding reports, on a subpage to the "Oil Spill Science" tab and built a new tab, "Emerging Coastal Challenges," to promote ongoing work with NCEI.

Results:
Team communications work toward restructuring outreach processes and products, including adding workshop reports to its publication library and rebranding, helped the program increase output and strengthen user engagement. The team's communicator produced nine publications and three translations and supported seven seminars in person and three more remotely, working with a wide variety of organizations. The team's expanded website had 22,500 hits in 2019, almost doubling 12,000 in 2016.

Focus Area: Environmental Literacy and Workforce Development
Impact or Accomplishment: Accomplishment

The Mississippi Coastal Cleanup Program educates more than 7,400 people

Recap:
The Mississippi Coastal Cleanup Program, led by Mississippi-Alabama Sea Grant specialists, educated over 7,400 people about the impacts of marine debris and preventative measures through cleanup events, in-school education, public presentations, and festivals.

Relevance:
Marine debris is an issue that impairs the environment, storm water infrastructure, tourism and industry along coastlines. It is of the utmost importance to educate our youth on how to be responsible stewards of the environment in order to combat this increasing pollution issue. The Mississippi Coastal Cleanup Program's mission is to prevent and remove litter from the coastal environment through education, outreach, research and cleanup events.

Response:
The Mississippi Coastal Cleanup Program, led by the Mississippi-Alabama Sea Grant Consortium, educated over 7,400 members of the community through 20 cleanup events, 18 in-class presentations and activities, 15 public presentations and four outreach events at festivals.

Results:
The Mississippi Coastal Cleanup Program implemented education programs at 12 different local schools, most with multiple reoccurrences, reaching over 2,000 students in the classroom. The program also educated over 3,000 people at outreach education events and festivals and more than 2,400 during cleanup events.

Healthy Coastal Ecosystems

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Impact

Mississippi-Alabama Sea Grant-trained Master Naturalists provide 4,716 volunteer hours, improve 12,266 acres

Recap:
The Mississippi Master Naturalist Program increased awareness of environmental issues in Mississippi and Alabama, provided 4,716 volunteer service hours (valued at $119,928), educated 22,727 people and improved 12,266 acres.

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:
Mississippi-Alabama Sea Grant Consortium staff developed and formalized the Mississippi Master Naturalist Program in 2008 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. In 2019, the Mississippi Master Naturalist Program held two training courses, which led to the certification of 36 new Master Naturalists.

Results:
Participants in the two 2019 Mississippi Master Naturalist courses increased their environmental knowledge 10% on average. Active Master Naturalists documented 4,716 volunteer service hours, valued at $119,928. Through these volunteer hours, participants reached or educated more than 22,727 people and directly or indirectly improved 12,266 acres through stewardship activities.

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Impact

Living shorelines outreach efforts lead to protection of over 10 miles of shoreline

Recap:
Living shorelines education and extension efforts led to the protection of 1,250 acres of marine habitat with an annual ecosystem service value approaching $48 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. The program produces outreach materials about the pros and cons of different methodologies for stakeholders, such as environmental managers, contractors and property owners. In 2019, the program provided 59 presentations, routine site visits and 18 publications focused on improving the effectiveness and ease of implementing living shorelines projects.

Results:
Living Shorelines Program extension specialists informed decision-making through research, informed technical assistance (e.g., site visits, design and implementation recommendations, permitting assistance, etc.) and outreach (e.g., contractor and property owner trainings and print materials) on protection, restoration or enhancement of more than 10 linear miles of Alabama and Mississippi shoreline. Their efforts led to protecting about 1,250 acres with an annual ecosystem service value approaching S48 million (based on ecosystem service values from Costanza et al. 2014).

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Impact

Mississippi and Alabama Coastal Cleanup programs remove 17.8 tons of marine debris

Recap:
The Mississippi Coastal Cleanup Program, coordinated by a Mississippi-Alabama Sea Grant extension specialist, removed over 17.8 tons of litter from the coastal environment.

Relevance:
Litter is an issue that impairs the environment, stormwater infrastructure, tourism and industry along coastlines. Mississippi-Alabama Sea Grant Consortium's Mississippi Coastal Cleanup Program has a mission to prevent and remove litter from the coastal environment through education, outreach, research and cleanup events.

Response:
The Mississippi Coastal Cleanup Program has been led by Mississippi-Alabama Sea Grant staff since 2016. In 2019, they organized or facilitated 20 cleanup events that led to the removal of over 17.8 tons of marine debris from the coastal environment.

Results:
The cleanup events attracted 2,484 volunteers who contributed 8,520 volunteer hours (valued at $216,664) and removed 17.8 tons of litter, which carries a conservative ecosystem service impact of $59,070. Volunteers also collected data on the types of litter to identify sources and design targeted prevention methods.

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Impact

Mississippi-Alabama Sea Grant's 2019 oyster gardening programs produce 7.51 acres of habitat valued at $162,976

Recap:
Oyster gardening programs in Alabama and Mississippi produced 152,093 advanced stocker sized oysters from 131 sites with a restorative potential of 7.51 acres and an economic value of $162,976 generating a program-wide return on investment of 12.2:1

Relevance:
Wild oyster populations remain under threat. 2019 illustrated this concern with unprecedented freshwater inputs resulting in losses of wild oyster reefs estimated in Mississippi as high as 95%, according to the Mississippi Department of Marine Resources. Education and restorative efforts are needed to recognize the consequences and spearhead recovery efforts. Oyster gardening provides both.

Response:
The Mississippi-Alabama Sea Grant Consortium-led oyster gardening programs facilitated hands-on engagement with oyster resources for stakeholders of all ages, K-12 through retiree. Volunteers, with access to coastal waters of the two states, received juvenile oysters set on whole shell from instate hatcheries. The volunteer oyster gardeners grew the oysters in cages through the nursery phase from late spring through early winter. Then, the larger, pre-spawn oysters were planted on restoration sites.

Results:
In 2019, volunteer oyster gardeners at 131 sites grew 152,093 advanced stocker sized oysters in small cages suspended from piers. Oysters production represented a restorative potential of 7.51 acres and an economic valuation of $162,976, return on investment of 12.1:1. When considering volunteer hours, 193 volunteers contributed 1 hour per week for 25 weeks of the season with a volunteer time value of $131,240.

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Accomplishment

Groups file suit to protect Pearl River map turtle after journal publishes Sea Grant legal research article

Recap:
After reading Mississippi-Alabama Sea Grant Legal Program's article on the Pearl River map turtle, two environmental groups (Center for Biological Diversity and Healthy Gulf) filed suit against the U.S. Fish and Wildlife Service to list the species under the Endangered Species Act, which would protect the turtle and its habitat.

Relevance
After more than five years after the Pearl River map turtle species was identified, existing laws have not slowed the decline of the population. Without protection under the Endangered Species Act, the species could become extinct.

Response:
The Mississippi-Alabama Sea Grant Legal Program conducted research and wrote an article that examined state and federal laws protecting the Pearl River Map turtle. The Environmental Law Reporter, a national law journal, published the article as its featured article of the month. The article examined how the Endangered Species Act could offer additional protections for the species.

Results:
After the article was published, two environmental groups (Center for Biological Diversity and Healthy Gulf) filed suit against the U.S. Fish and Wildlife Service to list the species under the Endangered Species Act, which would protect the turtle and its habitat. A Girl Scout troop read the article and is planning actions, such as an app or caution signs, to protect the turtle in its community and contacted the Mississippi-Alabama Sea Grant Legal Program for ideas.

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Accomplishment

Coastal residents assess feasibility of constructed wetlands for flood reduction along Magnolia River, Alabama

Recap:
Due to Mississippi-Alabama Sea Grant support, residents along Magnolia River are assessing the feasibility of constructed wetlands to provide multiple ecosystem benefits, including reduced flooding as sea levels rise.

Relevance:
Coastal watersheds are facing increased pressures from climate change, rapid development, and upstream stressors (e.g., nutrients, debris, increased precipitation). These pressures generate increased flooding, erosion and habitat degradation. Residents along the Magnolia River in Alabama, are interested in utilizing constructed wetlands as a mechanism to reduce flood impacts, nutrient pollution and erosion; however, before they are able to apply for implementation funding, they must demonstrate the feasibility of constructed wetlands to accomplish their goals.

Response:
The Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative provided funding to a multi-organization partnership, led by Baldwin County Soil and Water Conservation District, to conduct a feasibility study assessing if constructed wetlands would meet their goals both now and over changing sea-level conditions in the next 15 years. If the study indicates success, the partnership will utilize the outputs from the study to apply for implementation money.

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Accomplishment

Program leads effort to add 25 miles to Alabama's Eastern Shore Blueway

Recap:
The Mississippi-Alabama Sea Grant Consortium worked with the Alabama Department of Conservation and Natural Resources and several local governments to expand the Eastern Shore Blueway, a recreational waterway trail for non-motorized vessels.

Relevance:
Coastal tourism in Alabama has increased every year since 2010. With more than over 10 million people visiting Baldwin and Mobile counties in 2018, the Eastern Shore Blueway provides an opportunity to introduce visitors to nature while educating them on sustainable tourism practices that protect habitats and ecosystems. The blueway, a recreational waterway trail for non-motorized vessels, encourages passive recreational uses that protect habitat and wildlife.

Response:
Mississippi-Alabama Sea Grant led partners at the Alabama Department of Conservation and Natural Resources, Baldwin County Commission and the cites of Fairhope and Daphne to expand the Fish River and Weeks Bay Blueway into Bon Secour and Mobile Bay. Mississippi-Alabama Sea Grant's tourism specialist conducted an inventory of public access sites and amenities and evaluated the sites to make sure they were in good condition with no safety, environmental or accessibility issues and where suitable sites for kayaks and canoes.

Results:
The Fish River and Weeks Bay Blueway was expanded to the Eastern Shore of Bon Secour and Mobile Bay. It now consists of 15 launching sites and covers over 40 miles. The expansion added 25 miles to the blueway and allows additional access to natural areas and coastal waters.

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Accomplishment

Gulf of Mexico Sea Grant science outreach team informs federal partner decisions to improve tools

Recap:
The Gulf of Mexico Sea Grant science outreach team helped NOAA's National Centers for Environmental Information product developers improve the data tools Harmful Algal BloomS Observing System (HABSOS), Gulf of Mexico Data Atlas and Coastal Ecosystem Maps by sharing tools with target audiences, collecting feedback about those tools, and connecting NOAA-affiliated developers with direct access to data from states in the region.

Relevance:
NOAA's National Centers for Environmental Information (NCEI) houses federal and other environmental data and creates tools for end-users to access the needed information. NOAA wished to update and refine several of its NCEI tools and requested assistance in gaining feedback from target audiences to understand ways tools could be improved. NCEI also was unable to access some data from non-federal partners.

Response:
NCEI partnered with the Gulf Sea Grant science outreach team to engage with specific audiences to assist in getting feedback from end users on three particular tools: Harmful Algal BloomS Observing System (HABSOS), Gulf of Mexico Data Atlas and Coastal Ecosystem Maps. NCEI developers expressed the desire to standardize the way that state-level partners share data and to include data from states not currently participating.

Results:
Sea Grant science outreach specialists obtained feedback on the utility of NCEI tools from target audiences at meetings and conferences around the Gulf of Mexico. NCEI developers used this information to make improvements to the tools. Team members also helped connect developers to state-level decision-makers who could grant or improve raw data access to improve Harmful Algal BloomS Observing System (HABSOS) tool efficacy.

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative serves as an avenue for resilience resources

Recap:
The Northern Gulf of Mexico Sentinel Site Cooperative partnership provided access to sea-level rise tools, products and services for coastal stewards, researchers and outreach professionals.

Relevance:
Sea-level rise (SLR) is a ubiquitous stressor, negatively impact 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. 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. This Mississippi-Alabama Sea Grant supported partnership called the Northern Gulf of Mexico Sentinel Site Cooperative (Cooperative), conducted trainings, developed extension and outreach products, conducted research projects and successfully obtained funding to fill SLR needs and gaps. NOAA conducted an external review of the Cooperative to assess its impact.

Results:
An external review of the Cooperative indicated it increased its partners' abilities to discuss SLR throughout their networks and to communicate SLR science to broader audiences. The Cooperative increased consideration of SLR among Gulf municipal, state and federal entities for planning, restoration and infrastructure investments. Further, the Cooperative identified local partners' needs and communicated them to funders and federal agencies, ensuring funding opportunities reflect stakeholder needs on the ground.

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Accomplishment

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

Recap:
Individual water quality and habitat monitoring and mapping programs are better connected to the broader GoM monitoring, restoration, and mapping community. Their programs are contributing to the enhancement of GoM resource monitoring through input into CMAP's monitoring program inventory and baseline assessments catalogue, as well as, through discussions of their monitoring program's attributes, best practices and protocols, and lessons learned.

Relevance:
The Gulf of Mexico Monitoring Community of Practice aims to increase collaboration and effectiveness of regional water quality and habitat monitoring and mapping programs by providing a forum for sharing and documenting best practices and protocols used by restoration and monitoring practitioners. By providing structured opportunities for stakeholders to network and share lessons learned, the Council Monitoring and Assessment Program promotes consistency among monitoring programs leading to enhanced tracking of restoration efforts at various scales.

Response:
Through continued partnership with USGS, NOAA, and GOMA's robust network of regional partners, the GoM MCoP successfully reached 150+ individuals during two webinars and two in-person workshops during this reporting period. 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 region-wide monitoring program inventory and baseline assessment catalog, as well as, provided valuable insight into their monitoring program's guidelines and attributes which will shape future discussions aimed to increase cross-program compatibility for enhancing restoration progress tracking.

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Accomplishment

Woody plants can be a conduit for greenhouse gas transport from soil to atmosphere

Recap:
The one-year field study covered both greenhouse gas (CO_2, CH_4 and N_2O) concentrations in both soils and xylem of woody vegetation. The results clearly show the linkage between them. This is the first direct evidence that gases produced in the soils can be transported through woody plants. It has significant implication in the research on both climate change and plant physiology.

Relevance:
The linkage between soil and atmosphere in greenhouse gas pool is far from clear. Coastal wetland is a major source of CH_4, a potent greenhouse gas. Future sea-level rise will inundate large area of coastal regions. The feedback between flooding and greenhouse gas production and transport is the focus of this study.

Response:
Field study was setup to simulate future sea-level rise in coastal area, from a rarely flooded site to a flooded area with a transition site between them. Greenhouse gas concentrations associated with water level in soils were monitored. Meanwhile, greenhouse gas concentration in xylem of the woody plants were also monitored.

Results:
The results show that greenhouse gas concentrations in tree xylem were in the same magnitude with the soils. There is no known mechanism for woody plant to produce methane and nitrous oxide, leaving transport from soil to atmosphere the only interpretation of the results. This unknown source of gas transport has implication in revision of global greenhouse gas budget. It also has implication in plant physiology.

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Accomplishment

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

Recap:
Use a scientific base for informed decision-making that integrates observations, monitoring, and basic research into the role that sediment nutrients and organic matter play in supporting coastal marsh functions through the analysis of isotopes as a tracer.

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.

Response:
Provide data on the biodiversity and abundance of relevant wildlife (macroinvertebrates) and plants (coastal marsh vegetation and BMA) that can provide valuable information for adaptive management planning necessary to protect coastal habitats. Collaborations that have been established with USACE, MDMR Beneficial Use Group, MS Habitat Stewards, and RAE Blue Carbon Gulf Regional Initiative

Results:
Data being analyzed will contribute a better understanding of how Juncus-dominated marshes in the northern GoM function, the key ES related to elemental (C, N) and isotopic (d13C, d15N) cycling as restored sites using BU mature over time, and the role of the development of C and N cycles to better inform future restoration and living shoreline projects in the region.

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Accomplishment

Benthic Invertebrates are key indicators of restoration progress

Recap:
A graduate student is being 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 tropic 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.

Results:
Samples from spring and fall 2019 have been collected and processed. Stable isotope measurements from 2018 sediment and plant tissue samples were conducted in 2019 and invertebrate samples from all three years are being prepared for analysis, results of which will be reported in year 3.

Focus Area: Healthy Coastal Ecosystems
Impact or Accomplishment: Accomplishment

Professional and public communities are informed about impacts of Harmful Algal Blooms

Recap:
NCEI and Sea Grant participated in 6 meetings and partnered with the Gulf of Mexico Alliance to conduct a workshop with participants from the scientific and public communities. The intent of the workshop was to improve the communication of impacts of the algal blooms for increased understanding in the public and private sectors

Relevance:
A significant economic impact resulted from a harmful algal bloom in the Mississippi Sound in 2019/ Fisheries were closed or restricted. Beaches and coastal waters were closed. Tourism declined dramatically.

Response:
See recap. NCEI and Sea Grant partnered with the Gulf of Mexico Alliance to conduct a workshop bringing the scientific community and the public/private sectors together.

Results:
A working group has been formed to develop improved communication methods for informing the public in the event of a harmful algal bloom.

Resilient Communities and Economies

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Senate staff, NGO use Mississippi-Alabama Sea Grant legal article in efforts to improve water quality

Recap:
A Mississippi-Alabama Sea Grant Legal Program article on water quality gave a U.S. Senate staffer background to develop legislation on water quality improvements, and the Mississippi Center for Justice used the article for research to develop water quality improvement programs.

Relevance:
Wastewater issues can harm water resources, affecting human health and fishery sustainability.

Response:
The Mississippi-Alabama Sea Grant Legal Program (MASGLP) analyzed how limitations in the Clean Water Act as well as elevated costs for septic in marshy coastal areas contribute to pollution. The article provided a valuable summary of the issue and links to resources for policymakers. It analyzed how the high costs of septic affect low-income areas' water quality, considering environmental justice issues and Clean Water Act limitations, providing a useful summary of resources for policymakers.

Results:
U.S. Senate staff and a Mississippi Center for Justice (a nonprofit organization) lawyer separately contacted the MASGLP to discuss the issues in the article. The staffer gained background to develop legislation on water quality improvements, and S. 3274 (a bill to help low-income communities get clean water by improving wastewater systems) was introduced, co-sponsored by that senator. The Mississippi Center for Justice gained information on developing policy to improve wastewater issues among economically disadvantaged communities.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Mississippi-Alabama Sea Grant-led team develops local sea-level rise two-pagers, enhances coastal resilience

Recap:
The Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative led a team that produced local sea-level rise two-pagers that reduced barriers to accessing and utilizing locally-relevant sea-level rise projections, enhancing the accuracy and effectiveness of community resilience planning and coastal habitat management.

Relevance:
Seas are not rising uniformly, generating significant differences in the amount, timing and impacts of sea-level rise (SLR). Without locally relevant projections of SLR, coastal decision-makers could be underestimating SLR by more than 25%. Local projections are available; however, they are in formats that are challenging to understand and interpret. This has delayed and prevented federal and state decision-makers and extension and outreach professionals from integrating this information into their work.

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 developed a customizable template and data analysis helper to communicate the data in a clear, standardized format. The two-page template is designed to help extension and outreach professionals guide conversations with decision-makers about the available local SLR projections, their implications and how those data could be integrated into future planning.

Results:
Federal and state decision-makers utilized the two-pagers to identify SLR scenarios for planning. Locally, they were used to consider future risk in building and maintenance of critical infrastructure in multiple counties and states. For example, the two-pagers were used during conversations with Jackson County Utility Authority to consider risk-tolerance and determine which SLR projection should be used when designing a new wastewater treatment facility. Extension and outreach professionals also used them to communicate with partners.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Mississippi-Alabama Sea Grant improves flood outreach in Orange Beach by creating a Program for Public Information (PPI)

Recap:
Mississippi-Alabama Sea Grant improved coastal resilience and flood communication within Orange Beach by developing a Program for Public Information (PPI), which will net additional points under the Community Rating System (CRS) and move the city closer to the goal of improving its CRS class score.

Relevance:
Orange Beach experiences hurricanes, storm surge and has a high average annual rainfall, which can result in flash flooding-the impacts of which will intensify with sea-level rise. By implementing a flood communication plan before a flood disaster, the city will have a clear and consistent approach to local flood messaging. A written flood communication plan, such as a Program for Public Information (PPI), can also be periodically modified and edited to reflect changing conditions within the city.

Response:
The Mississippi-Alabama Sea Grant Consortium (MASGC) partnered with Orange Beach to create a PPI that organized city flood communication activities. Sea Grant helped identify target audiences, draft messages and catalogue city flood literature. MASGC-supported staff helped organize a PPI committee to monitor progress, assisted local officials with the CRS self-assessment and facilitated a courtesy review by a FEMA official. The city council approved the Orange Beach PPI in March 2020.

Results:
By creating a PPI, Orange Beach can potentially improve upon its class 7 CRS score. A courtesy review conducted by FEMA determined that the city would be eligible for at least 82 additional points by adopting the PPI, which could lower the city's class rating. A reduction from a class 7 to class 6 CRS community would result in a 5% insurance discount being applied to both special hazard and non-special flood hazard properties.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Environmental Protection Agency, Coast Guard-led Region 6 Regional Response Team add new advisory positions with Sea Grant team input

Recap:
The Gulf of Mexico Sea Grant oil spill science outreach team collaborated with SEA Consulting and the Environmental Protection Agency and Coast Guard-led Regional Response Team 6 to make significant changes to the official Regional Response Team 6 contingency plan to include new seafood liaison and science and technology advisor positions on regional teams preparing for marine oil spill response in Texas and Louisiana.

Relevance:
The Gulf of Mexico Sea Grant oil spill science outreach team is comprised of the four Sea Grant programs in the region. The team serves audiences who rely on a healthy Gulf of Mexico for work or play and to connect and stimulate discussion among these audiences while sharing information about oil spill science. One such audience is the Regional Response Teams (RRTs), jointly led by the Environmental Protection Agency (EPA) and U.S. Coast Guard, who develop oil spill response plans for the region. RRTs are made up of several, local Area Committees.

Response:
Gulf of Mexico Sea Grant oil spill science outreach team members began joining local Area Committee Meetings and RRTs to learn the response process, build their network of trusted sources of information and be able to effectively share information with other target audiences, such as university researchers or commercial fishers, who might benefit from a role in the process.

Results:
Region 6 Regional Response Team (RRT6) members and SEA Consulting invited team members to help develop appendices to the RRT6 contingency plan. The appendices assist with engaging with specific Sea Grant target audiences by creating a seafood industry liaison and a science and technology advisor. These new roles assist with integrating fishermen's issues into response decisions and create another mechanism for researchers to share their expertise. RRT6 formally adopted these appendices in March 2019.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Sea Grant science outreach team partners host a favorably-reviewed national oil spill workshop series that generated reports featured by National Institutes of Health

Recap:
The National Academies of Sciences, Engineering, and Medicine's Gulf Research Program and the Gulf of Mexico Research Initiative partnered with six Sea Grant programs to host a series of positively-reviewed oil spill resilience workshops in coastal communities around the country that generated reports outlining regional recommendations for future research and outreach projects.

Relevance:
A meeting co-hosted by the National Academies of Sciences, Engineering, and Medicine's Gulf Research Program (GRP) in 2017 revealed that almost 10 years after the Deepwater Horizon oil spill, many questions remain about the human health and socioeconomic impacts and how to address these issues during future spills. The GRP wanted regional level input to identify common and region-specific needs to inform human dimensions of oil spill preparedness.

Response:
The GRP and Gulf of Mexico Research Initiative supported six Sea Grant programs to coordinate a series of workshops around the country - in Alabama, Alaska, California, Louisiana and Virginia. Workshops focused on public health, social disruption and economic impacts of oil spills allowing regional audiences to consider their ongoing needs and make recommendations for emerging outreach and research topics. Workshop organizers produced five regional reports and a summary report of commonalities across locales.

Results:
The National Institutes of Health recognized the reports' significance and featured them on their website. Further, an evaluation completed more than six months after the final workshop revealed that the majority of respondents strongly agreed that the workshops helped them extend their professional network, identified relevant priorities and would improve oil spill preparedness. In addition, 93% of respondents indicated that their knowledge of spill Response, planning, and/or human well-being improved due to the workshop series.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Mississippi-Alabama Sea Grant leads development of Resilience Action Plan for Fairhope, Alabama

Recap:
In response to issues involving the city marina that the city of Fairhope, Alabama, identified during a Coastal Community Resilience Index exercise, Mississippi-Alabama Sea Grant, in partnership with a technical advisory committee, developed a Resilience Action Plan for the city.

Relevance:
Mobile Bay is a sensitive and important ecological habitat threatened by pollution. The marina owned by the city of Fairhope, Alabama, at the confluence of Fly Creek and Mobile Bay had fallen into disrepair under previous management, with stormwater issues and a lack of pumpouts and other water quality protection devices in place. The city sought assistance in developing an action plan to improve the marina.

Response:
Following a Mississippi-Alabama Sea Grant Consortium-led Coastal Community Resilience Index (CRI) workshop, Fairhope sought assistance in implementing identified issues. Under the externally funded "Connecting the Dots" project, Mississippi-Alabama Sea Grant and the city of Fairhope, under the guidance of a technical advisory committee, undertook the development of a Resilience Action Plan, a document that outlines the redevelopment of the marina in a phased approach.

Results:
A final Resilience Action Plan to address stormwater and Clean and Resilient Marina standards was produced for the city of Fairhope. The city is taking a phased approach to implementation of the plan, addressing issues as funding is available. Some completed phases include alleviation of stormwater issues, installation of a pumpout station and channel dredging. The city remains focused on implementing the plan.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Mississippi-Alabama Sea Grant supports business continuity planning in the city of Ocean Springs, Mississippi

Recap:
Mississippi-Alabama Sea Grant worked with the city of Ocean Springs and its chamber of commerce to offer assistance in developing Business Continuity Plans, which include identifying resources that may be needed immediately after a storm, staging resources and/or services (i.e. medical services, equipment, such as generators) and building needed relationships to ensure effective post-disaster communication.

Relevance:
The city of Ocean Springs completed the Coastal Community Resilience Index self-assessment and identified a need for local business continuity planning. This need was also identified in the city's Comprehensive Plan and Hazard Mitigation Plan. A survey found that most businesses in Ocean Springs did not have a Business Continuity Plan or a written Business Plan. Business continuity planning ensures critical services can quickly resume after a natural or man-made disaster.

Response:
Mississippi-Alabama Sea Grant funded and provided technical support to the city of Ocean Springs and local chamber of commerce to identify standards for Business Continuity Plans and offered competitive grants to local businesses to share the cost of preparing the plans. The city held a lunch-n-learn to gain interest from local businesses, shared the importance of continuity planning and hosted a workshop for businesses to begin the process of completing a draft plan.

Results:
Mississippi-Alabama Sea Grant strengthened the city's economic and social resilience by working with business leaders to identify overall business resilience needs, which led to five local businesses preparing their own Business Continuity Plans.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Tangipahoa Parish improves ordinances, new-procedure training to enhance stormwater and floodplain management

Recap:
Tangipahoa Parish, Louisiana, enhanced floodplain and stormwater management through policy gap analysis, updated enforcement and best practice protocols, and coordination between partners to further the recovery process and reduce future vulnerability as outlined in the Tangipahoa Parish Community Recovery Plan.

Relevance:
Tangipahoa Parish has no major flood control structures. The parish is prone to storm surge flooding from tropical storms and riverine flooding from extreme rain events. There have been seven major disaster declarations in the parish, including two in 2016 that impacted nearly 16,000 structures. Water quality and impaired waterways are also a consideration, with rapid development in the southern portions of the parish and hydrologic alterations and agricultural runoff concerns in the northern reaches.

Response:
The Mississippi-Alabama Sea Grant Consortium funded a team to conduct a stormwater management policy gap analysis, which included assessing relevant codes, ordinances, rules, and regulations. The Tangipahoa Parish Stormwater Management Plan enforcement protocols and documentation were updated to meet state requirements, and staff education materials were created for training the parish government on the new procedures. Model ordinance language was developed to implement best practices for flood reduction and improved water quality.

Results:
The parish completed a review of relevant land and floodplain management ordinances and identified best practices, model language and opportunities for future updates of key ordinances. They completed a Stormwater Management Policy Gap Analysis, assessing relevant codes, ordinances, rules, and regulations and identified implementation challenges. They translated best practices to community-specific recommendations including guidance in support of preliminary hydrology and hydraulics studies and priorities for watershed management in the Parish.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Mississippi-Alabama Sea Grant funds drainage system maintenance to reduce flood losses, gain CRS points in Covington, Louisiana

Recap:
The city of Covington, Louisiana, increased its CRS score in three areas as a result of updating its Flood Damage Reduction Activities under the Community Rating System.

Relevance:
Covington is a relatively small city on the north shore of Lake Pontchartrain in St. Tammany Parish, Louisiana. It has experienced extreme flooding events and needed to update its Flood Damage Reduction Activities (Activity 540) under the Community Rating System (CRS), an incentive program FEMA offers to lower flood insurance premiums.

Response:
Mississippi-Alabama Sea Grant supported a team to assist the city of Covington, Louisiana, in increasing drainage system maintenance to reduce flood losses. The work is intended to improve their Community Rating System (CRS) score, which will decrease the flood insurance premiums for their residents.?The team developed two videos to increase the public's understanding of the community's drainage system: one for public education and outreach and the second for internal training purposes.

Results:
This project improved drainage system maintenance efforts to reduce flood losses to existing development and improved related CRS scores for the city. The work helped the city gain CRS points in three areas: channel debris removal, problem site maintenance and stream dumping regulations. The city council also approved and adopted added language to the litter ordinance to address the dumping of trash, landscape debris and other materials in rivers, creeks, canals, ditches or storage basins.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Mississippi-Alabama Sea Grant helps Covington, Louisiana, develop Flood Preparation and Response Plan

Recap:
Due to support from Mississippi-Alabama Sea Grant, the city of Covington created a flood response plan and implemented response exercises to prepare residents and businesses for future events and increased their community's resilience.

Relevance:
Covington, Louisiana, has experienced several storm-related disasters, but a 2016 rainfall event triggered unprecedented flash flooding throughout the area. Covington had never experienced this type of flooding. Water impacted over 300 buildings, 57 streets, and seven sewer lift stations. Police and fire departments evacuated multiple subdivisions. The flooding caught the community off guard, so leaders identified the need to more accurately and efficiently notify residents of impending flash floods.

Response:
Support from Mississippi-Alabama Sea Grant enabled the city to compile data from the flood event into a GIS database for use by city departments. They drafted a flood preparation and response plan to be ready to respond to future flash flood events. The city led and completed an emergency response exercise using the plan to test and practice the response techniques. They provided education materials to residents and business owners, which tied into their Community Rating System program.

Results:
The city developed a new flood response plan, linked the plan to its CRS program, implemented response exercises and shared the process and lessons learned with neighboring communities through a free workshop for surrounding local governments and other interested individuals. They also shared deliverables and publications online and gave presentations at the Louisiana Chapter of the Association of State Floodplain Managers.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Mississippi-Alabama Sea Grant helps Fairhope, Alabama, develop stormwater management plan for Tatumville Gully Watershed

Recap:
The project improved stormwater management infrastructure using low-impact engineering that protects, enhances and improves the natural coastal resources, as well as increases the city's sustainability, resilience and preparedness.

Relevance:
Fairhope is frequently affected by storms, flooding, hurricanes and tornadoes. All have a high probability of occurring, and numerous federally declared disasters have impacted the city. The Tatumville Gully watershed is a particularly vulnerable area. The gully is experiencing many threats including erosion, flooding, invasive species and many older homes on low-lying parcels. It is located in a historic black community, which has the highest concentration of low-income and vulnerable residents in the city.

Response:
Mississippi-Alabama Sea Grant funded the city of Fairhope to identify and place stormwater infrastructure for the watershed into the city's GIS system with elevation and size data. In addition, the city generated hydrologic and hydraulic models to evaluate and predict stormwater flows/levels, using current conditions as a baseline.

Results:
The Stormwater Management Plan made recommendations to for offsetting stormwater discharges by increasing pipe size, installing new ponds to provide greater storage volume and modeled low areas as possible detention for upstream ponds. Scenarios were run using the hydrologic and hydraulic models to determine if certain recommendations would increase/decrease stormwater flow. The South Fairhope Community Action Plan was developed in concurrence with the stormwater management plan and both have resulted in work to improve the Young Street Community Park.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Mississippi-Alabama Sea Grant assists Aransas County, Texas, in joining the Community Rating System, saving on flood insurance premiums

Recap:
After completing the Coastal Community Resilience Index (CRI) self-assessment, Aransas County decided to apply for funding to (1) join the CRS and (2) strengthen the communication protocols for alerts and action notices for the county.

Relevance:
Aransas County experiences frequent flash flooding (five events in 2015 alone). The county's vulnerable location along the Gulf Coast puts the county at risk for hurricanes and associated storm surges. If the frequency and severity of hurricanes increases, the area could be impacted more frequently in the future. Flooding has been an ongoing hazard to the county with recent changes in precipitation regime moving from drought conditions, and these events could become more frequent and severe.

Response:
Due to support from Mississippi-Alabama Sea Grant, the county developed a comprehensive website (http://www.setxgis.net/aransas) with a library of resources, including elevation certificates, Letter of Map Amendment (LOMA), Flood Insurance Rate Maps (FIRMs), ArcGIS maps and resources for floodplain protection and the permitting process for development within the county. The county also developed a Hurricane Harvey/Flood Response Recovery Plan that includes a communications protocol.

Results:
This work allowed Aransas County to apply for the Community Rating System to begin receiving discounts on flood insurance premiums. These efforts have resulted in greater preparedness to storm events and increased capacity to respond and adapt to changes in weather patterns, climate and storm events.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Mississippi-Alabama Sea Grant-funded project reduces risk of flooding through addition of portable stormwater pump

Recap:
A small grant from Mississippi-Alabama Sea Grant helped New Port Richey, Florida, purchase equipment that diverts water to and from large retention areas, helping residents and businesses with flooding issues.

Relevance:
New Port Richey staff recognized the need to replace aging stormwater management equipment after heavy storms in 2016, including Hurricane Hermine, flooded the city and damaged roads.New Port Richey had never experienced such severe flooding, and people had to use boats or kayaks to evacuate.As Hurricane Irma approached in September 2017, residents were again worried about flooding.

Response:
The city received funding from Mississippi-Alabama Sea Grant to reduce water levels in flood-prone areas by purchasing and utilizing a new stormwater pump, reassuring residents and business owners. The new pump was able to free up the existing small pumps to quickly answer the call of residents with smaller flooding issues while at the same time making sure the larger retention areas remained functional in order to protect the neighborhoods and community.

Results:
Residents, business owners and city staff in New Port Richey, Florida, now have peace of mind that heavy rains and storms will not cause damage or cut off local roadways, thanks to new stormwater equipment.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Islamorada amends ordinances to include additional freeboard, climate literacy training and post-disaster redevelopment plan

Recap:
With small grant funding from Mississippi-Alabama Sea Grant, the South Florida Regional Planning Council helped the Islamorada Village of Islands remap their Coastal High Hazard Area and developed recommendations for where to locate future infrastructure to protect buildings from future flooding.

Relevance:
Sea-level rise in South Florida manifests itself prominently via extreme tides, elevated storm surge and water tables exceeding ground elevations in low-lying areas. These impacts cause transportation delays, compromised drainage, property damage, erosion, complications to regional water supplies, habitat degradation and an array of other costs and inconveniences. Islamorada identified a need for high-resolution data to evaluate potential storm surge and sea level rise impacts.

Response:
Mississippi-Alabama supported a project team to use LIDAR and storm surge data to redefine the Coastal High Hazard Area (CHHA) for a Category 1 storm at current sea levels and two future sea-level scenarios. This information was used to identify assets under current and future risk within the CHHA. The South Florida Regional Planning Council completed the data aggregation, GIS modeling and drafting of GIS maps displaying storm surge under various sea-level rise scenarios for Monroe County.

Results:
Results were presented in the form of an interactive map using ESRI's Story Map platform. A comprehensive set of recommendations to address local sea-level rise impacts was provided with the maps. Using the time-lapse feature of the mapping tool, planners and local officials can easily visualize the changing CHHA and potentially increasing vulnerability. Islamorada used these recommendations to amend the Village Code of Ordinances to include additional freeboard, conduct employee and elected official climate literacy training, and draft a post-disaster redevelopment plan which includes sea level rise as a hazard.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Project enables community to develop, adopt shoreline master plan that improves resilience and ecosystem benefits

Recap:
The city of South Padre Island, Texas, developed a Shoreline Master Plan that identifies and preserves aquatic habitats (such as wetlands and mangroves) that provide protection from sea level rise and storm surge.

Relevance:
The community of South Padre Island, Texas, has a history of confronting strong storms and responding to their impacts. Over the last 50 years, four major hurricanes have impacted the small, low-lying barrier island community, exacting moderate to severe damage from the Gulf shoreline to the Laguna Madre. Hurricanes Ike (2008) and Dolly (2008) greatly impacted South Padre Island, causing structural and environmental damage and weakening the seasonal beach-tourism economy upon which the community relies.

Response:
With support from Mississippi-Alabama Sea Grant, the city of South Padre Island revised its Comprehensive Plan to include a Shoreline Master Plan. The Shoreline Master Plan provides a list of broad, interrelated goals that enhance or support existing education, tourism, conservation and public access projects within the city. Each goal is accompanied by recommendations that build upon commitments from the city's previous planning documents and the knowledge gained from results of a public planning meeting.

Results:
South Padre Island adopted the Shoreline Master Plan, which promotes resilience and preserves adjacent aquatic habitats that serve to attenuate water level rise and storm surge. Maintaining this vital storm buffer minimizes damage to hard structures and lessens the overall flood risks to upland areas of the island. Storm buffering helps ecosystems withstand disturbances. Additionally, conservation of ecologically important lands will ensure that future development will take place in more resilient locations.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

A shoreline management planning tool for local government and stakeholders

Recap:
The shoreline management tool produced by this project assisted local governments in addressing challenges related to shoreline resilience planning and assists local stakeholders in making technical decisions about sustainable and resilient shoreline erosion control.

Relevance:
Many shorelines in Cedar Key, FL are rapidly eroding and would be suitable for a resilient living shoreline approach, but implementation rates of living shorelines are lower than they could be because of barriers including 1) lack of awareness of the options; 2) difficulty selecting the appropriate shoreline erosion control project design for a specific property and; 3) a complex regulatory environment that makes it difficult to begin the permitting process.

Response:
The creation of a local tool to help residents determine if a living shoreline would be suitable for their property and, if so, what type of design they should pursue, what permits would be needed, and how to apply. This Shoreline Management Master Plan (SMMP) will serve as an essential part of the City of Cedar Key's ongoing climate change adaptation planning efforts and will give homeowners the resources they need to implement living shorelines.

Results:
The SMMP mapping tool has been viewed 941 times since launch and the project has been presented at 7 different events to at least 235 people. PIs conducted 12 individual shoreline consultations and site visits. The SMMP map is pending incorporation into the City of Cedar Key comprehensive plan. Two living shorelines are in the planning stage as a result of this tool, three other municipalities have reached out for assistance creating a similar tool.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Alabama FORTIFIED roof endorsement to benefit all Alabama homeowners by providing resiliency upgrades through insurance

Recap:
A new home insurance endorsement, enacted through the State Legislature, allows Alabama homeowners to affordably upgrade to a resilient, wind-resistant FORTIFIED Roof after it has been damaged.

Relevance:
Hurricanes, tornadoes, and severe storms damage the properties of Alabama homeowners every year. The housing stock in the state consists of many existing homes built to older building standards. Many homeowners lack the financial resources or knowledge to upgrade their homes to be resilient using modern construction techniques. A method to allow homeowners to affordably and easily improve their homes' ability to resist damage from severe weather better was needed.

Response:
Alabama leads the nation in FORTIFIED construction, a nationally recognized construction standard that reduces damage from hurricanes and severe weather. For years, Smart Home America has led outreach efforts to increase the use of resilient construction and FORTIFIED, creating an understanding of the benefits FORTIFIED provides. Alabama supports FORTIFIED in many ways, and in 2019, local legislators decided a new approach was needed to allow homeowners to make their homes more resilient after a storm.

Results:
Using a new model to provide resiliency upgrades, HB 283 was passed. Homeowners can now buy insurance that will upgrade their homes with a resilient FORTIFIED Roof. The bill requires "all insurance companies writing homeowners insurance to offer an endorsement that upgrades a home to a fortified standard adopted by the Institute for Business and Home Safety (IBHS) when the insured incurs damage covered by the policy that will require the roof to be replaced."

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Impact

Smart Home America and Mississippi-Alabama Sea Grant collaboration model expand partnership opportunities

Recap:
Smart Home America, in partnership with Mississippi-Alabama Sea Grant Consortium, replicated a collaborative partnership model which has expanded the collective capacity of both organizations to bridge the gap between the public and private sectors and increase coastal resilience to wind and flood risks.

Relevance:
Recent storm and flood events have exposed the need for resiliency in community development and housing. However, meeting the demand for expertise in wind and flood resilience has been challenging for both Gulf Sea Grant Programs and Smart Home America. A new public-private partnership model was envisioned to bridge the gap in organizational capacity and expertise while providing the ability to enhance community resilience outreach and education activities.

Response:
Smart Home America and the Mississippi-Alabama Sea Grant Consortium developed a unique public-private partnership to combine Sea Grant science and tools with Smart Home America's ability to leverage both public and private sector partners. This partnership model has continued for three years, allowing both organizations to introduce proven science and new tools to a greater audience and enhance the understanding of wind and flood resilience methods.

Results:
A shared staff position has expanded the outreach efforts of both organizations. These efforts have supported the adoption of beyond-code construction standards in nearly 80% of coastal Alabama jurisdictions and led to the adoption of enhanced floodplain management ordinances throughout the region. Sea Grant and other public and private sector partners from several states have also expressed an interest in using the model to increase community resilience to wind and flood risks.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Tumbling tower game teaches about impacts of sea-level rise, enhances engagement with audiences at outreach events

Recap:
Audiences of all ages at public outreach events engaged and learned about the connected impacts of sea-level rise on coastal communities.

Relevance:
Coastal residents are already feeling the impacts of sea-level rise (SLR) and may lack understanding of how those stressors are connected to SLR. Information on SLR impacts and solutions is often presented to adults and professionals in a technical manner as disparate impacts or changes. Adult and youth coastal residents need to be knowledgeable of the basics of SLR in order to pursue and support solutions.

Response:
The Mississippi-Alabama Sea Grant Consortium-supported Northern Gulf of Mexico Sentinel Site Cooperative developed a tumbling tower game (e.g. Jenga) that highlights the connected impacts of SLR on coastal communities. The block tower has layers of colors representing community attributes: water, critical facilities, connection, coastal land, fisheries and home. Play cards allow players to read an SLR impact and remove a block. SLR solutions and impacts are addressed in youth-accessible language with versions for differing age groups.

Results:
The physical presence of the block tower game on tables at two outreach events drew families with children. The game kept participants engaged in conversation about SLR with table facilitators.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant uses research, expert input to develop draft game board for The Watershed Game Coast Models

Recap:
The Mississippi-Alabama Sea Grant Consortium and partners developed a draft gameboard for coast-specific versions of The Watershed Game, an existing tool to help show 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:
It is challenging to communicate the connections between land management and resulting impacts on water quality and resilience to coastal community decision-makers and residents. Through game play, The Watershed Game demonstrates how land uses impact water quality and increases players' knowledge of tools that can reduce these impacts. However, the game is specific to inland communities not coastal ones.

Response:
The Mississippi-Alabama Sea Grant Consortium (MASGC) and partners used background research and expert input to inform the development of a Watershed Game Coast Models draft game board. They created 60 tool cards featuring plans, practices and policies to address key water quality challenges. The development team also conducted two workshops for formative assessment and is working to integrate this feedback.

Results:
MASGC, in collaboration with partners, developed a draft game board and tool cards for coast models of The Watershed Game, a proven engagement tool that lets players experience how land use impacts water quality, natural resources and the ability of a community to prepare for and respond to flooding.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

The city of Apalachicola, Florida, takes innovative steps to protect economically valuable historic buildings

Recap:
Due to support from Mississippi-Alabama Sea Grant's Northern Gulf of Mexico Sentinel Site Cooperative, the city of Apalachicola, Florida, is taking steps to preserve its cultural and economic resources with a suitability assessment of novel techniques to floodproof historic structures while maintaining integrity of the architecture.

Relevance:
Historic buildings are the foundation of Apalachicola's economy. Downtown Apalachicola - the economic heart of the city - is composed of shops, restaurants and inns all housed within iconic historic structures from adapted warehouses to original inns from the industrial era. These buildings, already vulnerable to hurricanes, are increasingly vulnerable to smaller flood events as a result of sea-level rise (SLR); however, traditional flood protection measures often conflict with persevering the historical integrity of buildings.

Response:
The city and the Apalachicola NERR partnered with experts in historic architecture and flood proofing to design and price plans for 12 historic buildings in downtown Apalachicola in need of floodproofing. These specific buildings were selected based on a recent assessment demonstrating vulnerability to SLR.

Results:
The results will be used to seek implementation funding. Funding and technical support was provided through the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Project to collect first-floor elevation data in Biloxi, Mississippi

Recap:
Due to support from Mississippi-Alabama Sea Grant's Northern Gulf of Mexico Sentinel Site Cooperative, the city of Biloxi, Mississippi, is undertaking a project to better understand parcel-level flood vulnerability in their economic development district, which will allow them to more accurately and effectively address flood risk.

Relevance:
As seas rise, understanding which structures are vulnerable to current and/or future flood levels is critical to undertaking flood prevention activities in Biloxi, Mississippi. Unfortunately, many historical buildings and other structures that represent homes and businesses in the important economic development district do not have known first-floor elevations. These elevations are vital for cities to understand potential flood damage, and without them it is difficult to take action to reduce flood risk.

Response:
Working with researchers and extension professionals, the Biloxi floodplain administrators are collecting first-floor elevation data for their valuable economic development district using a novel technique. Additionally, they are utilizing primary and secondary historical sources to identify high-water marks for storms as far back as the early 1900s. Funding, technical and stakeholder engagement support was provided through the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative and the legal team.

Results:
Due to this funding opportunity, floodplain administrators are pursuing innovative techniques to understand their flood risk. Coastal residents have engaged in the process and are learning more about their flood risk by speaking directly with researchers working in the neighborhood.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Participation on advisory team enhanced sea-level rise resilience capacity in northern Gulf of Mexico coastal communities

Recap:
Stakeholders served on an advisory team to guide a resilience project led by the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative, which increased stakeholder's capacity to address sea-level rise and associated impacts.

Relevance:
Sea-level rise (SLR) is magnifying coastal hazards such as storm surge and erosion; however, it is complex and there exists a lot of uncertainty and misinformation among coastal decision-makers. Coastal professionals, such as floodplain managers, community planners and elected officials, need localized information and technical support to understand and apply the available information.

Response:
As part of a project to reduce fiscal and communication barriers to understanding and addressing SLR impacts, the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative developed an advisory team to guide project efforts. The team included elected officials, municipal staff, outreach professionals and training coordinators from Mississippi, Alabama and northwest Florida and met monthly to discuss SLR, potential local impacts from SLR and options to address changing risk in their communities.

Results:
In advisory team exit surveys, 100% of respondents indicated participation increased their knowledge about SLR, risk to their communities and options to address SLR impacts. All agreed or strongly agreed they were more likely to address SLR in their work due to their time on the advisory team. Benefits cited were ability to visually communicate SLR concepts, increased understanding of SLR and learning about the availability of local data and resources to support SLR action.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Gulf TREE enhances selection of climate science for decision-making in the Gulf of Mexico

Recap:
Due to Mississippi-Alabama Sea Grant led activities to maintain Gulf TREE, professionals across local, state and federal governments, researchers and non-profits have been able to identify appropriate climate resilience tools for their efforts, generating a more deliberate and thorough determination of what climate science to apply in the Gulf of Mexico, which enhances resilience outcomes.

Relevance:
There are an overwhelming number of resources, often dubbed "tools," available for increasing resilience to climate change. The volume and diversity of tools leaves professionals, such as elected officials, natural resource managers, and community planners, unsure which tool they should use. This lack of understanding leads to misapplication or underutilization of the available resources.

Response:
The online, filter-based search engine Gulf Tools for Resilience Exploration Engine (Gulf TREE) allows users to be matched with the most appropriate tool(s) for their purpose with as few as five questions. Mississippi-Alabama Sea Grant specialists with the Northern Gulf of Mexico Sentinel Site Cooperative have continued to increase awareness, provide training and update Gulf TREE to keep it relevant for users.

Results:
Professionals at the local, state and national levels benefited from utilizing Gulf TREE. Gulf TREE applications included using it to understand the range of available tools and to identify a tool for a specific purpose. For example, a consultant used Gulf TREE to find a tool to assess sea-level rise risk to road infrastructure and found and applied a tool he had never heard of before. Web data analysis indicated 80 uses this year.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Sea-level rise Lunch 'n' Learns for coastal consultants, engineers enhance coastal community resilience

Recap:
Mississippi-Alabama Sea Grant-led Lunch 'n' Learns focused on sea-level rise for coastal engineers and environmental consultants enhanced coastal community resilience through increased application of sea-level rise knowledge and skills among Mississippi and Alabama coastal consultants and engineers.

Relevance:
Coastal communities depend on engineers and consultants to enhance and expand their planning and infrastructure capacity; however, even among these experts, integrating sea-level rise into coastal projects and planning faces knowledge and skills barriers.

Response:
To increase knowledge and skills around integrating sea-level rise (SLR) into coastal planning, the Mississippi-Alabama Sea Grant supported Northern Gulf of Mexico Sentinel Site Cooperative partnered with Mobile Bay NEP, Weeks Bay NERR, and Grand Bay NERR to host SLR Lunch 'n' Learns for coastal engineers and environmental consultants. Participants learned SLR basics, how to utilize exceedance probabilities for risk-based planning and how to find and apply local SLR rates and data on SLR impacts.

Results:
The Lunch 'n' Learns were very well received with 100% of participants agreeing or strongly agreeing that it was a good use of their time and 86% stating they learned something they would use in their work moving forward. Additionally, in a follow-up survey six months after the Lunch 'n' Learns, 71% of the respondents indicated that they had utilized the knowledge, skills and tools covered at the event.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Sea-level rise resilience video series increases understanding, willingness to consider SLR in planning

Recap:
Working with coastal officials, outreach professionals and non-profits, the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative (Cooperative) increased awareness of and discussion about sea-level rise science, impacts and mitigation options by developing short, informative videos that allowed coastal leaders to inform and engage their constituencies, generating more resilient communities.

Relevance:
Sea-level rise (SLR) is ubiquitous, directly and indirectly affecting coastal communities. It is crucial that coastal decision-makers understand SLR, potential impacts and options for taking action to address potential impacts. Unfortunately, SLR science is complicated and advancing at a rapid pace. Practical solutions for small coastal communities are not well described or shared, making it difficult for coastal decision-makers to understand their vulnerabilities and what options are available for addressing them.

Response:
To reduce communication barriers around SLR science, impacts and potential adaptations, the Mississippi-Alabama Sea Grant-supported Cooperative developed two video series in collaboration with coastal decision-makers. The first series communicates the science around SLR, how it may impact the northern Gulf of Mexico and potential solutions to address or avoid these impacts. The second series highlights case studies of actions communities around the Gulf of Mexico have taken to reduce their vulnerability to sea-level rise.

Results:
The videos have been successfully utilized to engage coastal residents, elected officials and municipal staff across the region. At open house events focused on sharing the videos with coastal residents, 100% of attendees said in post-event evaluations that they learned something as a result of participating. Additionally, municipal staff and environmental consultants reported an increased understanding and willingness to consider SLR during planning among constituents and elected officials.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant Consortium assesses needs, provides resources during unprecedented harmful algal bloom events impacting Gulf coast states

Recap:
Members of the Mississippi-Alabama Sea Grant Consortium extension and outreach team responded to two different harmful algal bloom events that occurred in Fall 2018 through Summer 2019 by increasing awareness of impacts and threats related to these events and developing outreach materials, hosting workshops and working with diverse audiences to share contacts and resources to reduce impacts and improve understanding of the events.

Relevance:
Harmful algal blooms are not common in coastal Alabama or Mississippi, and freshwater-derived harmful algal blooms (HABs) have never occurred in coastal Mississippi. However, in less than 12 months there was a threat of red tide closing coastal waters in Alabama and the occurrence of a freshwater blue-green algal bloom in Mississippi that resulted in water contact advisories being issued throughout the entire coast.

Response:
The Mississippi-Alabama Sea Grant Consortium (MASGC) worked with industry and community leaders to identify their needs related to the HAB events and took a multipronged approach to addressing their concerns. MASGC held workshops, presented at HAB-related conferences and meetings, convened panels and developed two fact sheets. MASGC worked with state agencies to ensure accurate information was disseminated and shared information from the Sea Grant network to help inform state agency needs related to identifying toxins.

Results:
Through collaborating with state agencies, universities, NGOs, businesses and communities, more than 350 people attended workshops and Sea Grant-led presentations and panels to learn more about HABs in northern Gulf of Mexico waters. In addition, more than 10,000 people received the MASGC harmful algal bloom fact sheets through email, Facebook, Twitter, online newsletters and print newsletters.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Santa Rosa County conducts flood vulnerability assessment to inform capital improvement projects, enhance flood risk communication

Recap:
Santa Rosa County, Florida, secured funding from the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative (Cooperative) to conduct a flood vulnerability assessment and develop a web application that will enable better flood risk communication with residents and more effectively utilize capital improvement projects to reduce flooding.

Relevance:
Municipal staff, cities and counties are faced with increasing pressures to foster a robust tax base while minimizing risky building practices. This can be challenging for municipal staff who feel hamstrung by lack of data or the limited data available to make flood-related decisions. To accurately understand and communicate local flood risk, municipal staff need resources specific to their unique community that accounts for local hydrodynamics, building codes, socioeconomic vulnerability and future conditions.

Response:
Santa Rosa County, Florida, obtained funding from the Mississippi-Alabama Sea Grant-supported Cooperative to conduct a countywide flooding and sea-level rise (SLR) vulnerability assessment. They are collecting data under guidance from a steering committee to identify current and future flood risk issues among municipal staff and residents that are most pressing to consider. They are collaborating with a local university to develop a model using the prioritized data to describe risk in an indexed score.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant takes sea-level rise resilience on the road

Recap:
In order to disperse complex information, the Mississippi-Alabama Sea Grant-supported Northern Gulf of Mexico Sentinel Site Cooperative and its partners took to the road with short films about sea-level rise and their associated hazards, engaging communities and organizations across the northern Gulf of Mexico so they are better able to take resilient action.

Relevance:
There are few issues as relevant to coastal communities in the northern Gulf of Mexico (Mississippi, Alabama and northwest Florida) as sea-level rise (SLR). Rising seas impact communities in many different ways, directly and indirectly. With many complexities and quickly advancing research, SLR science is difficult to disperse accurately and effectively among many audiences - even those most at risk.

Response:
The Mississippi-Alabama Sea Grant-led Northern Gulf of Mexico Sentinel Site Cooperative developed a series of short films in concert with experts, decision-makers and practitioners and took them on a "road show". Project partners asked communities and organizations for their participation in short film screenings and facilitated discussions around SLR resilience. As events grew in popularity, groups began asking to join them. Events ranged through community and government meetings, booths at community events and partner-hosted events.

Results:
At 14 total events across the northern Gulf of Mexico, the road show has reached around 200 people. Of those surveyed, 98% said they learned something as a result of participating, and what they took away ranged across many specific subjects pertaining to SLR resilience. Personal anecdotes shared with event facilitators included attendees' personal plans for adaptation and information they said they can use to encourage larger-scale adaptations.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

National Water Extension Program outreach, engagement efforts reach over 400 individuals

Recap:
The National Water Extension Program, led by Mississippi-Alabama Sea Grant, identified needs, filled gaps and facilitated the information exchange among organizations, communities and stakeholders in need of timely water data and tools in order to support decision-making processes.

Relevance:
Stakeholders across the U.S. revealed a need for consistent, high spatiotemporal resolution, integrated water data to address information and service gaps. NOAA, The University of Alabama, and the Mississippi-Alabama Sea Grant Consortium created the National Water Extension Program. The program goal is to facilitate the delivery of resources to 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.

Response:
During 2019, the National Water Extension Program participated in 13 meetings and gave 12 presentations that resulted in interaction with more than 400 individuals, including water resources managers, planners and coastal resilience practitioners, Sea Grant professionals and a variety of NOAA personnel. Interactions enabled the program to facilitate multi-way communication and prioritize work that prepares Sea Grant and NOAA to better serve the educational and informational needs regarding complex water systems in the future.

Results:
Extensive engagement helped the program develop critical partnerships that are assisting in the identification of needs, filling gaps and facilitating information exchange among organizations, communities and stakeholders. These efforts serve Sea Grant constituents across the United States and help provide needed, timely educational resources as well as water data and tools that support decision-making processes.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant leads regional team to update, enhance Coastal Community Resilience Index

Recap:
In response to stakeholder feedback, Mississippi-Alabama Sea Grant led a team of regional experts and cooperative project teams to develop an updated version of the Coastal Community Resilience Index, a community self-assessment tool, more inclusive of vital topics and adding a focus on green infrastructure.

Relevance:
The Coastal Community Resilience Index (CRI) is a highly successful tool that at least 57 communities have used to examine how prepared they are for storms and storm recovery. Evaluations of the CRI, however, revealed shortfalls in some areas and a desire by stakeholders to broaden some of the topics. At the same time, two complementary projects were funded through other entities around the region. The need to coordinate these three efforts became clear.

Response:
The Mississippi-Alabama Sea Grant Consortium partnered with two complementary projects through the Harte Research Institute and Louisiana Sea Grant to coordinate efforts to update the Coastal Community Resilience Index and enhance the index workshop process with real-time mapping. Mississippi-Alabama Sea Grant formed a team of regional experts to vet potential updates and new information to include in a revised CRI through a series of conference webinars.

Results:
Three distinct projects to address updates and enhancements to the CRI succeeded in strengthening the resilience evaluation tool without divergent tools being created. The CRI now includes a focus on green infrastructure, a section on health and human services, and strengthened sections on business resilience and community needs. Without this holistic approach to project management led by MASGC, the CRI would not remain a strong assessment tool that meets the needs voiced by stakeholders.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant-led workshop series reveals needs within eastern Gulf of Mexico communities to prepare for and recover from future oil spills

Recap:
Mississippi-Alabama Sea Grant-supported professionals developed and led two workshops within Alabama, funded through The National Academies of Sciences, Engineering, and Medicine's Gulf Research Program, to determine the research and resource needs of eastern Gulf communities to prepare for and recover from future oil spills.

Relevance:
A meeting hosted by the National Academies of Sciences, Engineering, and Medicine's Gulf Research Program (GRP) in 2017 revealed that almost 10 years after the Deepwater Horizon oil spill, many questions remained about whether coastal communities across the U.S. were prepared to respond to a large oil or chemical spill event. Recommendations from this meeting included the need to develop regionally specific workshops to determine needs of communities from across the United States.

Response:
The Mississippi-Alabama Sea Grant Consortium (MASGC) developed and led two workshops in coastal Alabama. The workshops identified the unique needs of communities in the eastern Gulf, specifically focusing on how oil spills affect public health, societal function and impact the economy. To ensure participation by diverse audiences, MASGC held one workshop during standard business hours and another in the evening at a family-friendly venue. MASGC advertised workshops in multiple languages, and translators assisted during participant discussion.

Results:
Workshop attendees made eastern Gulf-specific recommendations for ongoing oil spill preparedness and resilience. MASGC created a workshop report that captured the dominant needs and requests of participants. The report was shared with the GRP and all participants. A follow-up questionnaire indicated attendees agreed or strongly agreed that they improved their knowledge on the issues presented (100%, N=51), benefited from networking opportunities (98%, N=50) and believed the workshop successfully identified regional needs (96%, N=49).

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Gulf of Mexico oil spill science outreach team fosters collaboration between emergency responders, university researchers

Recap:
The Gulf of Mexico Sea Grant oil spill science outreach team hosted a workshop series fostering collaboration between emergency responders and university researchers culminating in a workshop report to serve as a resource for both groups in the Gulf of Mexico to understand how they can better work together in the future.

Relevance:
In 2014, the newly formed Gulf of Mexico Sea Grant oil spill science outreach program held meetings with target audiences, both with individuals and groups. Those meetings and subsequent conversations with leaders from the oil spill
Response community and academic researchers uncovered the need for increased collaboration between oil spill responders and academic researchers.

Response:
To meet this need, the oil spill outreach team conducted workshops to bring researchers and responders together to discuss the lack of collaboration between these two target audiences. The team hosted five workshops, one in each Gulf state, in order to give emergency responders and researchers an opportunity to network, to learn more about each other's roles, and to find ways to work together going forward.

Results:
During these workshops emergency responders and researchers discussed ways each could contribute to the others' efforts, including both groups opening lines of communication by sharing data and attending regional meetings that discuss
Response plans. Funding for specific projects was identified as the largest barrier to working together. Attendees shared similar ideas across the five workshops. A workshop report outlined the conversations and provides a pathway to next steps to continue potential communication and collaboration.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant-supported effort assesses resilience needs of inland coastal communities

Recap:
Mississippi-Alabama Sea Grant interviewed leaders from eight communities in Alabama's two coastal counties and counties adjacent to them to determine common needs to inform the future adaptation of the Coastal Community Resilience Index for communities not directly on the coast but still impacted by tropical systems.

Relevance:
As evidenced by Hurricane Michael in 2018, communities not directly on the coastline are heavily impacted by tropical systems, but many lack planning assistance to anticipate and address these impacts. The needs of these communities share some similarities, such as threats from flooding and high winds, with those along the coastline, but needs can diverge due to staffing, infrastructure and available funding.

Response:
In an effort to begin to address the needs of inland communities, the Mississippi-Alabama Sea Grant Consortium conducted in-person interviews with the leadership of eight communities, using the Coastal Community Resilience Index as a baseline guide, to assess their needs related to resilience planning and
Response. The communities ranged from the most northern areas of Alabama's two coastal counties (Mobile and Baldwin) to a community 75 miles off the coast.

Results:
This needs assessment brought forward information and gaps that can be addressed when adapting the Coastal Community Resilience Index, and the information gathered was compiled into a document for further comparison and analysis in the future. Overall, communities slightly off the coast were eager for technical assistance in planning for resilience. The majority clearly valued the Community Resilience Index tool and welcome the opportunity to participate in a similar version tailored to their community needs.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant leads Green Infrastructure Working Group to compile living shorelines resources

Recap:
The Green Infrastructure Working Group of the Climate and Resilience Community of Practice compiled and shared a catalog of living shoreline resources to help stakeholders across the Gulf find information on design and construction, cost and permitting.

Relevance:
There is disparity in permitting, local considerations and other factors influencing living shoreline implementation. Homeowners fear a living shoreline may be less effective than hardened solutions at protecting homes and other property. Others have questions regarding the cost of living shorelines versus a traditional bulkhead. There are concerns related to the permitting process and the requirement to monitor newly installed living shorelines. While many resources are available, partners were struggling to find a comprehensive inventory.

Response:
The Green Infrastructure Working Group produced a template for living shoreline implementation guidance and five state-specific living shoreline implementation guidance documents for application at the local level. They created five one-pagers to compliment the documents for use in outreach. They conducted a stakeholder webinar and stakeholder workshops to obtain feedback on document drafts. They developed and implemented roadshows to highlight finalized products containing beneficial information on green infrastructure project implementation.

Results:
Environmental consultants, engineers, landscape architects, realtors, property developers and researchers now have access to an easy-to-use document to answer questions about living shoreline techniques, installation, site suitability, cost and regulations. Stakeholders in the Gulf can benefit from these guides that are designed specifically for the individual states (Alabama, Florida, Mississippi, Louisiana and Texas).

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant-funded project protects/restores oyster beds, culturally significant sites in Louisiana

Recap:
A living shoreline was created to protect a mound of cultural significance to the Pointe-Au-Chien tribe that was threatened due to erosion and sea level rise, which was achieved by

Relevance:
Coastal Louisiana parishes are on the front lines of coastal erosion and relative sea level rise. The area has experienced a presidentially declared disaster from a hurricane or tropical storm an average of every three years. These natural forces are exacerbated by canals dug for oil and land exploration, timber, and fur industries. Tribes have continued to be negatively affected by the massive amount of land loss.

Response:
In a Mississippi-Alabama Sea Grant-supported project, the Coalition to Restore Coastal Louisiana (CRCL) worked with Terrebonne and Lafourche Parish governments and the Pointe-au-Chien tribe to restore eroding wetland with an oyster shell living shoreline to prevent culturally important artifacts from being lost to rising seas. CRCL recruited approximately 612 volunteers to help create over 8,800 shell bags, wrap 250 pallets and deploy 200 tons of shell into the water to create the living shoreline.

Results:
The Oyster Bed Surge Protection System benefited both the built environment and the existing shoreline. The installations protect the shoreline and significantly reduce erosion. Due to the location, the retention of the existing marsh continues to provide wave and storm surge protection and delays the erosion of the mound and channels. Habitat benefits include oyster cultch development and support of fish and wildlife habitat. Water quality is also expected to improve.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Paddle the Gulf logo selected

Recap:
A logo design contest had over 55 entries from college students enrolled in institutions throughout the five Gulf States. One winning logo was selected and is now in use to market the Paddle the Gulf initiative.

Relevance:
Having a logo for this initiative is critical for branding. Recognition of this logo will link the importance of stewardship of coastal resources to the public domain.

Response:
The logo has been broadly circulated and released through social media.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Identify open spaces/greenspaces/floodplains/landscape patterns to determine their impact on storm-water runoff

Recap:
The methodology applies the Soil and Water Assessment Tool (SWAT) to model runoff discharge in the watershed for over 1200 sub-basins. A range of relevant landscape metrics are measured using advanced GIS tools that describe the spatial structure of patches, classes of patches, or entire landscapes. Additionally, precipitation, slope, soil permeability, floodplain area, natural drainage density, wetlands, and impervious rate are estimated for sub-basins.

Relevance:
The objective of this task is to identify open spaces/greenspaces/floodplains/landscape patterns that should be protected with the goal of transferring this knowledge to other Mississippi-Alabama coastal communities. This research offers a new approach to framing the role of open spaces/greenspaces/floodplains/landscape patterns within a multifunctional green infrastructure in an urban setting.

Response:
Following analysis completed for over 1200 sub-basins:

1. Runoff Modelling - Soil and Water Assessment Tool to model watershed discharge using DEM, land use data, soil type data, weather data, observed discharge data.
2. Landscape ecology metrics using GIS/Fragstat: Percentage of Landscape, Edge Density, shape index, contiguity index, proximity index, Euclidean nearest-neighbor and patch cohesion index.
3. Regional watershed analysis: Mean annual peak runoff depth, precipitation, soil permeability, floodplain area, natural drainage density, wetlands,impervious rate.

Results:
This research investigates whether landscape patterns affect the level of storm water runoff. The output from this analysis will be used for regression that will identify open spaces/ greenspaces/ floodplains/ landscape patterns that should be protected with the goal of transferring this knowledge to other Mississippi-Alabama coastal communities.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Collaborative Partnerships are Identifying Best Practices in Green Infrastructure Planning

Recap:
Rapid growth and development in coastal cities increases the likelihood of flooding damage. The implementation of green infrastructure is one way to mediate the risks and damage. Working collaboratively at the regional level, communities are identifying and sharing best practices, and improving their plans and planning processes, to become more resilient.

Relevance:
Between 1960 and 2008, the population density in the Mississippi-Alabama coastal region increased by approximately 60%. In Alabama, it increased from 128.0 to 191.6 people per square mile, and in Mississippi from 106.8 to 197.3 people per square mile. The rapid expansion of coastal urban areas will likely lead to the conversion of undeveloped land into impervious surfaces; degrading ecosystem service, accelerating landscape fragmentation, exacerbating flooding damage, and increasing the amount of stormwater runoff.

Response:
Green infrastructure (GI) is a strategy that can be used to balance urban growth/development with sustainable infrastructure that reduces flooding damage. GI refers to water management practices that act like the natural water cycle and entails conserving and protecting natural resources (e.g., parks, wetlands, woodlands, open spaces). A tool to assess cities' inclusion of GI in their plans has been developed , and partnerships with regional planning commissions have been established, as to identify best practices.

Results:
Multi-state regional coordination is being facilitated that will allow planners in the MS-AL coastal region to work collaboratively to identify and implement best practices in green infrastructure planning. This will help the cities become more resilient to flooding and natural disasters, benefiting everyone that lives there. The assessment of cities' plans will allow communities to determine strengths and areas of improvement. This will benefit the communities by formalizing and institutionalizing green infrastructure planning practices.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Sea Grant-led team helps City of Cedar Key, Florida, combat coastal erosion

Recap:
Cedar Key, Florida, like other coastal communities, is being affected by coastal erosion and loss of coastal habitat. A Florida Sea Grant-led project showed living shorelines could help address these problems. The team created an online mapping tool that provides shoreline stabilization options and associated regulations for the entire coastline of the island community. The online tool has been accessed more than 2,000 times and is the foundation for the Cedar Key Shoreline Management Master Plan.

Relevance
Cedar Key, Florida, struggles with sea-level rise, erosion, and loss of coastal habitat. Living shorelines offer a potentially cost-effective and environmentally beneficial way of addressing these problems by using natural features and vegetation to enhance and protect shorelines. The typically low-energy Gulf waters surrounding Cedar Key make many parts of the island candidates for living shorelines. Challenges included determining what areas are suitable and what regulatory hurdles exist for constructing living shorelines.

Response
Two projects done by Florida Sea Grant in 2018-19 and Mississippi-Alabama Sea Grant showed the viability of using living shorelines to control erosion in the region. Building upon the results of these projects, and in the context of a series of public meetings, the Florida Sea Grant-led project team produced an online geospatial planning tool that suggests shoreline stabilization options, such as living shorelines, and describes associated regulations.

Results
The online tool is widely used and has become a cornerstone of the Shoreline Management Master Plan for the entire island of Cedar Key. The plan was added as an amendment to the City of Cedar Key's Comprehensive Plan. Additional expected outcomes include the increased application of sustainable shoreline maintenance and construction practices by coastal homeowners and an increased availability of living shoreline demonstration areas.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Identifying context specific gaps and drivers of resilience to reduce impacts from climate-related coastal hazards

Recap:
By demonstrating "who" and "what" is at risk from climate-related hazards, and by considering context specific drivers and gaps in resilience, communities will reduce impacts from climate-related hazard events. Informed decision-making to increase resilience, and to reduce risk, is an important part of this project. Resilience enhancement is being accomplished by working directly with community leaders, city officials, and businesses to apply the methods and communicate the project's results.

Relevance:
Generally speaking, a resilient coastal community is less vulnerable to coastal hazards and their adverse impacts on infrastructure, populations, and livelihoods. Making communities disaster-resilient means understanding the capacity of communities and decision-makers to actively adapt to, cope with, and transform in view of potential threats that are often spatially and temporally dynamic. Hence, resilience needs to be considered a multi-dimensional concept where natural hazard and community context matters.

Response:
In partnership with the cities such as Biloxi, MS, both "top-down" and "bottom up" approaches for assessing and addressing the resilience of Gulf Coast communities are being implemented. By applying a resilience scorecard assessment to coastal businesses, for instance, this project is helping stakeholders and communities to better understand the factors that can lead to losses and the diminished capacity of Gulf Coastal communities to respond to damaging climate-related hazard events.

Results:
Communities and businesses along the MS and AL Gulf Coast will reduce potential adverse impacts and losses from climate-related hazards. Moreover, they will increase their resilience to both slow- and rapid-onset climate-related hazard events by being well informed about potential gaps in their resilience and by taking ownership of their climate-related risk.

Focus Area: Resilient Communities and Economies
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant helps local government officials navigate the Community Rating System

Recap:
Mississippi-Alabama Sea Grant promoted better floodplain management practices in coastal areas and enhanced local knowledge by promoting participation in the Community Rating System program.

Relevance:
The Community Rating System (CRS) is a national program of flood outreach and mitigation activities communities can pursue to reduce the cost of flood insurance premiums. Participation in CRS encourages communities to go beyond state and federal requirements to pursue better practices in flood management and environmental sustainability. By engaging with communities that wish to participate in CRS, the Mississippi-Alabama Sea Grant Consortium (MASGC) is able to support local government success in coastal resilience while also addressing the continuing education needs of its local government stakeholders.

Response:
Mississippi-Alabama Sea Grant worked with floodplain managers through CRS users groups, such as Mississippi's Coastal Hazard Outreach Strategy Team (C-HOST) and the South Alabama Flood Engagement Team (SAFE-T). Beyond providing public outreach support, MASGC also worked with regional partners to provide greater assistance to coastal communities working on CRS activities. MASGC also helped facilitate and support The Nature Conservancy's (TNC) Open Space App, which helps communities determine how many open space points they are eligible for through CRS.

Results:
By facilitating C-HOST events, MASGC provided continuing education to floodplain managers. Sea Grant worked with C-HOST to provide 1.5 continuing education credits (CEUs), which provided over $200 in CEU savings for C-HOST members. Sea Grant has also helped communities find additional CRS open space credits to claim by partnering with TNC to promote its open space app. Due to MASGC's work with communities they are eligible for up to 2,020 CRS points by preserving open space.

Sustainable Fisheries and Aquaculture

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Impact

Marine Fisheries Ecology Program guidance assists in creation of commercial shark fishery in Mississippi

Recap:
The Mississippi-Alabama Sea Grant-supported Marine Fisheries Ecology Program worked with commercial fishermen and the Mississippi Department of Marine Resources to examine the feasibility and sustainability of a state fishery for sharks in Mississippi, which resulted in regulation changes that support a new commercial shark fishery.

Relevance:
Healthy fisheries are fundamental to the cultural and economic well-being of northern Gulf of Mexico residents, yet overfishing, habitat loss and changing environmental conditions threaten the sustainability of these resources.

Response:
In response to requests from Mississippi commercial fishermen, the Mississippi-Alabama Sea Grant-supported Marine Fisheries Ecology Program analyzed data from a long-term fishery independent shark survey to examine trends in shark distribution and abundance in Mississippi state waters. Then the program consulted with NOAA Fisheries Highly Migratory Species Division and the Mississippi Department of Marine Resources to provide technical expertise in the development a state-level fishery for sharks.

Results:
As a result of this guidance, changes were made to Title 22, Part 7 of the Mississippi Department of Marine Resources Regulations to allow commercial harvest of sharks in Mississippi state waters upon completion of a shark identification course. This regulatory change was adopted in 2020.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Impact

Training, technical support help grow off-bottom oyster aquaculture industry in Alabama, Mississippi

Recap:
Sea Grant training, technical support and applied research supported at least 9 new commercial oyster farms in Mississippi and 21 established commercial off-bottom oyster farms in Alabama, which helped create at least 42 full-time jobs and 30 part-time jobs, with at least $1.4 million dockside value of farmed oysters in 2019.

Relevance:
Prior to 2009, oyster aquaculture did not exist in Alabama and the natural reefs were in decline due to over harvesting and environmental factors. Prior to 2018, oyster aquaculture did not exist in Mississippi. Oyster aquaculture is important to the coastal communities for economic and cultural reasons.

Response:
A Mississippi-Alabama Sea Grant Consortium-supported training program and oyster park were established in Mississippi and Alabama to introduce residents interested in starting a commercial oyster farm to the industry. Mississippi-Alabama Sea Grant extension specialists provided ongoing technical, scientific and business support to the oyster farming industry. The program included three days in class course work and two days of training in the field.

Results:
The commercial oyster aquaculture industry began in 2009 and has expanded rapidly since the initial Sea Grant-supported off-bottom oyster aquaculture training program was launched 2012. These collaborative efforts helped create at least 42 full-time jobs and 30 part-time jobs, with at least $1.4 million dockside value of farmed oysters in Alabama in 2019.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Impact

Citizen-funded satellite tags aid specialists in documenting Atlantic tarpon habitat use in the northern Gulf of Mexico

Recap:
Findings from successful 2018 tarpon tagging efforts generated leveraged funds to expand the tarpon tagging study in 2019 and prompted the Mississippi Commission on Marine Resources to alter Title 22 Part 07, thereby limiting the previously unregulated take of tarpon in Mississippi waters.

Relevance:
Atlantic tarpon (Megalops atlanticus) are long lived, highly migratory, prized recreational sport fish with deep cultural significance for residents of the Gulf of Mexico region. Once abundant throughout the coastal waters of the northern Gulf of Mexico, tarpon have experienced substantial declines, likely due to a combination of habitat loss and fishing mortality. Understanding tarpon migration patterns is essential for informing future conservation and sustainability efforts for this species.

Response:
In 2018 and 2019, tarpon angling experts caught tarpon in the northern Gulf of Mexico and Sea Grant-funded specialists applied Wildlife Computers Smart Position and Temperature (SPOT) tags to the tarpon. Specialists then analyzed real-time data from these tags, created maps detailing tarpon movements and posted them on the Mississippi State University Marine Fisheries Ecology Facebook page. The popularity of these posts highlighted the lack of fishing regulations for the species in Mississippi waters.

Results:
The tarpon maps received more than 220K views in total and garnered interest from recreational anglers. In spring 2019, several anglers donated funds toward the purchase and deployment of four additional tarpon satellite tags, which were deployed that same year. The Facebook maps of the migration patterns caught the attention of local fishery managers, who worked with the Sea Grant-funded specialists to generate recreational and commercial fishing regulations limiting tarpon harvest in Mississippi waters.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Impact

Economist estimates potential economic impacts of Bonnet Carré Spillway openings in 2019, supports Mississippi's fisheries disaster application

Recap:
A Mississippi-Alabama Sea Grant-supported marine economist developed economic recovery models for dominant seafood species harvested in the region, which were used to estimate the potential economic impacts of the twice opening of the Bonnet Carré spillway in 2019 on the commercial fishing industry.

Relevance:
A Mississippi-Alabama Sea Grant Consortium-supported (MASGC) marine economist received several inquiries and requests for assistance in estimating the economic impacts of the prolonged and twice opening of the Bonnet Carré Spillway in 2019 on the commercial fishing industry in the Northern Gulf of Mexico states.

Response:
The marine economist estimated the potential economic impacts of the Bonnet Carré spillway opening to the 2019 commercial landings and dockside values of major seafood species harvested by commercial fishermen in the region. The results were posted to blogs, social media networks and university websites and emailed to key industry and state regulatory agencies and media contacts.

Results:
These estimates were used to justify the request for federal fisheries disaster declaration and authorization by the U.S. Congress to allocate federal assistance to the negatively impacted coastal communities.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Impact

Technical advice helps some new Mississippi oyster farmers avoid catastrophic loses, increase production despite challenges

Recap:
Mississippi-Alabama Sea Grant provided technical advice to four off-bottom oyster-farming operations in Mississippi to help them increase production and recover from freshwater events.

Relevance:
In response to historic freshwater inputs from the Bonnet Carre Spillway, newly established Mississippi oysters farms struggled with extended closures and dramatic crop losses. Oyster farmers requested assistance with options to increase crop survival and recovery strategies.

Response:
In 2019, Mississippi-Alabama Sea Grant Consortium-supported (MASGC) extension specialists provided technical expertise in production, marketing and insurance to Mississippi oyster farmers, including helping arrange a transfer of oysters to cooperating farms in Alabama where the crop could avoid the lower salinities experienced in Mississippi, which would have killed all of the oysters.

Results:
Because many farmed oysters were saved due to the quick response by MASGC-supported extension specialists all four oyster farms remained in business and expanded production in 2019 for an intended 2020 harvest. In addition, one Mississippi farmer also established a cooperative agreement to raise part of his crop in Alabama with an Alabama farmer.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Impact

A large-scale survey developed to estimate abundance of an economically valuable marine fishery

Recap:
Unique sampling design was developed to estimate red snapper population abundance across a large geographic area and parts of the design is being incorporated in a similar red snapper study being conducted in the SE region.

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.

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, are being used across the entire U.S. Gulf of Mexico. An operating model was also developed to analyze incoming data and develop the final Gulf-wide abundance estimate. The final estimate will be used for comparison and integration into the NOAA red snapper stock assessment.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Impact

Stock assessment influences management regulations to improve sustainability of the Alabama spotted sea trout fishery

Recap:
The Alabama Department of Conservation and Natural Resources Marine Resources Division recommended new management regulations for 2019 in order to end overfishing based on the results of a Sea Grant-supported stock assessment.

Relevance:
Spotted seatrout are among the most targeted gamefish in northern Gulf of Mexico estuaries, including in Alabama and Mississippi, where inshore fishers contribute significantly to the coastal culture and economy. Spotted seatrout catch per unit effort declined from 2012 to 2014 in Alabama fishery-dependent and -independent indices, raising concerns over stock status.

Response:
We performed an age-structured integrated stock assessment of Alabama spotted seatrout and estimated that the stock was experiencing overfishing and annual harvests should be reduced to increase sustainability of this valuable recreational fishery. We presented the findings in both oral and written formats to the Alabama Department of Conservation and Natural Resources Marine Resources Division.

Results:
Based on our findings, the Alabama Department of Conservation and Natural Resources Marine Resources Division recommended an increased lower size limit, a slot limit, and lower bag limits for Alabama spotted seatrout. The recommendations were approved by the Alabama Conservation Advisory Board and were applied beginning with the 2019 recreational fishing season. See: Rainer, D. 2019. Advisory Board Approves Flounder, Seatrout Changes. Available online at https://www.outdooralabama.com/node/2604.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Impact

Residents complete Mississippi-Alabama Sea Grant-supported training and start oyster farms

Recap:
Mississippi-Alabama Sea Grant's training program for off-bottom oyster farming leads to at least 12 people starting and operating commercial oyster farms.

Relevance:
In response to poor harvests, the Mississippi governor's oyster recovery plan includes novel investment in off-bottom oyster aquaculture as a new industry in Mississippi. Residents interested in off-bottom oyster aquaculture requested assistance with permitting and guidance on oyster-farming techniques.

Response:
In 2018, 25 Mississippi residents attended a formal adult training program (led by Mississippi-Alabama Sea Grant-supported extension specialists) called Oyster Farming Fundamentals, where they received basic training on oyster-farming techniques and methods, marketing, harvesting and permitting requirements over a six-session, 15-hour course. The course also included hands-on training.

Results:
Twenty-one participants completed the training, and all have expressed interest in pursuing commercial off-bottom oyster farms. At least 12 have obtained commercial permits with harvest planned for spring 2020.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant-supported Marine Fisheries Ecology Program changes behaviors among regional fisheries stakeholders

Recap:
By engaging with stakeholders in Mississippi and Alabama, the Marine Fisheries Ecology program extended research findings to change behaviors while promoting sustainable commercial and recreational fisheries.

Relevance:
Healthy fisheries are fundamental to the cultural and economic well-being of northern Gulf of Mexico residents, yet overfishing, habitat loss and changing environmental conditions threaten the sustainability of these resources.

Response:
In 2019, the Mississippi-Alabama Sea Grant-supported Marine Fisheries Ecology program engaged with recreational and commercial stakeholders through formal events (like the Gulf of Mexico Highly Migratory Species industry working group, the Gulf of Mexico Fishery Management Council Outreach and Education Technical Committee and the Gulf of Mexico Shrimp Fishery Improvement Plan), informal events (like boat shows, fishing rodeos and K-12 outreach) and digital platforms (such as Facebook and the Gulf Coast Fisherman newsletter).

Results:
The Mississippi-Alabama Sea Grant-supported Marine Fisheries Ecology program engaged more than 4,100 people at 28 informal events, distributed four issues of the Gulf Coast Fisherman newsletter to an audience exceeding 550/issue and shared content through the program's Facebook page. Individuals surveyed from audiences at formal and informal events noted increased knowledge about sharks (99%) and fisheries science (96%) and responded that they would modify fishing behaviors (65%) as a result of the information shared.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Survey reveals high awareness, satisfaction about red snapper research and management due to Sea Grant-supported efforts

Recap:
Pilot data suggest that focused efforts to engage with the public on the topic of red snapper served to increase public awareness of the Great Red Snapper Count; moreover, these data also reveal a fairly high level of satisfaction with current red snapper population levels and regulations.

Relevance:
Red snapper (Lutjanus campechanus) is one of the most valuable and culturally relevant fisheries in the Gulf of Mexico. In 2017, a team of scientists, mathematicians and statisticians initiated a study, termed the "Great Red Snapper Count," to independently estimate red snapper abundance in the U.S. Gulf of Mexico. Given the complexity of the project and the controversial nature of the fishery, stakeholder engagement is a critical component of the project.

Response:
To engage stakeholders, Sea Grant specialists created and distributed five videos and five fact sheets detailing the project's rationale, goals and methods. Then, Sea Grant specialists and social scientists developed an electronic survey to measure the extent of public awareness regarding the Great Red Snapper Count and the degree of public satisfaction with current Gulf red snapper population levels, regulations and management strategies. The team collected pilot data in January 2020 from 100 individuals.

Results:
Pilot data indicate broad familiarity with the Great Red Snapper Count (75% of respondents were somewhat or very familiar). The respondents' awareness of the four components of the project's methods varied (18-36% depending on method). Seventy-three percent of respondents were somewhat or very satisfied with Gulf red snapper population levels, and 73% of respondents were somewhat or very satisfied with current Gulf red snapper fishing regulations.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Economist develops methodology for costs of softshell blue crab pond growout in the United States

Recap:
A Mississippi-Alabama Sea Grant-supported marine economist developed a methodology and started estimating the costs of producing softshell blue crabs based on the results of pilot experiments in Coastal Mississippi and Coastal North Carolina.

Relevance:
The U.S softshell blue crab landings had drastically declined resulting to changes in the domestic market situation. The ex-vessel prices of blue softshell crab have been persistently increasing over the years. The blue crab hatchery research during the past decades have shown tremendous potential in supplying juveniles for grow-out operations.

Response:
Working with crab scientists, specialists and producers in Mississippi and North Carolina, the marine economist started creating enterprise budgets for softshell blue crab pond grow-out systems in 2018. Data were collected to develop the initial investment required to establish a commercial softshell crab pond production enterprise. The experimental production operations were conducted in Beaufort, North Carolina, while existing ponds in Lyman, Mississippi, were prepared for the experimental production operations in spring 2019.

Results:
Experimental results from pilot tests in Mississippi were compiled to understand pond grow-out practices. These experimental data were used to develop the initial economic model for the pond grow-out of softshell blue crabs. In 2019, the MASGC marine economist visited the pond experiment in Beaufort, North Carolina and incorporated experimental results into the economic model. Monthly wholesale prices of blue softshell crab products sold in the United States were compiled to monitor long-term price trends.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Marine economist estimates costs of producing surimi from catfish by-products to provide economic opportunities in rural communities

Recap:
An MASGC-supported marine economist developed a hypothetical surimi processing plant and started estimating the costs of producing surimi from catfish processing by-products to inform industry leaders of economic viability of producing this value-added product.

Relevance:
Catfish processing generates by-products consisting of heads, guts, skins and frames. These by-products are generally sent to rendering plants, sold to pet food companies, or used to produce fish meal. The entire U.S. catfish industry sold more than 320 million pounds of foodsize catfish in 2019. In catfish fillet processing, 60% of the whole catfish is the by-product, which would translate into almost 190 million pounds of by-products. Since Mississippi growers produced 54% of all live sales, catfish processing by-products in 2019 could be more than 110 million pounds.

Response:
Working with a seafood scientist and a chemical engineer, a Mississippi-Alabama Sea Grant Consortium-supported marine economist started creating a hypothetical surimi processing plant in 2019. The economist based the hypothetical plant on results of previous studies performed at the Mississippi State University (MSU) Experimental Seafood Processing Laboratory and analysis conducted by faculty and staff at the MSU Department of Agricultural Economics.

Results:
The marine economist estimated the potential supply of catfish processing by-products suitable for surimi production using secondary data on catfish production, processing and related literature on processing yields. The marine economist established annual ownership and operating costs of a catfish surimi processing plant. The results will inform the catfish industry that is considering converting processing waste into safe and domestically produced surimi products, which can provide more employment and income opportunities in the rural catfish-growing areas.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Marine economists promotes direct marketing to enhance sales of of food, seafood and specialty products in Mississippi

Recap:
An Mississippi-Alabama Sea Grant-supported marine economist regularly interacted with food businesses registered in Mississippi MarketMaker through the internet and social media networks.

Relevance:
MarketMaker is an interactive mapping system that locates businesses and markets of agricultural and seafood products and marine-related services. There are more than 12,000 businesses registered in Mississippi MarketMaker. This program provides an essential link between producers and consumers, as well as large institutional buyers.

Response:
A Mississippi-Alabama Sea Grant-supported marine economist regularly interacted with food businesses registered in Mississippi MarketMaker through social media. Several local producers directly market their products and services through social media. Monthly Mississippi MarketMaker Newsletters were prepared and published online. Links to this online newsletter were posted on social media networks, blogs and university websites.

Results:
Local businesses posted their appreciation of Mississippi MarketMaker in assisting in the promotion of their products and services through social media. The Mississippi MarketMaker Facebook page and Twitter account have more than 300 followers each while the Mississippi MarketMaker Blog was viewed by 2,081 visitors 2,888 times in 2019.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Economist develops methodology in measuring economic impacts of natural, technological and man-made disasters to marine sectors, supports disaster application

Recap:
An MASGC-supported marine economist developed a peer-reviewed methodology to estimate economic damages associated with disasters on commercial fishing and used the methodology to estimate long-term economic recovery models for commercial oyster fishing in Mississippi.

Relevance:
An Mississippi-Alabama Sea Grant Consortium-supported (MASGC) marine economist received several inquiries and requests for assistance in estimating the economic impacts of the natural, technological and human-made disasters to the commercial fishing industry in the Mississippi since 2005. These estimates supported the requests for a federal fisheries disaster declaration and/or authorization by the U.S. Congress to allocate federal assistance to the negatively impacted commercial fisheries.

Response:
The economist estimated the long-term economic impacts of the 2005 Hurricane Katrina, the Deepwater Horizon oil spill in 2010, the 2011 Bonnet Carre spillway opening and the economic recession in 2007-09 to the monthly commercial landings and dockside values of oysters harvested by commercial fishermen in Mississippi. The methodology and estimates of the economic impacts were presented in a scientific conference in 2019.

Results:
As a result, the editor of an economics journal invited the MASGC marine economist to submit the methodology and research results as a journal article. A journal article was published, and similar modeling efforts are ongoing for other dominant commercial species in 2020. The article has been downloaded 67 times since January 2020.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Shrimpers join MASGC effort to identify true costs of marine debris on shrimping industry

Recap:
Mississippi-Alabama Sea Grant developed a methodology and measured the perceived and observed economic impacts of marine debris on the shrimping operation of Mississippi commercial shrimpers in Mississippi.

Relevance:
Commercial shrimping is a significant portion of the Mississippi commercial fishing industry in terms of sales, job creation, income generation and tax revenues. Many commercial fisheries report that marine debris has resulted in lowering catch, higher fishing effort, additional repair and maintenance costs of fishing assets and longer fishing time.

Response:
Mississippi-Alabama Sea Grant Consortium-supported specialist developed an economic model that measures the impacts of marine debris on commercial fishing. The data required in estimating the marine debris economic model were collected from a preliminary survey of licensed commercial shrimpers in 2018.

Results:
A total of 44 commercial shrimpers participated in the preliminary survey of commercial shrimping operations in the 2018 shrimp season. Analysis of the preliminary survey showed that the responses of the 44 shrimpers to the questions dealing with marine debris impacts are homogenous across gear types, boat sizes, boat locations, and fishing effort. Shrimpers frequently encountered and perceived marine debris to be a problem with nearly 85% reported it as more/most frequent and more/most destructive.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

First reference genome for a copepod species

Recap:
A draft reference genome is developed for Acartia tonsa and will be available in support of current and future breeding efforts to improve aquaculture traits.

Relevance:
Genomic resources are needed in order to perform effective selective breeding of any organisms but are not available yet in copepods.

Response:
This work will provide a first draft reference genome for Acartia tonsa for which only a fragmented assembly is currently available.

Results:
Sequencing of the genome based on short reads is in progress. A linkage map is also in development and will be used to anchor the genome sequence assembly.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

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

Recap:
This descriptive trial demonstrates the ability of O. colcarva to thrive in greenhouse conditions, making it a good candidate for greenhouse mass-scale production. Expansion of greenhouse cultures is in progress.

Relevance:
Costs associated with laboratory cultures include lighting, a biosecure infrastructure, and air conditioning. The natural thermal tolerance of O. colcarva and its omnivorous, ambush feeding habits suggest that it may thrive and not be susceptible to crashes associated with ciliate blooms in greenhouse conditions. Greenhouse production of this species will facilitate ease of use while lowering production costs.

Response:
A pilot scale 200-liter culture was established in a greenhouse and exposed to daily temperature swings (18-35 ?), a natural photoperiod, and minimal biosecurity. This culture was fed a 1:1:1 mix of live Chaetoceros muelleri, Tisochrysis lutea, and Tetraselmis chuii. Water changes were carried out once per generation (1-2 weeks), and survival (stocked nauplii to adults) was enumerated for each generation.

Results:
A population has been maintained in the greenhouse for 7 generations with an average of ~50% survival from nauplius to adult.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

The effects of feed rates on naupliar production of Apocyclops panamensis fed exclusively on an algal concentrate diet

Recap:
We determined that algal concentrate is a suitable exclusive feed for Apocyclops panamensis to maintain a population, and even to produce commercial quantities of nauplii to utilize as a live feed for marine finfish larviculture.

Relevance:
Optimizing feed rates can reduce feed costs considerably while maximizing naupliar production. The costs associated with culturing live feed for larviculture is one of the most significant, and any savings in the cost of algae, is synergistic with cost saving due to not overfeeding cultures requiring more labor to maintain healthy cultures.

Response:
We fed three different amounts of algal concentrate and conducted nauplii counts through one natural reproductive cycle to determine what was the optimum feed rate (based upon total nauplii harvested).

Results:
We determined that when algal concentrate (Nanno 3600 and Roti Grow Plus) is utilized as the only source of feed for Apocyclops panamensis the optimum feed rate of 0.02 ml per a 1000 of copepods which stocked at a density of 5 copepods per ml. administered twice a day was the optimum.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Algal concentrates will increase production of Oithona colcarva

Recap:
A diet consisting exclusively of algal concentrates is not sufficient for survival and reproduction of O. colcarva using current culture methods.

Relevance:
Partial or complete replacement of live algae with commercially-available algal concentrates will reduce production costs and facilitate the development of copepod culture in marine hatcheries because it will eliminate the need for the specialized equipment, trained personnel, and biosecurity infrastructure required for culturing live algae.

Response:
Two algal concentrate diets (1:1:1 mix of Chaetoceros muelleri, Tisochrysis lutea, and Tetraselmis chuii and a commercially-available shellfish diet) were compared to a control diet (1:1:1 live mix of Chaetoceros muelleri, Tisochrysis lutea, and Tetraselmis chuii) under a 18L:6D photoperiod. Copepods were fed experimental diets daily, and survival/development was assessed after 9 days.

Results:
There was no difference in survival of copepods between the 1:1:1 concentrate mix and the live 1:1:1 mix through 9 days, but survival was lower in the shellfish diet. For both concentrate diets, development to adulthood was delayed and neither population reached adulthood before termination of the experiment. Further experimentation is needed to determine if O. colcarva can survive until adulthood and be reproductively viable using algal concentrates.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Effects of culture salinity on growth and reproduction of the copepods A. tonsa and P. crassirostris

Recap:
By understanding the effect of salinity on both copepod species we can calculate which salinity is optimal for population growth and reproduction and how suboptimal salinities will impact these parameters.

Relevance:
Salinity impacts the growth and reproduction of numerous copepod species. Understanding the effect of salinity on copepod production parameters would facilitate optimization of production protocols for copepods in recirculating systems and potentially maximize output per unit volume.

Response:
The copepods A. tonsa and P. crassirostris were reared at four salinities (20, 25, 30, 35ppt) with constant temperature, diet, stocking density and photoperiod. Over the course of three replicated experiments data to determine developmental time, mortality at maturity, sex ratio, egg production, egg hatch and life span were collected.

Results:
Preliminary analysis of data indicates that within the salinity range tested there was minimal observable impact on P. crassirostris for any of the parameters measured. For A. tonsa the percentage of females was inversely proportional to salinity. The cumulative egg production across the first five days of reproduction period was highest for the 30ppt treatment.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Batch culture of Parvocalanus crassirostris with continuous water treatment will increase production efficiency

Recap:
Further experimentation may be necessary to increase statistical power and determine if there is a significant effect of water treatment on naupliar production.

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:
Three temporally replicated experiments comparing a 400-liter static production tank with a 400-liter recirculating production tank were completed. Daily nauplii production was enumerated and water quality parameters were tested for the duration of the experiment.

Results:
Preliminary analysis suggests naupliar production may not be different between the water treated culture and the static culture.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

The effect of culture density on growth and reproduction of the copepods A. tonsa and P. crassirostris

Recap:
Determining the effect of stocking density on the life history traits of the two copepod species will facilitate the determination of how best to control culture density to optimize production.

Relevance:
One of the limitations to the efficient production of copepods is that reproduction is negatively impacted beginning at low culture densities. Understanding which aspects of growth and reproduction are impacted by density and how will facilitate optimization of culture density to maximize naupliar production.

Response:
Four densities (A. tonsa - 0.75, 1.5, 2.25, 3.0 ind./ml; P. crassirostris - 1.0, 3.0, 5.0, 7.0 ind./ml) which represent a range from low to high were stocked. Over the course of three replicated experiments, developmental time, mortality at maturity, sex ratio, egg production, and egg hatch were monitored. Also, we evaluated how changing the density at the time of maturity (high to low and low to high) impacted reproduction.

Results:
Experiments are ongoing. For P. crassirostris, the data collected so far indicate minimal effect of density on the parameters measured.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Increased 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 two higher stocking densities tested in the current experiment. A stocking density of 8 adults/ml is recommended as the ideal stocking density for this species.

Relevance:
Maximizing harvest of copepod nauplii optimizes the availability of suitably sized and nutritionally complete food for marine finfish larvae. Determining the ideal culture density will maximize production of O. colcarva nauplii per unit volume and decrease the cost per unit. In a previous experiment, a stocking density of 24 nauplii/ml (the highest density tested) produced the most nauplii. This experiment tested stocking densities higher than the previous experiment.

Response:
Three rearing densities (8, 24 and 48 adults per ml) were evaluated under a 18L:6D photoperiod. Copepods were fed a 1:1:1 mix of live Chaetoceros muelleri, Tisochrysis lutea, and Tetraselmis chuii. 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 this experiment.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

The effects of salinity on naupliar production of Apocyclops panamensis

Recap:
A salinity higher than the previous commercial standard yielded better results, but full strength sea water (35 p.p.pt.) was not optimal. The absolute optimum salinity is 27 ppt to 30 ppt.

Relevance:
Maximizing naupliar production is paramount to providing sufficient live prey for larviculture on a commercial basis. In addition, if lower salinities prove to be optimum for production it can be a significant cost savings in the reduced need for synthetic sea salt for any inland facility, or for those facilities not near a clean source of water of adequate salinity.

Response:
We utilized three different salinities (standard current commercial [control]-15 p.p.t., full strength seawater 35 p.p.t., and a mid-range salinity 25 p.p.t. and stocked replicated static culture tanks with the determined optimum density of copepods, and administered feed at the optimum rate and completed one reproductive cycle, and harvested and counted nauplii.

Results:
Initially we determined that a mid-range salinity performed best (25 p.p.t., vs. 15 p.p.t. [control] and full strength seawater 35 p.p.t. We subsequently narrowed the results through further testing that demonstrated that the absolute optimum salinity is 27 ppt to 30 ppt.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Education highlighting advancements in aquaculture and feed systems technology

Recap:
Aquaculture feed systems curriculum will introduce K-12 audiences to the benefits of sustainable aquaculture while highlighting core scientific concepts in biology.

Relevance:
Positive information about sustainable aquaculture is important to disseminate to the public. Specifically, educating students and teachers is necessary to build a foundation for aquaculture literacy.

Response:
The USM Marine Education Center will develop a curriculum for sustainable aquaculture and live feed applications. This includes lessons for K-12 teachers to incorporate into recurring biology courses along with interactive modules for public visitors to the MEC.

Results:
Educators at the MEC have become familiar with aquaculture literature and ongoing research with live feed systems. Currently curriculum is being developed for K-12 audiences and professional educators and for an educational module to deliver at the MEC.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Selected lines of Acartia tonsa for improved aquaculture traits

Recap:
Selected lines compatible with algal concentrates as food source and showing improved reproductive rates and tolerance to high culture density will contribute to cost-effective large-scale intensive production of Acartia tonsa for aquaculture.

Relevance:
Large scale production of copepods as live prey is limited by the need for large amounts of live microalgae to support cultures, the low tolerance to high density, and limited reproductive rates. Production and life history traits can be selected for if they have a genetic basis. Live microalgae can be replaced by algal concentrates for cost effective feeding of large cultures but current strains of Acartia tonsa do not perform well on microalgae preparations.

Response:
Selective breeding will be implemented to develop lines with improved reproductive traits and performance at high density and/or tolerance to algal concentrate diets.

Results:
A preliminary experiment evaluated the potential to select an Acartia line compatible with feeding algal concentrates based on current domesticated broodstock. A new stock is generated based on undomesticated A. tonsa in an attempt to improve the diversity of compatible genotypes and the feasibility of breeding a line feeding on concentrate.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Utilization of live monoalgal diets for Oithona colcarva will increase production efficiency

Recap:
Significantly reduced naupliar production and poor survival to adulthood on all three monoalgal diets demonstrates that a mixed diet is required for adequate production at this time.

Relevance:
The live algae needed to feed O. colcarva is a major cost associated with mass-scale production as it requires trained personnel and biosecurity infrastructure. 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 monoalgal diet 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 live monoalgal diets (Chaetoceros muelleri, Tisochrysis lutea, and Tetraselmis chuii) and a control diet (1:1:1 mix of all three algal species) were evaluated under a 18L:6D photoperiod. Daily separation of adults allowed for enumeration of produced nauplii.

Results:
Naupliar production was significantly greater in the 1:1:1 mix diet than in any monoalgal diet.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

The effect of probiotics on copepod production, water quality and Vibrio spp. reduction

Recap:
Probiotic treatment reduced Vibrio sp. counts but did not affect the total number of bacteria.

Relevance:
Controlling water quality and preventing emerging pathogens in intensive aquaculture are key factors for production. Biofloc and probiotics are strategies for controlling water quality and disease in recirculating systems. In this research, we focused on probiotics. Probiotics are a consortium of microbes which can be used for water quality management or as a preventive control method for emerging diseases.

Response:
We applied Epicin probiotics from Epicore daily for 15 days to Apocyclops panamensis stocked at 4000/L in 300 L tanks. The control group did not receive probiotics. Water quality, total microbial count, and Vibrio spp. were studied. Also, samples were collected for subsequent microbial community evaluation.

Results:
Total microbial count in water did not differ between the probiotic treated system and the control system. However, Vibrio sp. was significantly higher in the control system. After 15 days, total Vibrio was 4 log cfu/ml in the control system and less than 1 cfu/ml in probiotic treated system.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Stakeholder Engagement strategy Phase I: Introduction to the Research

Recap:
Five informational whiteboard videos, as well as several articles, were produced and released to keep constituents engaged and informed about The Great Red Snapper Count.

Relevance:
Past exclusion of fishermen from the research process has led to diminished trust and approval of scientific and management practices. To bridge this gap, our Stakeholder Engagement strategy aims to communicate the research process and findings from this study to as many constituents as possible.

Response:
Our Stakeholder Engagement outreach team produced and released five informational whiteboard videos and fact sheets through various social media sources. This completed Phase I for this component. Several articles were also written and distributed among fishing forums, social media, and websites.

Results:
The series of 5 videos for Stakeholder Engagement was blasted to over 50 key media outlets representing 11 universities, 13 non-profit organizations, 6 state agencies, 6 fishing magazines and forums, and 5 Sea Grant offices. Also worth mentioning, one MSU extension article about the tagging study drew the attention of the Associated Press in Jan. 2019. That article was picked up by 81 newspapers across the country and received 135.6M unique views over one week.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Successful interstate transfer of hatchery reared blue crab juveniles for pond production of soft-shell crabs

Recap:
Hatchery produced blue crabs foster expansion of sustainable blue crab aquaculture and provide an industry-driven solution to dwindling domestic supply and unfilled market demand.

Relevance:
Downward trends in juvenile crab populations have led to more risk averse management policies. These policies may eliminate harvest of undersized peeler crabs 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. Regional transport of juvenile crabs in chilled containers was successful with little mortality observed.

Response:
To address and foster commercial production of soft crabs using hatchery-reared blue crabs, a team of investigators from three universities, a community college, two Sea Grant programs, Sea Grant Extension Service, a State Resource Agency, and private industry partnered to demonstrate and transfer production technologies to academic and private sectors, develop economic models for all phases of production and disseminate project findings to stakeholders.

Results:
Hatchery-reared juvenile blue crabs were transferred from Mississippi to a private sector pond in North Carolina, Both soft-shelled and hard crabs were harvested from the pond. Industry participants were surprised at the rapid growth of the crabs in their pond. This initial stocking provided industry participants an opportunity to study current pond rearing protocols and to formulate changes in those protocols to increase efficiency and profits.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant-supported program enhances learning opportunities for oyster farmers in southern U.S.

Recap:
The Oyster South Symposiums in 2019 brought together more than 125 oyster farmers who shared industry knowledge and best practices, and 7 oyster farmers received fellowships to take part in other peer-to-peer learning experiences .in commercial off-bottom oyster farming across the southern US leads to enhanced, practical learning opportunities where in the first year an industry symposium was held and peer-learning opportunities were provided to improve knowledge and decision-making.

Relevance:
In response to market opportunities and advances in culture methods, a number of individuals have started commercial oyster farming from North Carolina around to Texas. Individuals sought advice on all aspects of commercial off-bottom oyster farming.

Response:
Sea Grant supported attendance and enhanced learning opportunities for commercial oyster farmers at the annual Oyster South Symposium on Feb. 21-22, 2019 in Orange Beach, AL. Through fellowships, Sea Grant funding also provided more than 7 additional peer-to-peer learning opportunities for Southern oyster farmers to attend industry conferences and visit peers in other parts of the country.

Results:
There were 240 attendees (more than 125 were oyster farmers) at the Oyster South Symposium. Sea Grant funding supported four oyster farmers to attend the symposium as guest speakers. This award also supported travel for over 7 oyster farmers to attend industry shows and visit other oyster farms to learn about different farming methods and marketing opportunities.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

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 Alma Bryant High School 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:
Alma Bryant High School in Irvington, Alabama, established Bonus Point Oyster Company in Grand Bay, Alabama. 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. As part of this project, a graduate student is studying how different gear types, desiccation practices, policy and tumbling methods affect profitability on the farm. Harvest is anticipated in the next reporting period.

Results:
Four high school students and one graduate student gained valuable practical experience on the oyster farm.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Recreational discard mortality of Gulf of Mexico reef fish has been underestimated by previous studies

Recap:
Research suggests discard mortality of red snapper and gray triggerfish has been underestimated in Gulf of Mexico stock assessments which could undermine sustainable fisheries management.

Relevance:
Discard mortality of caught-and-released marine fish is complex and challenging to estimate. Discard mortality is assumed equal to 11.8% for red snapper and 5% for gray triggerfish in recent stock assessments. Given the large number of red snapper and gray triggerfish that are discarded by recreational fishers annually (nearly 70% of the total catch), erroneous assumptions of discard mortality in stock assessments can greatly impact estimates of stock productivity, stock status, and sustainable fishing levels.

Response:
Researchers used geopositioning underwater acoustic telemetry to monitor the 3-dimensional movement and survival of red snapper and gray triggerfish at 30-60 meter depths at two 15-square kilometer study sites in the northern Gulf of Mexico. The large size and finescale 3-dimensional positioning accuracy of the array enabled the researchers to identify many instances where large predators (typically pelagic sharks) consumed transmitter tagged fish shortly after release and moved quickly away from the tagging reef.

Results:
Predation by large pelagic predators was estimated to account for 83% of red snapper and 100% of gray triggerfish discard mortality. Overall mortality estimates were much higher (>23% for red snapper and >27% for gray triggerfish) than currently assumed in stock assessments for both species. Previous studies which excluded predation have underestimated discard mortality and more studies which include predation effects are needed to better estimate discard mortality and inform stock assessments.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Mississippi-Alabama Sea Grant-supported research shows descender devices improve survival of discarded red snapper

Recap:
Mississippi-Alabama Sea Grant-supported research shows descender devices improve survival of released red snapper, allowing fish which would have otherwise died to survive and spawn or be caught again.

Relevance:
Recreational fishers discard the majority of the red snapper they catch in the Gulf of Mexico. A significant proportion of these discarded fish suffer immediate or delayed mortality, contributing to wasted harvest and increasingly stringent management regulations to rebuild depleted stocks. Descender devices may improve the survival of released red snapper, thus converting some of these wasted discards to fish that will be available in the future for spawning or harvest.

Response:
Researchers used geopositioning underwater acoustic telemetry to monitor the three-dimensional
movement and survival of 141 red snapper and 26 gray triggerfish at 30-60 meter depths at two 15-square kilometer study sites in the northern Gulf of Mexico to test whether descender devices reduced discard mortality.

Results:
Red snapper released with descender devices had significantly lower discard mortality within the first 2 days (95% CI = 18.8% - 41.8% for descender-released vs. 44.0% - 72.4% for surface-released, unvented fish), while there was no significant effect of descender devices on discard mortality of gray triggerfish.

Focus Area: Sustainable Fisheries and Aquaculture
Impact or Accomplishment: Accomplishment

Harvest slots could increase recreational fishing opportunities and sustainability in Gulf of Mexico red snapper

Recap:
Mississippi-Alabama Sea Grant-supported research suggests harvest slots (a minimum and a maximum size requirement for harvested fish) and reduced discard mortality could increase recreational fishing opportunities for Gulf of Mexico red snapper by lengthening the recreational harvest season.

Relevance:
Fishery managers are considering using harvest slot regulations (a minimum and a maximum size requirement for harvested fish) to increase recreational fishing seasons for red snapper in the Gulf of Mexico. However, anticipating the effects of regulatory changes is challenging because the fishery includes complex interactions between sectors (commercial, recreational, or bycatch), sub-sectors (e.g., private vs. for-hire recreational fishers), and red snapper population dynamics (e.g., size-based availability of fish and stock-recruitment).

Response:
We performed simulation analyses within the most recent Gulf of Mexico red snapper stock synthesis assessment model to quantify the effects of management actions on fishery harvests, catches, and fishing seasons. We explored many different input variables and model assumptions including discard mortality, harvest slots, and catch allocation schemes.

Results:
Some harvest slot regulations in GOM red snapper combined with decreases in discard mortality rates would increase recreational fishing opportunities by lengthening the recreational harvest season. However, under the current recreational-commercial harvest allocation framework, harvest slots regulations could benefit the recreational sector while greatly reducing harvest and having deleterious effects on the economically important commercial sector of the GOM red snapper fishery.