

Final Evaluation Findings

Grand Bay

National Estuarine Research Reserve

September 2016 to September 2023

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Summary of Findings

The Coastal Zone Management Act requires the National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management to conduct periodic evaluations of the operation and management of each national estuarine reserve participating in the National Estuarine Research Reserve System. This evaluation examined the operation and management of the Grand Bay National Estuarine Research Reserve by the Mississippi Department of Marine Resources, the designated lead agency, for the period from September 2016 to September 2023. The evaluation focused on three target areas: program administration, habitat restoration and land acquisition, and partnerships.

The findings in this evaluation document will be considered by the NOAA Office for Coastal Management in making future financial award decisions concerning the Grand Bay National Estuarine Research Reserve. The evaluation came to these conclusions:

Findings for Program Administration

Accomplishment: The Mississippi Department of Natural Resources provides strong support to the Grand Bay National Estuarine Research Reserve including providing additional financial support to address building maintenance issues, including a new sustainable composite deck in 2017, and a 42-foot outreach vessel for educational programming, plus administrative support that allows the reserve to manage additional grants and grow its staff capacity and programming.

Recommendation: The Grand Bay National Estuarine Research Reserve is encouraged to explore opportunities to further enhance integration across sector work, for example, setting aside structured time for sector staff to discuss, explore, and pursue opportunities to further integrate their work.

Recommendation: The Grand Bay National Estuarine Research Reserve is encouraged to consider its facility needs and to develop a Procurement, Acquisition, and Construction proposal that would facilitate the implementation of the reserve's programs while meeting NOAA funding requirements.

Findings for Partnerships: Education and Outreach

Accomplishment: The Grand Bay National Estuarine Research Reserve has a strong education program and is exceptional in identifying nontraditional audiences that could benefit from its programming and developing programs specific to their abilities and interests. Examples include programs for veterans with disabilities, artists, and students interested in coastal and marine related careers.

Findings for Partnerships: Community Resilience and Green Infrastructure

Accomplishment: The Grand Bay National Estuarine Research Reserve strives to work closely with its local government partners and assist with helping them address coastal management issues of concern. These efforts have led to the reserve leading an effort with the City of Moss Point to address decades of flooding issues with the installation of green infrastructure and creating a collaborative with the City of Moss Point, City of Pascagoula, Jackson County, and other partners to share information and support green infrastructure as a tool for stormwater management.

Findings for Habitat Restoration and Land Acquisition

Accomplishment: The State of Mississippi has acquired lands in and around the Grand Bay National Estuarine Research Reserve boundary that support the mission of the reserve. The reserve is also undertaking a long-term large-scale pine savanna restoration project on lands within its boundaries, and surrounding lands, that includes extensive research and monitoring to inform adaptive management and determine long-term success of the restoration. Prescribed burning, invasive treatment, and mechanical clearing has already led to extensive habitat improvement and increases in biodiversity.

Recommendation: The Grand Bay National Estuarine Research Reserve is encouraged to undertake an effort to regularly convene land and natural resource managers to share information and to problem-solve around common issues such as permitting.

Recommendation: The Grand Bay National Estuarine Research Reserve is encouraged to explore opportunities to better organize and share its full suite of monitoring data and data analyses. This could include developing an internal coastal data management system or looking for opportunities, including the development of new partnerships and collaborations, to enable its diverse data and data analyses to be incorporated into basin-wide coastal data management tools and applications.

This evaluation concludes that the Mississippi Department of Marine Resources is adhering to the programmatic requirements of the National Estuarine Research Reserve System in the operation of the Grand Bay National Estuarine Research Reserve.

Program Review Procedures

The Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1451 et. seq.), requires that state coastal zone management programs and national estuarine research reserves that are developed under the act and approved by the secretary of the Department of Commerce be evaluated periodically. Section 315 of the Coastal Zone Management Act and implementing regulations at 15 CFR Part 921, Subpart E, require that a research reserve be periodically evaluated with regard to 1) its operation and management, including education and interpretive activities; 2) the research being conducted within the research reserve; and 3) adherence to the requirements of section sections 315(b)(2) of the Coastal Zone Management Act.

The National Oceanic and Atmospheric Administration (NOAA) evaluated the Grand Bay National Estuarine Research Reserve in 2023. The evaluation team consisted of Carrie Hall, evaluation team lead; Matt Chasse, site liaison; and Jennifer Harper, manager, Apalachicola National Estuarine Research Reserve. The support of reserve staff members was crucial in conducting the evaluation, and this support is most gratefully acknowledged.

NOAA sent a notification of the scheduled evaluation to the director of the Mississippi Department of Marine Resources, published a notice of intent to evaluate in the *Federal Register* on August 2, 2023, and notified members of Mississippi's congressional delegation. The reserve posted a notice of the public meeting and opportunity on Facebook on September 13, 2023.

The evaluation process included a review of relevant documents and a survey of stakeholders, which helped identify three target areas for the evaluation: program administration; land acquisition and habitat restoration; and partnerships. A virtual site visit was conducted and the evaluation team held meetings with staff members and group discussions with stakeholders and program staff members about the target areas. In addition, a public meeting was held on Wednesday, September 20, at 12:00 p.m. at the Grand Bay Reserve, 6005 Bayou Heron Road, Moss Point, Mississippi, to provide an opportunity for members of the public to express their opinions about the implementation of the program. Stakeholders and members of the public were also given the opportunity to provide written comments. A summary of the written comments received and the NOAA Office for Coastal Management's responses are included in Appendix A. NOAA then developed draft evaluation findings, which were provided to the Mississippi Department of Marine Resources for review, and the department's comments were considered in drafting the final evaluation findings.

Final evaluation findings for the national estuarine research reserves highlight the reserve's accomplishments in the target areas and include recommendations, which are of two types.

Necessary Actions address programmatic requirements of implementing regulations of the Coastal Zone Management Act. These must be carried out by the dates specified. Failure to address necessary actions may result in a future finding of non-adherence and the invoking of interim sanctions, as specified in the Coastal Zone Management Act, Section 312(c).

Recommendations are actions that the office believes would improve the program but which are not mandatory. The state is expected to have considered the recommendations by the time of the next evaluation or dates specified.

Evaluation Findings

Program Administration

Overview

The Grand Bay National Estuarine Research Reserve sits within the Mississippi Department of Marine Resources. During the evaluation period, the reserve's reporting structure shifted, and the program manager now directly reports to the agency director. The department provides strong support to the reserve, including providing additional funding for building repairs, including a new sustainable composite deck in 2017, and a 42-foot outreach vessel, the *MISS NERR*, for student field trips and staff. The department is also able to manage additional grant funds that have allowed the reserve to significantly expand its programming. The department currently has knowledgeable grants management staff who are able to manage the reserve's cooperative awards with NOAA and external grants that support the reserve.

The department has created new staff positions to manage the additional workload that has come with the reserve's success in obtaining external funds. Since its creation in 2015, the department and reserve regularly participate in a state internship program that recruits college students or recent graduates to work for the summer. The internship program has been a very successful pipeline for hiring employees.

Accomplishment: The Mississippi Department of Natural Resources provides strong support to the Grand Bay National Estuarine Research Reserve including providing additional financial support to address building maintenance issues, including a new sustainable composite deck in 2017, and a 42-foot outreach vessel for educational programming, plus administrative support that allows the reserve to manage additional grants and grow its staff capacity and programming.

Reserve leadership encourages professional development and is supportive of innovative projects created by staff and volunteers. The reserve is encouraged to continue to support professional development and information sharing, and in particular consider opportunities for staff that are not sector leads to engage with other reserves and to learn and share ideas. The reserve staff work well together and support each other when needed. There is an opportunity to further integrate work across sectors to maximize the reserve's ability to address priority issues. With the addition of a new research coordinator, the reserve is in a good position to further enhance integration and is encouraged to set aside structured time for sector staff to discuss, explore, and pursue opportunities to further integrate their work to support the region in addressing coastal issues.

Recommendation: The Grand Bay National Estuarine Research Reserve is encouraged to explore opportunities to further enhance integration across sector work, for example, setting

aside structured time for sector staff to discuss, explore, and pursue opportunities to further integrate their work.

Reserve staff are valued for their expertise, ideas, and ability to problem-solve. The reserve's partners appreciate the reserve staff for their collaborative approach and sharing of their expertise. Reserve staff have close partnerships with other research reserves in the region and Mississippi-Alabama Sea Grant that help maximize the impact of their work and ensure it is not duplicative.

The reserve also partners with offices within the department. For example, the reserve's research and monitoring is used by the department's Office of Marine Fisheries to inform management of flounder statewide. Recently, there have been new opportunities to grow partnerships. With a recent change in leadership, the Office of Coastal Resources Management is now sending staff to participate in Coastal Training Program offerings, and the reserve and coastal program are discussing opportunities to partner more in the future, particularly around resilience. The leadership in the Coastal Preserves has also changed and the programs have been talking and sharing more; for example, the reserve has shared monitoring guidance.

The reserve also has a strong partnership with Mississippi State University, and the university hosts the research coordinator and several research assistant positions. The reserve partners with the university on many projects including conservation grazing, bacterial source tracking, and effectiveness-monitoring of inter- and sub-tidal reef restorations. Select reserve collaborations and partnerships are highlighted throughout the findings.

The reserve currently uses a contract to fund Mississippi State University to hire select staff that conduct work on behalf of the reserve. The university believes that a cooperative agreement is a better vehicle. Other states use different mechanisms to facilitate these types of arrangements. The department and reserve are encouraged to work with NOAA to study and determine the best option or options for a funding vehicle for staff located within Mississippi State University.

Advisory Committee

The reserve successfully simplified its advisory committee structure, going from a Reserve Management Board and a Citizen Advisory Committee, to a new Community Collaborative. The collaborative also serves as the advisory group for the Coastal Training Program. The collaborative has been an effective vehicle for reviewing and providing input into the reserve's plans and initiatives, such as the new management plan.

Management Plan

The reserve, with input from the Grand Bay Community Collaborative, completed the Grand Bay National Estuarine Research Reserve 2023-2027 Management Plan. Notice of the plan's completion was published in the *Federal Register* on June 28, 2023.

Facilities

After the destruction of its facilities (two trailers) by Hurricane Katrina in 2005, the reserve designed a permanent facility with resilience and green building techniques in mind. The reserve's facility has some design features and attributes that have led to problems with water damage, pest infestations, and access for maintenance, and the building's unique features have made it challenging to find contractors with the experience needed to address issues. The department provided the reserve with additional funding for replacing the deck in 2017 and funds for additional maintenance in 2022. A full building inspection was completed in 2021 and is being used as a list for needed repairs, and, in addition, normal aging repairs continue.

The reserve's facilities are also at staff and programming capacity and could benefit from additional space for hosting educational events and staff offices. A few evaluation participants also noted that additional space for housing researchers would be valuable as there are no other housing options nearby. With the addition of new and expanding programming for user groups with different abilities, such as veterans and Jackson County exceptional school students with disabilities, the reserve could benefit from accessibility improvements, particularly for getting from the building to the boardwalk. A concrete path could provide other benefits as well, allowing equipment such as lifts to clean windows to be operated even when the ground is wet.

The reserve is also in the process of updating its Coastal Resources Center and received a two-year \$49,711 grant from the Institute of Museum and Library Service to develop a redesign plan for its exhibit space through multi-level community engagement. The reserve is committed to making the visitor center more engaging for people of all abilities and will need additional funding to make these improvements.

The National Estuarine Research Reserve System will be modifying some of its requirements around Procurement, Acquisition, and Construction funding that will expand the types of projects that can be funded. This could open opportunities for the reserve to modify its existing building and potentially expand its facilities. Facility needs raised during the evaluation include:

- Opportunities to address long-term maintenance issues and reduce future maintenance costs.
- Providing a more accessible trail from the building to the boardwalk.
- Updating the visitor center based on the current planning process to include exhibits that will engage a broader and more varied audience.
- Addition of an outdoor classroom adjacent to the existing classroom facilities to expand education program capacity.
- Addition of office space to house an expanding staff.
- Additional educational and meeting room(s) that can accommodate growing programming.
- Additional housing opportunities for visiting researchers.

The reserve is encouraged to consider the following and to develop a proposal(s) for Procurement, Acquisition, and Construction funding from NOAA.

Recommendation: The Grand Bay National Estuarine Research Reserve is encouraged to consider its facility needs and to develop a Procurement, Acquisition, and Construction proposal that would facilitate the implementation of the reserve's programs while meeting NOAA funding requirements.

To address these needs the reserve is also encouraged to continue to explore opportunities to revise the building use agreement with the U.S. Fish and Wildlife Service in light of the service's planned reduction in staff. There may be opportunities to allow more flexibility in utilizing the service's space for reserve staff and programming. In addition, there may be an opportunity to work with the service to repair its Bayou Heron Pavilion, which lost its roof in a hurricane but is still used for reserve educational programming. The reserve's main facility is located on U.S. Fish and Wildlife Service property, and any major work or expansion will require permission and federal permits.

A number of evaluation participants raised the issue that the reserve was hard to find and not well known. The reserve has taken advantage of opportunities to bring its message to the public, such as participating in a segment of Mississippi Roads, a PBS show that highlights the unique things in Mississippi (www.youtube.com/watch?v=Sqh3rWOb2yQ). Opportunities to improve visibility that were discussed included working with the Federal Highway Administration to obtain a sign on I-10 to direct visitors to the reserve. The reserve is currently looking into expanding its presence at the Welcome Center off of I-10, which could potentially include a new road that would allow easier access from the highway.

Partnerships: Education and Outreach

Overview

The reserve has a strong education and outreach program, including education programming for K-12 students and nontraditional audiences, workshops for teachers, and community outreach events. The education coordinator is an active participant in national workgroups, helping to strengthen the education program nationally. The reserve is challenged in that schools in the region face a significant turnover of teachers, principals, and district leadership on a regular basis, and schools don't have resources for additional activities. Reserve education staff continually work to engage with the local teachers, principals, and district leadership to be able to bring students to the reserve for field experiences and to visit classrooms to provide education on estuaries. Grand Bay education staff make sure that teachers know what is being offered throughout the year, adapt programs to specific needs, and help teachers gain approval for field experiences. The reserve has also applied for grants that can cover additional costs such as buses.

The reserve reached 8,759 students from July 2016 to June 2022. The reserve's ability to reach students was impacted by staffing gaps over the evaluation period and COVID-19 over the latter

half of the period. The long-time education coordinator retired just prior to the start of the evaluation period. The education program has also shifted its focus, and the reserve reaches fewer K-12 students but has expanded its education programming to include more focus on nontraditional audiences and outreach. Demand for educational programming continues to exceed the reserve's capacity. The reserve added a full-time educator position in 2017 and expanded the job descriptions of the program development specialist, special programs and communication manager, and director's assistant/administrative assistant to assist with outreach programming. In fiscal year 2023, the reserve has dedicated funding to add a full-time education position to help address the region's needs.

The reserve has many great education programs and opportunities but is limited by staff and facility capacity. The reserve is encouraged to evaluate and prioritize its education program commitments on a regular schedule based on the educational goals and objectives identified in the management plan (2023). Such an approach will assist the reserve in being strategic about choosing which opportunities to pursue.

As discussed below, the reserve has a number of innovative and successful education programs. The reserve is encouraged to share success stories with NOAA so that the successes can be used to tell the importance of the national system's work both internally and externally.

K-12 Education

The reserve has several programs focused on its traditional audiences.

- The reserve's On the Road programming is designed to meet the needs of an individual classroom with educator-guided experiences in the classroom or on-site. The programs are designed for pre-K, K-12, college, and homeschool students. As part of the program, schools receive preparatory lesson plans aligned with state standards. Hands-on activities are used to teach students about diversity of coastal habitats and stewardship practices. Field experiences have students participating in activities such as dip netting, cast netting, water quality testing, and kayaking.
- The reserve is also expanding its work with homeschool students. Prior to the pandemic, the reserve identified homeschool students as a new audience. The reserve partnered with NOAA's research lab to create a shark dissection course, providing students with laboratory experience. After the pandemic, there has been an increase in homeschool students, and several homeschool co-ops are part of the reserve's On the Road program. Interaction with this audience has also led to the reserve working with toddler and pre-K audiences. Staff have adapted programs to fit this new audience.
- Conceptualizing Human Alteration and Natural Growth in Estuaries and Savannas (CHANGES) was an environmental education program for high school students focused on ecological processes and applicable restoration practices. Students were able to participate in monitoring processes from experimental design planning and data collection, to data entry and manipulation. They learned to identify differences between natural and anthropogenic change, discussed pros and cons of efforts to restore ecosystems to a previous functional state, and assessed ecosystem responses to weigh the benefits of decisions. The program was funded by the National Academies of

Sciences Gulf Research Program from 2018 to 2022 and focused on schools with a large percentage of underserved students. Funds were allocated toward alleviating field trip costs such as substitute teachers, transportation, and lunches during field experiences. The reserve was able to work with 250 students for 3,925 contact hours. Eighteen teachers and teaching assistants were involved, with 228 teacher contact hours. The reserve continues to use the lessons and activities developed in the reserve's education programs and teacher workshops.

- Biodiversity Relationships and Aquatic Chemistry Knowledge in Saline Habitats (BRACKISH) uses place-based learning approaches, specifically hands-on and inquiry-based learning, to foster environmental literacy in eighth grade students in Pascagoula and Moss Point. The three-day program immerses 8th-grade students in reserve science and their local estuarine environment to increase environmental literacy, problem solving skills, and place-attachment. The students visit the bay on day two to investigate the environment by collecting water quality data, species sampling, and exploring estuarine habitats. On day three, concepts learned during the program are reinforced through mock case studies related to water quality issues within their community. Target schools contain a large percentage of underserved students, so funds are allocated toward alleviating field trip costs such as substitute teachers, transportation, and lunches during field experiences. BRACKISH is funded by the National Academies of Sciences Gulf Research Program from 2022 to 2025.

Teacher Trainings

The reserve holds annual multi-day Teachers on the Estuary (TOTE) programs. The target audience includes teachers from Mississippi, southeastern Louisiana, and southwestern Alabama. The reserve designs workshops based on the needs and input of teachers. For example, history teachers do not have as many local opportunities to receive continuing education units that are specific to history. The education program developed a cross-discipline training called "Living History of the NERR: Using Science to Tell the Story!" It was so popular in 2022, the reserve adapted the workshop and held it again. After teacher workshops, staff work closely with the teachers throughout the school year to help them integrate what they learned into their classrooms.

Through evaluations, education staff learned that it is hard for teachers to commit to a consecutive three-day workshop. The reserve began creating one-day teacher workshops to meet this need. Evaluations also showed that teachers were interested in learning more about mammals. Education staff created a popular one-day "Let's Get Batty" workshop that they plan to host again. The workshop covers the conservation, ecological benefits, and current research on bats, while debunking any myths about the flying mammals. Teachers build their own bat houses that can be installed at their school.

Education staff work with teachers to create lessons specific to teachers' needs that address the state's learning marks they need to achieve for a topic. This allows teachers to easily know what standards are achieved with a lesson.

Reserve education staff actively participate in associations and groups to reach a wide audience of teachers. For example, education staff are active members of the Mississippi Science Teachers Association, hosting a booth and trainings at the annual conference. Education staff also partner with other education providers, such as teaching at professional development workshops hosted by the Marine Education Center or Dauphin Island Sea Lab. Education staff are also active in the National Marine Educators Association and the regional Southern Marine Educators Association (SAME) attending meetings regularly and serving on the board of SAME.

Other Audiences

The education program looks for opportunities to address unmet needs in the community and has expanded its programming for nontraditional audiences. When the reserve is planning to work with a group that has extra challenges, it invites the group leaders to visit the space. This offers a chance to build relationships, address specific challenges, and alleviate anxiety. Reserve staff have found that relationship building takes longer with nontraditional audiences and more trust is needed. The reserve staff invest the time needed in building the relationships. The reserve also regularly solicits input on its activities and uses the feedback to inform program improvements and to develop new programs.

The reserve has done a phenomenal job in expanding its educational programming with communities not typically served by reserves in the system. Several examples are highlighted below, including the reserve's deliberate and thoughtful engagement with military veterans with disabilities and artists. The reserve is encouraged to share its success in engaging nontraditional audiences with other educators across the Gulf Coast and the national system of reserves. In addition, the reserve is encouraged to continue its efforts to attend conferences and share knowledge and make connections.

In 2017, the reserve partnered with the Gulf Coast Veterans Healthcare System to help meet the needs of veterans. Education staff work closely with healthcare therapists to create programs that meet the unique needs of patients in four therapy departments: post-traumatic stress disorder, substance recovery, blind rehabilitation, and in-care/dementia. The veteran's program is now part of the reserve's regular monthly programming, and veterans look forward to participating.

To meet the needs of veterans affected by blindness, the reserve worked with therapists to develop a Frog Call Identification class for both sight-abled and visually impaired participants. The reserve incorporated the veterans' devices such as iPhone aids, binoculars, and canes into the workshop. Veterans were able to practice navigating around trees, walking through plant areas, and kayaking. A field guide with large print and QR codes was developed to help participants identify frog calls, and information is included on how veterans can contribute to a U.S. Geological Survey database just by sitting on their porch at home and listening to calls. The reserve has also done kayaking events, and plant identification with sound, taste, and smell.

For veterans in the post-traumatic stress disorder and substance abuse recovery programs,

education staff work closely with the therapists to design activities that give veterans opportunities to discover new hobbies in a relaxing, natural environment. Some of these activities include kayaking, birding, boating, nature hikes, plant and animal identification courses, and art activities.

For veterans with dementia, the reserve works with therapists to design programs that connect participants to nature in ways they might not have been able to in a while. Staff bring nature to patients so they can see, feel, smell, hear, and sometimes even taste things from the environment. The programs are inclusive to all skill levels. Reserve staff also work with therapists to give dementia patients an opportunity to use their hands and brains, while taking great care to avoid any obstacles that may be a form of frustration. When COVID-19 caused a pause in activities, reserve staff sent cards with pictures of Grand Bay and messages to veterans with an encouraging note that were highly valued by the veterans.

The reserve and Walter Anderson Museum of Art regularly hold joint art workshops focused on natural history. A workshop might begin with a tour of the museum and include a kayak trip and estuary-focused art project. The reserve also holds its own art workshops including batik, wood cutting, and botanical watercolor. The reserve's art programming has been so successful that in 2022 a group of educators from the other Gulf reserves requested a training workshop so they could learn the education program's methods and bring them to their reserves. For example, after attending, Apalachicola Reserve incorporated art into its 2023 TOTE workshop. One evaluation participant stated they loved the workshops as a way "to connect with nature and my art," and they had taken what they learned to do mini workshops with friends.

The museum recently created and hired a new educational position. Going forward, there should be even more opportunities to partner with the Walter Anderson Museum of Art, and staff are interested in participating in programming for veterans with the reserve. Evaluation participants noted an interest in seeing the reserve hold workshops on nature photography, a popular hobby. The art museum has a photographer on staff who could potentially assist with such a workshop. A few evaluation participants also noted an interest in engaging stewardship and research staff more with key nontraditional audience partners.

GenSea launched in 2022, as a program focused on keeping college graduates working in the state by showing them the wide array of careers available on the coast. Mississippi loses 60,000 college-educated people a year to other states. The GenSea program manager saw the special programs and communications manager give a talk at the Bays and Bayou Conference and realized the reserve had a curriculum that talks about coastal careers. The reserve and GenSea then partnered to host five classes together, the reserve adapting its curriculum to GenSea's needs. The GenSea program manager commended the reserve staff's skill in working with high school students. The partnership has also benefited the reserve by bringing in more types of teachers.

The reserve also works with a number of community college teachers and students. For example, one community college professor the evaluation team met with takes their classes for

a field trip to learn about green building features and the surrounding ecosystem and restoration activities. Students are able to meet scientists and learn about the reserve. Students then often volunteer to help with reserve outreach events while earning extra credit.

Accomplishment: The Grand Bay National Estuarine Research Reserve has a strong education program and is exceptional in identifying nontraditional audiences that could benefit from its programming and developing programs specific to their abilities and interests. Examples include programs for veterans with disabilities, artists, and students interested in coastal and marine related careers.

Signature Events

The reserve holds three large events each year to entertain and educate the public. The reserve relies heavily on volunteers to help set up, staff, and clean up after the event.

- Celebrate the Gulf Marine Education Festival is held in April in conjunction with the Art in the Pass Festival. In 2023, the reserve and volunteers hosted 38 community booths for different organizations, and over 8,000 people attended.
- National Estuaries Day in September brings visitors out to the reserve to enjoy boat rides and learn from reserve scientists about the reserve habitat. The reserve also provides hands-on activities for visitors to learn more about the estuary.
- The Star Party is held in December during the Geminids meteor shower. A volunteer from the Jet Propulsion Center at NASA brings stargazing equipment for people to look at the stars. The reserve provides a variety of soups and hot chocolate to enjoy. Some of the activities include a hayride from the Coastal Resources Center to the boat launch, viewing the Geminids meteor shower, a screech owl walk on the Savanna Trail boardwalk, cookie decorating, pictures with Santa Claus, reindeer games, and creative crafts.

Citizen Science, Volunteers, and Friends Group

The reserve supports conservation action education. The education coordinator sits on the reserve system's Conservation Action Education workgroup. The reserve has designed and hosted programs that promote conservation efforts by the public, including an annual Fly Tie Lure class. The class is held in partnership with the Mississippi Gulf Coast Fly Fishers Association and teaches fishermen how to create their own lures from more sustainable products (not plastic). The Phenology Trail (Savanna Trail) engages walk-in visitors and volunteers in recording changes in plants and animals over time and tracking changes after restoration activities.

The reserve is also supportive of, and has benefited from, citizen science. A reserve staff member asked one volunteer, a retired botanist, to make an herbarium reference collection to help staff accurately identify plants while doing field transects. The volunteer was an iNaturalist enthusiast and realized this could be an even bigger opportunity to share reserve data. The volunteer has posted over 800 specimens in iNaturalist and is also working with more formal online databases around the world, including the Southeast Regional Network of Expertise and Collections, a consortium of 233 herbaria. This volunteer stated that their work with the reserve

was one of the most productive partnerships in 16 years of volunteering. The volunteer has also led several plant identification workshops.

Mississippi State University brings a master naturalist group to the reserve annually. The master naturalist program has been a great source of volunteers with expertise that benefits the reserve. For example, two years ago, a retired oceanographer who was part of the master naturalist program decided to do a project on ticks. They placed fabric at a monitoring site and came out twice a month for a year to count the Gulf Coast ticks on the fabric. The volunteer's work led to an increased understanding about the tick population and its seasonality. A pamphlet was developed to showcase the results, and it is available at the trailhead. The volunteer also led a lunch-and-learn and is scheduled for a talk at the upcoming research symposium. More monitoring will be done again after the area undergoes a prescribed burn.

The reserve has benefited from having volunteers that can bring their expertise to the reserve to share. For example, one volunteer has taught several botanical art workshops. In addition, the reserve has also benefited from volunteers, such as students and others, who help with large events.

Looking forward, a reserve volunteer has developed a friends group, Friends of the Grand Bay NERR, a 501-3(c), that will support the reserve's education outreach and other efforts. As the organization is built out, the additional funds to support education and outreach activities, for example, funding buses, substitute teachers, and lunches, will be a great opportunity for the reserve and local schools.

Partnerships: Community Resilience and Green Infrastructure

Community Resilience

The reserve works with communities to improve their resilience, often in partnership with other organizations. The reserve has hosted a number of workshops to support communities' engagement in the National Flood Insurance Program. In August of 2023, the reserve partnered with Sea Grant to hold a Flood Certification Workshop for 25-30 people. Changes to the National Flood Insurance Program came out weeks earlier and the workshop was very timely. In addition, the workshop provided a much-needed opportunity for local government staff to obtain six low-cost certified floodplain manager credits and maintain their certification.

The reserve is also part of the Coastal Hazard Outreach Strategy Team (CHOST), led by NOAA Mississippi-Alabama Sea Grant, that helps communities improve their Community Rating System score and lower their flood insurance rates. The reserve has assisted or led a number of activities, for example, helping several communities use the Coastal Resilience Index, a self-assessment tool to determine areas where communities most need to strengthen resilience. The reserve's partners in the region are hoping to continue and expand their relationship with the reserve in addressing resilience, for example, around new initiatives such as the creation of resilience hubs. A partner the team met with also voiced an interest in addressing plastics, an emerging issue.

The Coastal Training Program also supports emergency management efforts in the region and has worked with Jackson and Baldwin counties by participating in the local emergency planning committees, and with the Alabama Department of Conservation and Natural Resources and the Mississippi Emergency Management Agency on disaster preparedness.

The Coastal Training Program often partners with Weeks Bay Reserve and with all the Gulf reserves to work on regional projects such as an RStudio series. The program has also worked with private partners such as Longleaf Wilderness Medicine (wilderness first aid classes), Chevron (disaster planning), Mississippi Wildlife (conservation easements), and Wetland Resources Environmental, Inc. (wetland delineation) on workshops. The Coastal Training Program also contributed to the design and hosting of the reserve's research symposiums in 2019, 2021, and November 2023.

Green Infrastructure

Flooding is a major problem on the Mississippi Gulf Coast. To address this issue, the Coastal Training Program provides workshops, works with local governments and partners to implement green infrastructure, and supports other projects to build the region's resilience. The Coastal Training Program coordinator has improved their skills in this area including becoming a certified floodplain manager and regularly participating in the Floodplain Managers Association. The Coastal Training Program team has also worked to build relationships with local decision makers, including mayors, city council members, county supervisors, city planners, and green infrastructure experts.

The City of Moss Point is an underserved community that has had flooding issues for decades. Recently, the new mayor of the City of Moss Point expressed openness to working with the reserve on green infrastructure as a method to help address flooding issues. The Coastal Training Program coordinator and program development manager partnered with the city to support them in writing and managing three grants to further green infrastructure projects. In 2020, the reserve received funding from the U.S. Environmental Protection Agency to implement the proposal, "Stormwater System Resilience through Green Infrastructure." The grant funded collaborative work with city officials, community organizations, and residents to identify project sites. Addressing flooding at Kreole Elementary School was identified as a priority as parents were unable to pick up their children on-site during large rain events. Students had to be transported elsewhere for pick up. Currently, the project design is being finalized and permitted. Implementation will begin in 2024. Additional elements of this project are being supported by the Mississippi Coastal Management Program. The reserve is also planning to conduct training on maintaining the features, developing guides, and conducting post-implementation workshops.

Another project funded through the first round of the National Estuarine Research Reserve System Bipartisan Infrastructure Law awards involves facilitation of a feasibility study looking at the opportunity to take a park in Moss Point and to redesign it to capture runoff to help the community address flooding issues in adjacent neighborhoods. The project includes a

community-based design approach to create park designs and construction drawings. The Coastal Training Program is also in the process of applying for additional grants with the city to continue to fund this work.

The reserve also created a “ditch brigade” in the City of Moss Point to help clean out ditches to improve stormwater flow and educate citizens on the importance of good drainage. The brigade’s first effort this past summer was impacted by tornadoes that hit right before the scheduled work. The reserve pivoted and volunteers were able to help with the cleanup and recovery from the tornadoes. More cleanup efforts and education are planned for the future.

To better improve communication and support collaboration around green infrastructure in the region, the reserve brought together a “collaborative,” a professional networking group to meet quarterly to discuss current and future projects. The collaborative will provide a forum for identifying and resolving project conflicts and finding ways that the group can work together for better stormwater management. The collaborative includes representatives from Jackson County, the City of Moss Point, Pascagoula, and other partners. So far, the group has met once. A newsletter is also planned to help members stay connected with all of the different projects underway. Representatives from the City of Moss Point and Jackson County expressed excitement about the collaborative and the opportunity to work together towards addressing stormwater issues and building community resilience.

Reserve staff have earned the trust of partners in Moss Point and Jackson County, overcoming the hesitancy of local governments to work with the Mississippi Department of Marine Resources. As one partner noted, “Local leaders value the expertise of the reserve staff and have confidence in their ability to bring partners to the table.”

One of the reserve’s ongoing challenges is meeting fatigue, with several green infrastructure projects and programs in a small town and grant requirements to engage with the community. The reserve is working to find new and creative ways of engaging the public in a meaningful way that will help the projects and guard community members’ time. The reserve may want to consult with other reserves that are also working directly with community members on stormwater projects, such as Great Bay National Estuarine Research Reserve.

The reserve is committed to supporting local communities in their efforts to address flooding. With the staffing needs created by the three green infrastructure projects underway at Moss Point and the four projects for which the reserve has applied to receive funding, the reserve is dedicating upcoming Bipartisan Infrastructure Act capacity-building funds to the Coastal Training Program to hire an additional full-time position. The reserve’s partners are also very supportive of this work and are looking to expand their efforts and work with the reserve on additional projects.

The Coastal Training Program was awarded the National Estuarine Research Reserve System’s 2022 “Exemplary Leadership Award: Coastal Training Program Award of Excellence” for its ongoing work with the Moss Point community and its efforts to reduce flooding through the

use of green infrastructure practices. The City of Moss Point's efforts will also be showcased when the Gulf of Mexico Climate and Resilience Community of Practice holds its next annual meeting in the city. The reserve is helping to plan the event, and attendees will be able to visit demonstration sites, hear from people in Moss Point, and see how an underserved community is making progress.

Accomplishment: The Grand Bay Reserve strives to work closely with its local government partners and assist with helping them address coastal management issues of concern. These efforts have led to the reserve leading an effort with the City of Moss Point to address decades of flooding issues with the installation of green infrastructure and creating a collaborative with the City of Moss Point, City of Pascagoula, Jackson County, and other partners to share information and support green infrastructure as a tool for stormwater management.

The reserve is encouraged to further share this success story. One opportunity could be to have a student or intern create a story map. For example, the Mission-Aransas Reserve was able to use the expertise of advertising students for a similar project.

Habitat Restoration and Land Acquisition

Land Acquisition

The state and reserve have made significant strides in filling gaps in landownership within the reserve's boundary, adding 977 acres since 2013. After the *Deepwater Horizon* oil spill, inholdings within the reserve and refuge boundaries were prioritized for acquisition based on factors that included the potential to support prescribed burning activities, parcel size, risk of development, and ecological condition. In 2018, approximately 1,500 acres of property in the area were acquired by the state, including 617 acres within the reserve boundary. The acreage acquired outside the reserve's boundary is part of the reserve's upland wet pine savanna restoration project. In April 2023, the *Deepwater Horizon* Oil Spill settlement led to another 40 acres being moved into state ownership.

Mississippi Phosphates, a bankrupt fertilizer factory on the reserve's border, was investigated by the U.S. Department of Justice, Environmental Crimes Section. A settlement was finalized in March 2018, and the state obtained title to 320 acres on the western side of the reserve.

Pine Savanna Restoration and Monitoring

In 2018, the reserve was awarded a ten-year contract from Mississippi Department of Environmental Quality as part of the *Deepwater Horizon* Natural Resource Damage Assessment process to restore, maintain, and monitor 3,000 acres of pine savanna and flatwood habitats across the landscape. The Grand Bay Land Acquisition and Habitat Management Project activities include mastication, invasive species treatment, and prescribed fire.

The more extensive use of prescribed fire on the reserve was also jump-started by two wildfires on reserve property. In 2016, a wildfire burned 4,029 acres, and in 2017 another wildfire

burned 438 acres. In 2018, the reserve conducted prescribed burns on 878 acres, and in 2023 1,137 acres were burned. The wildfires and prescribed burns over the last seven years have already dramatically changed the landscape, and increases in biodiversity are being documented.

The reserve has established 16 long-term monitoring plots and has plans to add three more this year that are currently being monitored by the U.S. Fish and Wildlife Service. Through grant funding, the reserve has expanded its staff and now has a team of five to conduct monitoring and research related to the restoration effort. The reserve monitors vegetation, invasive species, and bird populations to assess the effectiveness of restoration activities. The reserve has also been fine-tuning its monitoring processes to identify best practices, for example, testing different monitoring techniques for birds and finding that area searches work best. The data from the restoration monitoring has been put in a public repository, and researchers are reaching out to the reserve for more information.

The reserve is building on the project's monitoring efforts and conducting additional monitoring, including investigations into reptiles and amphibians, that address needs in the site profile. For example, the reserve recently started a project, "Flying Insects as Bioindicators of Restoration Efforts," to investigate how the flying insect community characteristics change over impounded wetlands after a prescribed burn of the surrounding upland pine savanna habitat. This project is a partnership with the Mississippi State University, Coastal Marine Extension, as it has a large data set characterizing insect communities across varied restoration sites at the reserve in relation to bat communities. Understanding the invertebrate communities better will improve understanding of ecosystem health, including the biotic communities that depend on insects, from pitcher plants to birds, bats, and fish.

In 2023, the reserve also began participating in a new project, "Downstream Effectiveness of Restoration Activities," in partnership with Mississippi State University and Dauphin Island Sea Lab, to characterize plankton and infauna communities in the reserve catchment to quantify ecological effectiveness of upland prescribed burns. They are monitoring habitat gradients from poor to excellent habitat quality so they can see change over time to help with adaptive management.

Accomplishment: The State of Mississippi has acquired lands in and around the Grand Bay National Estuarine Research Reserve boundary that support the mission of the reserve. The reserve is also undertaking a long-term large-scale pine savanna restoration project on lands within its boundaries, and surrounding lands, that includes extensive research and monitoring to inform adaptive management and determine long-term success of the restoration. Prescribed burning, invasive treatment, and mechanical clearing has already led to extensive habitat improvement and increases in biodiversity.

The reserve has been very successful in obtaining grant funding to conduct restoration projects and is continuing to pursue new opportunities to build on these projects. New staff have been brought on to help implement restoration and monitoring activities. Department and reserve

leadership will need to continue to plan for the staffing of potential new projects and the ramping down of existing projects.

Many restoration efforts in coastal Mississippi are underway, and more are likely to be initiated in the next five years. A major challenge the reserve faces in implementing restoration projects is navigating permit approvals for small and large monitoring and restoration activities and receiving permits in a timely manner. The process has gotten more complex, and it can take almost two years to receive approval. Another challenge is the scale of the restoration effort and number of land managers that are involved. The reserve may wish to consider if it would be beneficial to develop memorandums of understanding to share skilled land management professionals and resources across state and federal agencies in Mississippi, as well as across state lines.

The reserve is also encouraged to consider leading, or partnering with others, to develop a group of regional land managers that could be convened regularly, for example quarterly to annually, to share and discuss projects; identify innovative tools, methods, and research; and work together to problem-solve around issues such as permitting. Members could further build relationships and share expertise on specific types of projects. The reserve is encouraged to consider the scope and if it would be more beneficial to focus on land managers in Mississippi, or Mississippi-Alabama, or if the group should be Gulf-wide. The reserve is also encouraged, more generally, to think about the potential of Gulf-wide partnerships and opportunities with other reserves and organizations that enable staff to share knowledge and expertise about land management approaches at the Grand Bay Reserve.

Recommendation: The Grand Bay National Estuarine Research Reserve is encouraged to undertake an effort to regularly convene land and natural resource managers to share information and to problem-solve around common issues such as permitting.

The reserve is collecting extensive restoration monitoring data that is being used to inform management. The NOAA Office for Coastal Management encourages the reserve to continue to look for new ways and opportunities to utilize and share monitoring data and results of data analyses. The reserve is encouraged to explore the use of a broader data management system to organize the data from its numerous projects, both internally and externally. The reserve could consider working with partners to develop a data management system—a potential example is the Louisiana Coastwide Reference Monitoring System—or to integrate the data and data analyses into existing basin-wide coastal data management tools and applications.

Recommendation: The Grand Bay National Estuarine Research Reserve is encouraged to explore opportunities to better organize and share its full suite of monitoring data and data analyses. This could include developing an internal coastal data management system or looking for opportunities, including the development of new partnerships and collaborations, to enable its diverse data and data analyses to be incorporated into basin-wide coastal data management tools and applications.

The U.S. Fish and Wildlife Service is a key partner in the reserve's restoration efforts, and the two agencies have a strong relationship. A service representative described the reserve as "critical for our success." The reserve and refuge coordinate land restoration efforts and share staff, particularly with prescribed burns. The reserve has five staff with current certifications through the National Wildfire Coordinating Group. The refuge has been very successful in getting fire crews detailed to the refuge to fill in staffing gaps so that prescribed burns can be completed. The refuge has been able to use reserve facilities to house temporary fire crews. The refuge is also currently writing a long-term plan, and a key issue is resilience. The refuge is using the reserve surface elevation table (SET) data to inform sea-level rise planning and other data to inform its planning. Refuge staff also look to the reserve for their input as subject matter experts of the landscape. The reserve is using its NOAA capacity Bipartisan Infrastructure Law funds to work in partnership with the U.S. Fish and Wildlife Service, the State of Alabama, nongovernmental organizations, and private landowners to develop restoration plans and projects to expand on the wet pine savanna habitat restoration.

The U.S. Fish and Wildlife Service also supports the reserve through other efforts. The service obtained a \$20,000 grant to purchase four feral hog traps, for a total of five active traps. The reserve has been able to increase its feral hog trapping program, and staff are now accessing more remote areas. The reserve removes hundreds of hogs a year from the reserve.

Research

The reserve has a robust research program and strong publication record. From 2017 to 2022, 40 new research projects were initiated in the reserve. From January 2017 to April 2022, the reserve was involved in 67 peer-reviewed papers and theses. The reserve's research, monitoring, and stewardship staff have published papers on a wide range of issues from plant genetics, turtles, water quality, restoration, and erosion, to public attitudes toward wildlife. The reserve's research and monitoring and stewardship sectors work together ensuring that the reserve's research and monitoring informs stewardship activities. The reserve is encouraged to continue to share its successes with the national system and add published papers to the system's database.

The reserve supports its research program through its success in applying for external funding. The reserve's largest externally funded project is the "Grand Bay Land Acquisition and Habitat Management Project." The reserve has been successful in obtaining other grant funding as well. For example, the reserve received a National Estuarine Research Reserve System Science Collaborative grant to lead a national effort to pioneer the use of analyzing SET data with R to track whether a marsh is sinking or gaining elevation relative to sea level. The reserve engaged with the Gulf of Mexico Alliance and universities to bring in other researchers, and the Coastal Training Program coordinator helped assist with outreach and training of others on the use of R. This effort with its use of annotated visualizations has also influenced how that national program displays data. The result was the first "National Synthesis of NERR Surface Elevation Table Data" (<http://bit.ly/460YsLf>).

A strength of the reserve and national system is that they are a place to conduct pilot projects. The reserve was able to work with the proponents of a *Deepwater Horizon* project, “Restoring Subtidal and Intertidal Reefs in Mississippi Estuaries,” that included Grand Bay to ensure that the project was designed to learn more about the function of artificial reefs, because many similar projects were being installed or proposed across the Gulf of Mexico. The reserve worked with its partners, including Mississippi State University and U.S. Geological Survey, to develop a comprehensive effectiveness-monitoring plan to assess the function of reefs in terms of achieving the project goals and several other metrics of reef function, such as nekton community use, invertebrate abundance and composition, erosion and sediment transport, and shoreline position and elevation. The reserve formalized its monitoring plans in the management plan and operations grant proposals and collected data for four years, both pre- and post-project and are currently analyzing and publishing the results of this study. The reserve is also working on a proposal to test the use of a conservation grazing area to support habitat maintenance on a 1,000-acre property adjacent to the reserve, the county’s land mitigation bank.

Law Enforcement and Dumping

The reserve’s primary partner on land management activities, the U.S. Fish and Wildlife Service, has lost many staff members in the past several years and has had difficulty hiring new staff. The refuge also plans to have reduced staff going forward. This has impacted joint projects. A big loss has been the retirement of a law enforcement officer stationed at the reserve headquarters. There are no current plans to fill this position. To address this gap, the reserve is working more with the department’s Marine Patrol and the Jackson County Sheriff’s Department, but this cannot replace having an officer on-site. After the virtual site visit in December 2023, the Department of Marine Resources stationed a marine patrol officer at the reserve, providing needed law enforcement capacity.

The reserve’s resource center was burglarized twice in 2021. The reserve has installed a comprehensive high-definition camera system at the center. The system is acting as a deterrent around the center, but the reserve still deals regularly with stolen items and illegal dumping on reserve property.

The reserve has prioritized trash removal since 2017. The reserve more than tripled its 2017-2022 evaluation metric target and removed 26,275 pounds of trash from estuarine waters, marshes, and upland areas. The reserve has also gated off some areas that were being used as public dumps and remains vigilant in order to address issues quickly. The reserve works closely with the department and Mississippi Coastal Resources Management Program to address wetland violations in regard to debris, including storm debris.

Evaluation Metrics

Beginning in 2012, reserves began tracking their success in addressing three evaluation metrics specific to their programs. The evaluation metrics include a five-year target and provide a

quantitative reference for each program about how well it is meeting the goals and objectives it has identified as important to the program. In 2017, reserves began a second five-year period and set targets specific to their programs based on measures from existing National Estuarine Research Reserve System performance measures. In 2022, reserves began a third five-year evaluation metric cycle and again set targets specific to their programs based on measures from existing National Estuarine Research Reserve System performance measures.

Evaluation Metrics: 2012-2017

Metric 1

Goal: By 2017, researchers, educators and local communities will develop a better understanding and knowledge of coastal resources that will be utilized to minimize impacts on water quality, habitats and ecological processes.

Objectives: By 2017, K-12 students will have increased insight into conservation needs gained through education, research and monitoring programs at the Grand Bay National Estuarine Research Reserve.

Strategy: Grand Bay National Estuarine Research Reserve staff will work to develop and implement a student curriculum that will promote the stewardship of our coastal resources, at the reserve and in off-site learning situations. Pre- and post-program testing will be used to determine student awareness and understanding of the importance of stewardship and conservation and potential impacts from climate change.

Performance Measure: From 2012 to 2017, number of K-12 students who participate in Grand Bay National Estuarine Research Reserve programs and are made aware of and understand the importance of stewardship and conservation in our coastal estuaries and the potential impacts from climate change.

Target: From 2012 to 2017, 1,500 K-12 students participate in Grand Bay National Estuarine Research Reserve programs and are made aware of and understand the importance of stewardship and conservation in our coastal estuaries and the potential impacts from climate change.

Results:

- Year 1 (2012–2013) = 6,588 K-12 students
- Year 2 (2013–2014) = 3,453 K-12 students
- Year 3 (2014–2015) = 3,336 K-12 students
- Year 4 (2015–2016) = 1,740 K-12 students
- Year 5 (2016–2017) = 4,835 K-12 students

Total = 19,952 K-12 students

Discussion: The reserve greatly exceeded its target by the end of year one. The initial target was set low. The reserve implemented a successful K-12 education program that has reached many students in the region.

Metric 2

Goal: By 2017, local communities will make improved, science-based decisions regarding management of coastal resources and watersheds.

Objective: By 2017, Coastal Training Program workshop participants will use reserve scientific knowledge and expertise to make informed coastal management decisions.

Strategy: Grand Bay National Estuarine Research Reserve staff will hold workshops and training programs that provide reserve generated science-based information, current status and trends of natural resources and natural resource management regarding reserve priorities of water quality, climate change and habitat protection.

Performance Measure: From 2012-2017, number of Coastal Training Program workshops and training programs held utilizing reserve or partner specific research, stewardship data, or stewardship expertise to address reserve priorities of water quality, climate change and habitat protection.

Target: From 2012-2017, 30 Coastal Training Program workshops and training programs held utilizing reserve or partner specific research, stewardship data, or stewardship expertise to address reserve priorities (water quality, climate change and habitat protection).

Results:

- Year 1 (2012–2013) = 22 Coastal Training Program workshops
- Year 2 (2013–2014) = 19 Coastal Training Program workshops
- Year 3 (2014–2015) = 15 Coastal Training Program workshops
- Year 4 (2015–2016) = 10 Coastal Training Program workshops
- Year 5 (2016–2017) = 10 Coastal Training Program workshops

Total = 76 Coastal Training Program workshops

Discussion: The reserve exceeded its target by year two and was able to more than double its target. The reserve's target was set low. The reserve successfully provided a wide variety of highly rated workshops to inform coastal decision makers in the region.

Metric 3

Goal: By 2017, Grand Bay National Estuarine Research Reserve develops connections with local communities to increase the public's overall appreciation and significance of coastal ecosystems.

Objectives: By 2017, reserve volunteers will have insight into conservation needs gained through involvement with education, research and monitoring programs at the reserve.

Strategy: Grand Bay National Estuarine Research Reserve staff will promote citizen/volunteer involvement in reserve education, research monitoring and stewardship efforts. Increased volunteer engagement in reserve activities reflects a link to local communities and an appreciation of coastal ecosystems.

Performance Measure: From 2012-2017, number of volunteer hours contributed in support of reserve education/training, research, and stewardship activities.

Target: From 2012-2017, 2,500 volunteer hours are contributed in support of reserve education/training, research, and stewardship activities.

Results:

- Year 1 (2012–2013) = 2,444 volunteer hours
- Year 2 (2013–2014) = 391 volunteer hours
- Year 3 (2014–2015) = 1,226 volunteer hours
- Year 4 (2015–2016) = 4,060 volunteer hours
- Year 5 (2016–2017) = 1,565 volunteer hours

Total = 9,686 volunteer hours

Discussion: The reserve exceeded its target in year two and was able to quadruple its target. The reserve’s target was set low. The reserve was able to use volunteers to assist with a variety of education, outreach, research, and stewardship activities.

Evaluation Metrics: 2017-2022

Metric 1

Goal: Build community connections and relationships to share understanding of coastal ecosystems and inspire people to protect them (Goal 3).

Objectives: People are inspired to take action on coastal conservation issues (Objective 3.2)

Strategy: Action 3.2.1: Enhance the visitor experience by removing trash and debris on public trails, every two weeks our Stewardship sector arranges for four staff members to spend 1-2 hours picking up debris in the reserve by boat or ATV. We then weigh the trash collected and track the number in a spreadsheet for reporting. We also conduct an annual Coastal Cleanup program where participants help pick up trash in the reserve. The amount of trash from this collection will also be included in our evaluation metric.

We are currently at 2,000+ pounds per year but thinking there will be less in years 4 and 5 if we are constantly staying on top of it.

Performance Measure: From 2017 to 2022, pounds of trash removed from the Grand Bay National Estuarine Research.

Target: From 2017 to 2022, 7,500 pounds of trash removed from the Grand Bay National Estuarine Research Reserve.

Results:

- Year 1 (2017–2018) = 4,930 pounds of trash
- Year 2 (2018–2019) = 3,625 pounds of trash
- Year 3 (2019–2020) = 7,025 pounds of trash
- Year 4 (2020–2021) = 5,702 pounds of trash
- Year 5 (2021–2022) = 4,993 pounds of trash

Total = 26,275 pounds of trash

Discussion: The reserve was able to exceed its target in year two and more than triple its target over five years.

Metric 2

Goal: Systematically collecting quality data to answer relevant research questions informs our understanding of Grand Bay ecosystems (Goal 1).

Objective: By 2023, there is a 20% increase in the number of new external research projects occurring in the Grand Bay National Estuarine Research Reserve (Objective 1.5).

Strategy: Action 1.5.1: Reserve research priorities are communicated to external researchers and communications result in more interest in working in the reserve which translates into more projects occurring in the reserve. We will count the number of new research projects occurring in the reserve as a measure of how effective we have been in reaching out to local and regional external researchers. We would like to see a 33% increase in new research projects over the five years. The baseline is three research projects initiated from 2013 through 2017. From 2018 through 2022 we would like to see four new research projects initiated.

Research and monitoring data are collected by calendar year, not cooperative agreement cycle.

Performance Measure: From 2018 to 2022, total number of new research projects being carried out in the Grand Bay National Estuarine Research Reserve.

Target: From 2018 to 2022, four new research projects being carried out in the Grand Bay National Estuarine Research Reserve.

Results:

- Year 1 (2018) = 6 new research projects
- Year 2 (2019) = 4 new research projects
- Year 3 (2020) = 12 new research projects
- Year 4 (2021) = 8 new research projects
- Year 5 (2022) = 10 new research projects

Total = 40 new research projects

Discussion: The reserve was able to exceed its target in year one. The reserve's target was set low. The reserve has been very successful in attracting researchers and obtaining funding to support research projects.

Metric 3

Goal: Build community connections and relationships to share understanding of coastal ecosystems and inspire people to protect them (Goal 3).

Objectives: Coastal Mississippi and Alabama citizens with knowledge of Grand Bay NERR and its work increases by 25% (Objective 3.1) and People are inspired to take action on coastal conservation issues (Objective 3.2)

Strategy: Action 3.1.3: Conduct science-based community events to promote the conservation of NERR natural resources.

Action 3.2.3: Staff engages with the public to inspire interest and ownership in conservation and conservation action in local coastal communities.

Description: Count the number of people in these four measures to determine our effectiveness at being a resource for the public. We will count the number of people attending each of our public presentations, including workshops, scientific conferences, community collaborative meetings, etc. We will add this to the number of people attending our public outreach events like Star Party, National Estuaries Day, NERR Birthday Party, Adventure Quenchers, etc. Conservation action programs will be identified as those programs which inspire some sort of action on the part of the participant that improves conservation like the Rain Barrel Workshop, Phenology Trail trainings, etc. And, the number of walk-in visitors will only be those who visit the Coastal Resources Center and will not include our satellite displays at the I10 Welcome Centers in Mississippi and Alabama. All these measures added together will give us an index of how many people we are reaching with a thorough and quality program experience.

Performance Measure: From 2017 to 2022, the number of people reached through public presentations, public/outreach activities, and conservation action programs, and number of walk-in visitors at NERRS education/visitor center. (Public Served Index)

Target: From 2017 to 2022, 1,350,000 people reached through public presentations, public/outreach activities, and conservation action programs, and number of walk-in visitors at NERRS education/visitor center. (Public Served Index).

Results:

Year 1 (2017–2018)	= 225,226 people reached
Year 2 (2018–2019)	= 215,400 people reached
Year 3 (2019–2020)	= 88,689 people reached
Year 4 (2020–2021)	= 2,051 people reached
Year 5 (2021–2022)	= 10,738 people reached

Total: = 572,104 people reached

Discussion: The reserve did not meet its goal as COVID-19 impacted the reserve’s ability to conduct presentations, outreach activities, conservation action programs, and the number of walk-in visitors at the visitor center. In years four and five the reserve also changed how it counted people reached and did not include all visitors to the I-10 Welcome Center that featured a reserve exhibit, which significantly lowered numbers.

Evaluation Metrics: 2022-2027

Metric 1

Goal: Goal 3 – Build community connections and relationships to share understanding of coastal ecosystems and inspire people to protect them.

Objective: Objective 3.3 – People are inspired to take action on coastal conservation issues.

Strategy: Action 3.3.1 – Enhance the visitor experience by removing trash and debris on public trails, as a remote reserve public dumping is a continuing problem. Every two weeks our Stewardship sector arranges for four staff members to spend 1-2 hours picking up debris in the reserve by boat or ATV. We then weigh the trash collected and track the number in a spreadsheet for reporting. We also conduct an annual Coastal Cleanup program where participants help pick up trash in the reserve. The amount of trash from this collection will also be included in our evaluation metric.

We are currently at 4,000+ pounds per year. We anticipate that our pound of trash per year will decrease over time as we hypothesize that the more the reserve is seen without trash and the more our programming includes discussions of trash as a problem, the less trash we will see in the reserve. We also anticipate that with our restoration activities which have opened line of sight in many places, there is a lessening of the perceived privacy to engage in illegal acts such as dumping.

Performance Measure: From 2022 to 2027, pounds of trash removed from the Grand Bay National Estuarine Research Reserve.

Target: From 2022 to 2027, 10,000 pounds of trash removed from the Grand Bay National Estuarine Research Reserve.

Results: Year 1 (2022–2023) = 3,515 pounds

Discussion: The reserve is continuing to invest in trash removal. Measures that have been instituted to reduce trash, such as gating roads, have been successful in reducing the amount of trash dumped at the reserve.

Metric 2

Goal: Goal 1 – Systematically collect quality data and answer relevant questions that inform management.

Objective: Objective 1.5 – External researchers conduct projects that contribute information to supporting reserve management priorities.

Strategy: Action 1.5.2: Action: Reserve research priorities are communicated to external researchers. We will count the number of new research projects occurring in the reserve as a measure of how effective we have been in reaching out to local and regional external researchers. The baseline is four research projects initiated from 2018 through 2022. From 2022 through 2027 we would like to maintain this increase.

Research and monitoring data are collected by calendar year, not cooperative agreement cycle.

Performance Measure: From 2022 to 2027 total number of new research projects being carried out in the Grand Bay National Estuarine Research Reserve.

Target: From 2022 to 2027, twenty new research projects being carried out in the Grand Bay National Estuarine Research Reserve.

Results: Year 1 (2023) = Two new research projects – Data collection still in process

Discussion: The collection of performance data for year one covers January to December 2023 and data collection has not ended.

Metric 3

Goal: Goal 3 – Build community connections and relationships to share understanding of coastal ecosystems and inspire people to protect them.

Objective: Objective 3.1 – Coastal Mississippi and Alabama citizens with knowledge of Grand Bay NERR and its work increase and Objective 3.3 – People are inspired to act on coastal conservation issues.

Strategy: Action 3.1.3 – Conduct science-based community events to promote conservation of Grand Bay National Estuarine Research Reserve resources. Action 3.3.4 – Staff engages with visitors to inspire interest and ownership in conservation and conservation action in communities.

Description: Count the number of people in these four measures to determine our effectiveness at being a resource for the public. We will count the number of people attending each of our public presentations, including workshops, scientific conferences, community collaborative meetings, etc. We will add this to the number of people attending our public outreach events like Star Party, National Estuaries Day, National Estuarine Research Reserve Birthday Party, Adventure Quenchers, etc. Conservation action programs will be identified as those programs which inspire some sort of action on the part of the participant that improves conservation like the Rain Barrel Workshop, Phenology Trail trainings, etc. And, the number of walk-in visitors will be the number of walk-in visitors at NERRS education/visitor center. All these measures added together will give us an index of how many people we are reaching with a thorough and quality program experience.

	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	Totals
Public presentations	1,071	1,291	1,110	744	562	4,778
Public/out-reach activities	6,731	10,453	2,064	1,179	9,751	30,178
Conservation action programs	0	12	0	0	0	12
	7,802	11,756	3,174	1,923	10,313	34,968

The above data does not include the number of walk-in visitors at NERRS education/visitor center as the first years tracked included visitors to I-10 and 2020-2022 numbers were impacted by COVID-19.

Performance Measure: From 2022 to 2027 the number of people reached through public presentations, public/outreach activities, and conservation action programs, and number of walk-in visitors at NERRS education/visitor center. (Public Served Index)

Target: From 2022 to 2027, 60,000 people reached through public presentations, public/outreach activities, and conservation action programs, and number of walk-in visitors at NERRS education/visitor center. (Public Served Index).

Results: Year 1 (2022–2023) = 15,462 people

Discussion: The reserve has a strong education program and is making progress towards its target.

Conclusion

For the reasons stated herein, I find that the State of Mississippi's operation and management of the Grand Bay National Estuarine Research Reserve, including education, research, and interpretative activities, is adhering to the terms of the reserve's financial assistance awards and the programmatic requirements of the Coastal Zone Management Act and its implementing regulations.

These evaluation findings contain four recommendations that must be considered before the next regularly scheduled program evaluation but that are not mandatory at this time. Recommendations that must be repeated in subsequent evaluations may be elevated to necessary actions.

This is a programmatic evaluation of the Grand Bay National Estuarine Research Reserve, which may have implications regarding the state's financial assistance awards. However, it does not make any judgment about or replace any financial audits.

Jeffrey L. Payne, Ph.D.
Director, NOAA Office for Coastal Management

Date

Appendix A: Response to Written Comments

Wei Wu, Ph.D.

Professor, Landscape Ecology

The University of Southern Mississippi

Grand Bay National Estuarine Research Reserve is taking a holistic view to conserve and restore key habitats and ecosystem services. The unique ecosystem - coastal pine savanna and retrograding coastal wetlands, and Pascagoula river delta nearby provide two contrasting systems that are difficult to find somewhere else. They are the natural experiment sites to test hypotheses related to sea-level rise and coupled nature-human systems to advance coastal science. The program manager has great visions to restore the retrograding wetlands by planning to improve hydrological connections and mitigate flooding risks in the urban areas. The coastal training program connects floodplain managers, officials in local and county governments, engineers, and scientists together to mitigate coastal flooding. Research Day is a great event to bring the stakeholders and scientists together to inform current research going on at the reserve. The outreach programs are attractive (hands-on experiences and boat ride), innovative (e.g., using art to communicate science), informative, and well attended. I have been working at the reserve for about 15 years. The place is well equipped with dedicated and super helpful staff who really want to advance coastal science and improve coastal resource management. This is the reserve we must have in Mississippi.

NOAA Office for Coastal Management Response: The NOAA Office for Coastal Management thanks Dr. Wu for her comments.

Jereme Phillips

Deputy Refuge Supervisor, Area II

U.S. Fish and Wildlife Service

The Grand Bay National Estuarine Research Reserve (NERR) is having significant positive impacts on native wildlife and habitats, the local community, and our scientific knowledge of the Grand Bay Estuary. In the area of land stewardship, a federal-state partnership between the Grand Bay NERR and the Grand Bay National Wildlife Refuge (U.S. Fish and Wildlife Service) has been a highly successful model of collaboration which has resulted in transformational habitat restoration projects that will endure for generations. As a direct result of this partnership, the Grand Bay NERR and National Wildlife Refuge are monitoring, studying, and restoring rare habitats along the Mississippi Gulf coast. In addition, the Grand Bay NERR does an exceptional job with public outreach and education which makes it an important educational center and member of the local community.

Grand Bay National Wildlife Refuge's challenges include restoring longleaf pine savanna habitats and marshes which have been altered by changes in land use and climate. The Grand

Bay NERR is assisting Grand Bay National Wildlife Refuge with these challenges by collaborating on landscape level conservation initiatives and by providing scientific research that informs habitat management. This critical information will become even more important as Grand Bay National Wildlife Refuge seeks to apply habitat management strategies that adapt to a changing landscape.

As for the future, Grand Bay National Wildlife Refuge envisions a strong, enduring partnership with the Grand Bay NERR as they collaboratively manage the Grand Bay Estuary and associated habitats for the benefit of native wildlife and the American people. Prescribed burning, wildlife and habitat monitoring, and environmental education are just a few of the areas where Grand Bay National Wildlife Refuge and NERR will continue to collaborate and build on a partnership that is much stronger and more effective than either program can be on its own.

NOAA Office for Coastal Management Response: The NOAA Office for Coastal Management thanks Mr. Phillips for his comments.

Penny Crawford
Volunteer
Grand Bay National Estuarine Research Reserve

I live on the Mississippi Gulf coast at the opposite end of the coast from the Grand Bay National Estuarine Research Reserve (NERR). We did visit the location several years ago and found the facility to be state of the art and very visitor friendly. I was really excited when I learned about the Batik workshop and rushed to participate. The staff was very helpful and encouraging to a novice. I was thrilled with my results. I am not an art major or an accredited art teacher but I have been painting and drawing all my life. For the last 25 years I have been perfecting my skills as a botanical watercolor painter. I have studied wildflowers through much of south Louisiana and coastal Mississippi. I am an accredited flower show judge and use those skills to arrange my wildflowers in a way that can bring out the best in them. Since participating in my first batik class at the NERR, two things have happened, I have attended almost every batik class since and I have volunteered to teach art workshops.

Since that time I have taught several botanical watercolor painting classes for adults and some for veterans. We have taken boat tours of Grand Bay, driving tours of the long leaf pine savanna and walked the boardwalk in the woods. When we take our tours, we are accompanied by well-informed staff members who help us to learn about the many aspects, plants, trees and animals on the property. We pick flowers and leaves to bring back to the classroom for our botanical drawing and painting. All supplies are provided for the botanical painting classes as well as the batik classes. All of these art classes are free and seem to fill immediately. People come from Louisiana, Mississippi and Alabama to attend.

The time we spend on walks, rides and boat rides has been extremely educational. Even though I consider myself somewhat informed about the flora and fauna of south Mississippi, I learn new things each time I take part in these events. The staff also provides nutritious and fun

meals for the workshop participants. They even take the environment into account when selecting and disposing of our utensils and containers. On a few occasions I have stayed in the NERR dorm when the event was for two days. This is a great facility, although I have still not figured out how to operate the television.

I was very excited to help provide the botanical painting workshops for the local veterans. I was a little intimidated not knowing what they would expect. I hope they enjoyed and benefited from the experience. I know I did. Meeting these heroes who have been struggling in their civilian life and interacting with them has been eye opening. From the young man who clinched his pencil with a death grip because his hand shook too much otherwise, to interacting with an older man who had never learned to read and write. Some of these people were very artistic and seemed to enjoy the opportunity to reconnect with their skills. Others were mostly glad to get outside and around new people. What a gift it was for the staff of the NERR to share with our veterans.

I was asked to discuss any challenges encountered in my time working with the staff and at the facility. Well, that list is short: I still cannot work the television in the dorm; it is long drive from my house to the NERR (but unless you build another facility I guess we cannot fix that), the cold days in January make batik class challenging but it keeps the bugs away and I always wish I could do more to help the veterans. That is my short list of challenges. Working with the staff has always felt like working with family, a very cooperative and upbeat family.

NOAA Office for Coastal Management Response: The NOAA Office for Coastal Management thanks Ms. Crawford for her comments.

Rick Ranew

Retired, Grand Bay NERR marine science educator

As a retired Grand Bay National Estuarine Research Reserve (NERR) marine science educator, I look back at the wonderful opportunities of teaching literally thousands of students and teachers through the many years of instilling both knowledge and passion for taking critical care of the coastal environments of the states of Alabama, Florida, Mississippi, and Louisiana. The key partnership of both research scientists and marine educators brought a balanced approach to many schools through teacher workshops at the center followed by On the Road programs traveled by me to many schools represented by the participating teachers at our workshops and ultimately ending with the students actually coming to our reserve to experience hands-on field trips working alongside the research scientists doing their daily work. Stewardship became a major emphasis to the future generations of students to become adequate caretakers of not only the coastal communities but also their own communities. One example of ownership taught by me and the stewardship department at the Grand Bay NERR was the restoration of our living shoreline at the boat launch on the reserve after the devastating destruction of Hurricane Katrina. Under the supervision of our director and Stewardship Coordinator, we brought a class of 30 fifth graders to work alongside of scientists to plant 300 sprigs of black needle rush plants during one day. The amazing result from this

educational outreach was students coming back to this very site to claim ownership of seeing a flourishing living shoreline full of diversity of marine organisms. Out of that group of 30 students came future participants of coastal cleanups and some even went into a study of marine science courses in college. Even though I can't be present for your live online discussion, I can still express the gratitude of having worked at the wonderful Grand Bay National Estuarine Research Reserve. It is a great place for students, teachers, and families to learn about their need to become better stewards of our beautiful coastal environments. Thank you for this opportunity to share my passion and gratitude for the years spent at a great center of learning.

NOAA Office for Coastal Management Response: The NOAA Office for Coastal Management thanks Mr. Ranew for his comments.