

Mississippi Department of Environmental Quality  
FY 2021 Annual Report for the Centers of Excellence Research Grants Program (COE)  
Grant Number RCEGR470004

**EXECUTIVE SUMMARY**

*Brief Description of the selected COE*

In February 2015, the Mississippi Department of Environmental Quality (MDEQ) made available for public comment for 45 days a draft Request for Proposals (RFP) describing the competitive selection process, rules, and policies. MDEQ prepared the draft RFP in accordance with state law and in compliance with 31 C.F.R. §34.700-708. Notice of the public comment and review period for the draft RFP was published in the Sun Herald and Clarion Ledger newspapers as well as online at [www.restore.ms](http://www.restore.ms). After consideration of meaningful input from the public, a final RFP was published in April 2015. Notice of availability of the final RFP was published in the Sun Herald and Clarion Ledger newspapers on April 6, 2015, and April 13, 2015, as well as online at [www.restore.ms](http://www.restore.ms). The deadline to submit proposals was May 7, 2015. As a result of the Final RFP, MDEQ received two proposals. After reviewing the proposals according to the qualifications and criteria described above, the Mississippi Based Restore Act Center of Excellence (MBRACE) was selected. MBRACE is a consortium of four Mississippi universities - Jackson State University, Mississippi State University, University of Mississippi and University of Southern Mississippi. The University of Southern Mississippi serves as the lead university for the consortium.

*Overview of focus of the COE*

The focus of MBRACE, a consortium of Mississippi's research universities, is a sound, comprehensive science- and technology-based understanding of the chronic and acute stressors, both anthropogenic and natural, on the dynamic and productive waters and ecosystems of the northern Gulf. The goals of MBRACE are: (1) serve as a focal point for new, long-term research and socioeconomic initiatives along the northern Gulf with relevance to Mississippi's resources; (2) serve the people of Mississippi and the northern Gulf region with a scientifically based understanding of ecosystem status and trends (past to present, predictive) with special emphasis on improved forecasting abilities to ensure sustainable coastal and ocean ecosystems of the Gulf; and (3) work within a consortium of stakeholders including Mississippi's research universities under the Mississippi Research Consortium, state and federal agencies, local communities, private industry, and non-governmental organizations.

*Summary of the annual performance of the COE*

MBRACE continues to move the Center of Excellence program forward. The five-person Executive Steering Committee (ESC) comprised of leadership from the four MBRACE universities continues to work with the administrative team to execute the program. A Call for Proposals to fund research under the next Core Research Program (Core-2) as well as the first round of Competitive Research Proposals was developed. The Core-2 proposal, a proposal submitted by the University of Southern Mississippi, the University of Mississippi, Mississippi State University, and Jackson State University jointly was approved, and three competitive research projects were awarded. Sub-awards were executed; however, research activities were impacted by statewide university COVID restrictions. In October 2020, the US Department of the Treasury issued an extension to the federal award to address COVID-related delays; the extended period of performance will expire in April 2023.

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**PROGRAMMATIC ELEMENTS**

*Award Recipient*

**Treasury – MDEQ:** Treasury issued the federal award to MDEQ in August 2015, with an effective date of September 1, 2016. MDEQ selected MBACE to implement the Centers of Excellence Research Grants Program. MBACE is a consortium of four Mississippi universities - Jackson State University, Mississippi State University, University of Mississippi, and University of Southern Mississippi. The University of Southern Mississippi serves as the lead university for the consortium. During the reporting period, MDEQ, with contractual support, performed program management activities, including the oversight, coordination, and monitoring of grant activities, sub-recipient activities, and funds expended under the program. MDEQ prepared federal financial and performance reports for the prior reporting period. MDEQ reviewed the sub-recipient's Monthly Project Progress Reports and monthly status calls were held to discuss project activities and support overall program scope and schedule management. Sub-recipient reimbursement requests were reviewed for consistency with the grant and sub-award agreement scope of work and budget. In October 2020, the US Department of the Treasury issued an extension to the federal award to address COVID-related delays; the extended period of performance will expire in April 2023.

*Award Sub-recipient/Consortium Lead*

**MDEQ – University of Southern Mississippi:** The sub-award agreement was executed on May 21, 2017, between MDEQ and the University of Southern Mississippi (Principal – Marcia Landen, DUNS - 62-333-5775) for \$3,442,337.00. The sub-award agreement was amended on March 30, 2020, to increase total funding to \$7,126,311.00; additional funding was incorporated to support continuation of prior research activities and implementation of the Competitive Research Program.

MBACE was selected as the Mississippi's Center of Excellence under Bucket 5 of the RESTORE Act. MBACE is a consortium of four Mississippi universities - Jackson State University, Mississippi State University, University of Mississippi and University of Southern Mississippi. The University of Southern Mississippi serves as the lead university for the consortium. The funds are being used to implement the MBACE program. This program is conducting research and development on the Gulf Coast Region that focuses on science, technology, and monitoring. The mission of MBACE is to seek sound comprehensive science- and technology-based understanding of the chronic and acute stressors on the dynamic and productive waters and ecosystems of the northern Gulf of Mexico, and to facilitate sustainable use of the Gulf's important resources.

During the reporting period, MDEQ and MBACE conducted routine monitoring and reporting activities, including monthly reporting submittal and monthly status calls, and participated in routine meetings. A Scientific Collection Permit was updated and submitted to the U.S. Department of the Treasury in accordance with Special Award Condition #3 of the Notice of Award. MDEQ worked with the sub-recipient during the reporting period to reallocate funding within the sub-recipient's detailed budget. A no-cost extension for COVID-related delays was submitted to Treasury during the prior reporting period; this extension was granted in October 2020.

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The MBACE Science Plan was accepted by Treasury during a prior reporting period. MBACE's long-term Science Plan focuses on Mississippi's directive toward sustainable coastal management through three major thrust areas: 1) monitoring and ocean observations, 2) modeling, and 3) process studies. No modifications were made to the Science Plan during the current reporting period. New appointments were made to the External Advisory Group (EAG) during the reporting period. MBACE continued data management activities with support from its contractor, Texas A&M University; data management activities were still underway as of September 30, 2020. At the All Hands meeting the EAG appointed Greg Steyer as the Group's Chair.

Additionally, the Executive Steering Committee (ESC) decided to move to quarterly teleconferences, with Lead PI conference calls during non-ESC call months to maximize efficiencies of communication and coordination between PIs.

MBACE's monitoring strategy for sub-recipients was finalized in a prior reporting period.

In a prior reporting period, MBACE accepted research proposals focused on understanding oyster reefs and their sustainability under the initial Core Research Program (Core-1). MBACE approved four projects that examine how ecological conditions relevant to oysters vary over time and between newly reported oyster reefs and adjacent unrestored oyster reefs in the Mississippi Sound:

**1. Water Quality and Benthic Habitat Observations for Enhanced Understanding and Sustainable Management of Oyster Reefs in the Mississippi Sound**

Mississippi State University (MSU)

Principal Investigators: R. Moorhead, P. Dash, A. Skarke

**2. Abiotic and Biotic Influences on Current and Historic Distributions of Oyster Reefs**

University of Mississippi (UM)

Principal Investigators: M. Slattery, G. Easson, D. Gochfeld, S. Showalter, K. Willett

**3. Sustainability and Restoration of Oyster Reef Habitat in Mississippi Sound: A Larval Transport and Recruitment Approach**

The University of Southern Mississippi (USM)

Principal Investigators: J.D. Wiggert, K. Barbor, M.K. Cambazoglu, A. Diercks, S. Howden, S. Milroy, C. Rakocinski

**4. Monitoring, Mapping, and Visualization of Oyster Reefs Habitat in the Mississippi Gulf Coast**

Jackson State University (JSU)

Principal Investigators: K. Ali, F. Tuluri, H. Shih, R. Kafouri

In June 2019, MBACE issued a Request for Proposals (RFP) soliciting proposals from the four consortium universities (JSU, MSU, UM, USM) for continuation of the Core Research Program (Core-2). In the current reporting period, a single, collaborative proposal was approved under the Core-2. USM is the Lead University for the Core-2 collaborative research project, with sub-awards issued to the collaborating universities (MSU, UM, and JSU). This project will extend the original research conducted under Core-1 to model and assess water quality in the western Mississippi Sound while expanding

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research into bays and other coastal waters, assessing locations with the potential for sustainable estuarine ecosystem development, and synthesizing all data from the first phase of research for distribution and use by competitively funded projects:

**MBRACE 2 – Core Research Program (Core-2)**

Lead University: The University of Southern Mississippi (USM)

Collaborating Universities: Mississippi State University (MSU), The University of Mississippi (UM), and Jackson State University (JSU)

Principal Investigators: Jerry Wiggert (Lead, USM), Kamal Ali (Co-Lead, JSU), Greg Easson (Co-Lead, UM), Anna Linhoss (Co-Lead, MSU), Mustafa Kemal Cambazoglu (USM), Padmanava Dash (MSU), Ali Humos (JSU), Scott Milroy (USM), Robert Moorhead (MSU), Chet Rakocinski (USM), Prem Parajuli (MSU), Huiru Shih (JSU), Marc Slattery (UM)

In June 2019, MBRACE issued a Request for Proposals (RFP) soliciting proposals for the Competitive Research Program. In the current reporting period, sub-awards were made under the Competitive Research Program; selected proposals focused on the topic areas of (1) Water Quality and (2) Oyster Reefs and their Sustainability. MBRACE approved three projects that examine these topics:

**1. Impacts of water quality on oyster development to inform oyster reef restoration and sustainability on the Mississippi Gulf Coast**

University of Mississippi (UM)

Principal Investigators: Deborah Gochfeld (Lead, UM), Kristine Willett (UM), Stephanie Showalter Otts (UM)

R. Moorhead, P. Dash, A. Skarke

**2. The distribution of submarine groundwater discharge and its effect on coastal water quality in Mississippi**

Mississippi State University (MSU)

Principal Investigators: Adam Skarke (Lead, MSU), Alan Shiller (USM), Natasha Dimova (University of Alabama)

**3. Optical observation for oyster larvae (O3L)**

The University of Southern Mississippi (USM)

Principal Investigators: Xiaodong Zhang (Lead, USM), Eric Powell (USM)

The following sections provide a summary update of each approved project.

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**Core Research Program (Core-1)**

Research activities under Core-1 were concluded during a prior reporting period. A final research summary report for all projects can be found at:

<https://static1.squarespace.com/static/59ef467949fc2b53f03c7df1/t/5f062f4e0b01c07d0f8e77a2/1594240847232/CORE+1+Research+Summary+-+Final.pdf>

**University of Southern Mississippi**

*Project Summary:* USM’s proposal for funding under the Core Research Program was approved for \$625,000; activities were performed under the existing subaward between MDEQ and USM. These funds were used for research on the sustainability and restoration of oyster reef habitat in the Mississippi Sound. The University of Southern Mississippi has completed work on their project titled “Sustainability and Restoration of Oyster Reef Habitat in Mississippi Sound: A Larval Transport and Recruitment Approach.”

All research activities concluded on Core-1. See the *MBRACE Core Research Program 1 Summary Report* for additional detail regarding research activities performed through this project.

**Lower-Tier Sub-Recipient(s)**

MBRACE is a consortium of four Mississippi universities - Jackson State University, Mississippi State University, University of Mississippi and University of Southern Mississippi. The University of Southern Mississippi serves as the lead university for the consortium. USM issued sub-award agreements during a prior reporting period; a summary of work being performed by each lower-tier sub-recipient is provided below:

**University of Southern Mississippi – University of Mississippi:**

*Project Summary:* The sub-award agreement was executed on August 31, 2017, between University of Southern Mississippi and the University of Mississippi (Principal - Marc Slattery, DUNS - 06-771-3560) for \$625,000. The funds were used to identify differences in abiotic and biotic stressors at current and historic oyster reef sites, to better understand oyster reef health and to inform management regarding the best places and practices to improve oyster reef restoration strategies.

All research activities concluded on Core-1. See the *MBRACE Core Research Program 1 Summary Report* for additional detail regarding research activities performed through this project.

**University of Southern Mississippi – Mississippi State University:**

*Project Summary:* The sub-award agreement was executed on September 15, 2017, between the University of Southern Mississippi and Mississippi State University (Principal - Robert Moorhead, DUNS - 07-546-1814) for \$624,953.25. The funds were used for research on the influence of water quality and benthic habitat conditions on the health of oyster reefs in the Mississippi Sound.

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All research activities concluded on Core-1. See the *MBRACE Core Research Program 1 Summary Report* for additional detail regarding research activities performed through this project.

**University of Southern Mississippi – Jackson State University:**

*Project Summary:* The sub-award agreement was executed on October 11, 2017, between the University of Southern Mississippi and Jackson State University (Principal - Joseph A. Whitaker, DUNS - 044507085) for a total of \$624,599. The funds were used to develop and build a sensor system that can remotely measure and record the valve movement of bivalves. This system will be used in the Mississippi Gulf oyster reefs to continuously measure and report the valve gaping of oysters. This data, together with data from the other University partners, may be used to better assess the health of oyster reefs.

All research activities concluded on Core-1. See the *MBRACE Core Research Program 1 Summary Report* for additional detail regarding research activities performed through this project.

**Core Research Program Continuation (Core-2)**

The sub-recipient initiated the second round of the Core Research Program (Core-2), supporting a single collaborative project to continue research on Core-1 projects. The University of Southern Mississippi (USM) is the Lead University for the Core-2 collaborative research project, with sub-awards issued to collaborating universities (Mississippi State University, The University of Mississippi, and Jackson State University):

**University of Southern Mississippi – Mississippi State University**

*Sub-Award Agreement Summary:* The sub-award agreement was executed on April 14, 2020, between University of Southern Mississippi and Mississippi State University (Principal – Kevin Enroth, Director, Office of Sponsored Projects, DUNS 07-546-1814) for \$388,183.97.

**University of Southern Mississippi – The University of Mississippi:**

*Sub-Award Agreement Summary:* The sub-award agreement was executed on April 23, 2020, between University of Southern Mississippi and The University of Mississippi (Principal – Renita L. Gray, Manager of Sponsored Programs Accounting, DUNS 06-774-3560) for \$377,388.00.

**University of Southern Mississippi – Jackson State University:**

*Sub-Award Agreement Summary:* The sub-award agreement was executed on April 14, 2020, between University of Southern Mississippi and Jackson State University (Principal – Joseph A. Whittaker, Vice President for Research and Economic Development, DUNS 04-450-7085) for \$206,732.00.

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Through Core-2, collaborating universities continue to model and assess seasonal trends in Mississippi Sound water quality, the dynamics of freshwater inflow into the Sound, and the suitability of Sound waters for sustainable oyster production. During the initial round of Core Research Program funding (2018-2020), the MBRACE partners, at USM, MSU, JSU and UM, collected essential base-line data that supported assessments of western Mississippi Sound water quality, stressors impacting water quality, oyster biology and ecology, and oyster reef health and sustainability. This new project extends the original Core Research Program's research activity through continued modeling and assessment of water quality in the western Mississippi Sound while expanding research activities into bays and other coastal waters, assessing locations with the potential for sustainable estuarine ecosystem development, and synthesizing all data from the first phase of research for distribution and use by competitively funded projects.

*Work Performed in the Current Reporting Period:* Through Core-2, collaborating universities continued to model and assess seasonal trends in Mississippi Sound water quality, the dynamics of freshwater inflow into the Sound, and the suitability of Sound waters for sustainable oyster production. Core-2 PI's engaged MDEQ Office of Restoration to discuss management implications of the work underway through each project. Data collection, data processing, and data analysis associated within the three research areas has continued: 1) model implementation – circulation modeling, 2) habitat suitability – ecological modeling, and 3) Plankton and Larvae sampling.

**Competitive Research Program**

Activity under the Competitive Research Program began during the reporting period. Three projects were selected for funding under the Competitive Research Program. Research activities were delayed due to COVID-related university closures and travel restrictions; however, research did begin during the reporting period. The information below summarizes the Competitive Research Program projects; a summary of work being performed by each lower-tier sub-recipient is provided below:

**University of Southern Mississippi**

*Project Summary:* USM's proposal for funding under the Competitive Research Program was approved for \$449,907; activities are being performed under the existing subaward between MDEQ and USM. With these funds, USM will perform research activities under its project titled "Optical observation for oyster larvae (O3L)." This project will develop an optical observation system measuring the complete set of the inherent optical properties in the Mississippi Sound to monitor and predict oyster larvae performance as measured by growth and survival at metamorphosis.

*Work Performed in the Current Reporting Period:* USM has continued discussions with coordinating partners and MDEQ on outcomes of research. The optical observation system is complete, and the team has continued to process data, analyze data, and perform data analysis.

**University of Southern Mississippi – Mississippi State University**

*Sub-Award Agreement Summary:* The sub-award agreement was executed on April 14, 2020, between University of Southern Mississippi and Mississippi State University (Principal – Kevin Enroth, Director, Office of Sponsored Projects, DUNS 07-546-1814) for \$450,052.00. With these funds, MSU will perform research activities under its project titled “The distribution of submarine groundwater discharge and its effect on coastal water quality in Mississippi.” This project will use geophysical profiling, geochemical tracer surveys, and submarine groundwater discharge (SGD) sampling in the Mississippi Sound (MS) and Mississippi Bight (MB) to quantify the spatial distribution and temporal variability of SGD, as well as its chemical composition. The research evaluates the role of paleochannel features in mediating SGD distribution, the sources of chemically distinct SGD in the study area, and the effect of SGD on water quality with emphasis on nutrient loading and the onset of hypoxia. The results of this research will contribute to an improved understanding of the contribution of SGD to nutrient budgets and water quality degradation in the MS and MB. Additionally, they will constrain the spatial and temporal variability of this poorly understood nutrient transport pathway, which may inform improved management of water quality and the multiple commercial fisheries in coastal Mississippi. Finally, MSU anticipates that these data will be directly relevant to the multiple productive commercial finfish and shellfish fisheries in the study area, particularly oyster reef sustainability and the optimal siting of future oyster cultch deployments.

*Work Performed in the Current Reporting Period:* MSU continued to coordinate and conduct fieldwork, including joint excursions with other PIs. Processing and data analysis, including the integration of external data, also continued.

**University of Southern Mississippi – The University of Mississippi:**

*Sub-Award Agreement Summary:* The sub-award agreement was executed on April 23, 2020, between University of Southern Mississippi and The University of Mississippi (Principal – Renita L. Gray, Manager of Sponsored Programs Accounting, DUNS 06-774-3560) for \$442,941.00. With these funds, UM will perform research activities under its projects titled “Impacts of water quality on oyster development to inform oyster reef restoration and sustainability on the Mississippi Gulf Coast.” This project will integrate field, laboratory, and policy research on the impacts of low salinity, pH, dissolved oxygen, and harmful algal blooms on the early life stages of oysters in order to inform sustainable oyster reef restoration in Mississippi coastal waters.

*Work Performed in the Current Reporting Period:* UM continued to construct new landers and awaited sensors from manufacturers. Method development for gene expression analyses and multi-stressor experiments continued. Data analysis and processing continued



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**Annual All-Hands Meeting**

Given COVID restrictions, the 2021 annual All-Hands Meeting was held virtually on February 18 and 19, 2021. This meeting was an opportunity for the lead PIs of the respective institutions to present their work-to-date on Core-2, Core-1 analyses, and Competitive Research Award grants, as well as identify project coordination opportunities among the research institutions and projects. The All Hands Meeting brought together all of the Lead PIs and related researchers, the EAG, as well as representatives from MDEQ and MDMR to hear progress of the Core-2 and Competitive Research Programs, as well as understand outcomes of Core-1 research activities.

**FINANCIAL ELEMENTS**

**Award Recipient**

Recipient: Mississippi Department of Environmental Quality  
Award Amount: \$7,821,526.00  
Expenditures to Date: \$4,627,302.53  
Funds Leveraged: \$0.00

**Consortium Lead**

Sub-recipient: The University of Southern Mississippi  
Sub-award Amount: \$7,126,311.00  
Expenditures to Date: \$1,184,909.46  
Funds Leveraged: \$0.00

**Core Research Program (Core-1)**

Sub-recipient: The University of Southern Mississippi  
Sub-award Amount: \$561,370.41 (FINAL)  
Expenditures to Date: \$561,370.41 (FINAL)  
Funds Leveraged: \$0.00

Sub-recipient: University of Mississippi  
Sub-award Amount: \$593,215.44 (FINAL)  
Expenditures to Date: \$593,215.44 (FINAL)  
Funds Leveraged: \$0.00

Sub-recipient: Mississippi State University  
Sub-award Amount: \$600,255.88 (FINAL)  
Expenditures to Date: \$600,255.88 (FINAL)  
Funds Leveraged: \$0.00

Sub-recipient: Jackson State University  
Sub-award Amount: \$508,520.02 (FINAL)  
Expenditures to Date: \$508,520.02 (FINAL)  
Funds Leveraged: \$0.00

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Core Research Program (Core-2)

Sub-recipient: The University of Southern Mississippi  
Sub-award Amount: \$422,099.07  
Expenditures to Date: \$101,573.12  
Funds Leveraged: \$0.00

Sub-recipient: University of Mississippi  
Sub-award Amount: \$377,388.00  
Expenditures to Date: \$56,313.70  
Funds Leveraged: \$0.00

Sub-recipient: Mississippi State University  
Sub-award Amount: \$403,177.97  
Expenditures to Date: \$59,245.17  
Funds Leveraged: \$0.00

Sub-recipient: Jackson State University  
Sub-award Amount: \$232,402.00  
Expenditures to Date: \$54,607.79  
Funds Leveraged: \$0.00

Competitive Research Program

Sub-recipient: The University of Southern Mississippi  
Sub-award Amount: \$464,898.00  
Expenditures to Date: \$119,352.64  
Funds Leveraged: \$0.00

Sub-recipient: University of Mississippi  
Sub-award Amount: \$457,897.62  
Expenditures to Date: \$183,926.62  
Funds Leveraged: \$0.00

Sub-recipient: Mississippi State University  
Sub-award Amount: \$554,391.00  
Expenditures to Date: \$99,223.48  
Funds Leveraged: \$0.00

**Gulf Coast Ecosystem Restoration Council Elements**

*Relevant Synergies/Collaboration with other RESTORE funding streams*

In 2016, MDEQ included a \$3.5 million project titled “Pascagoula Oyster Reef Complex Relay and Enhancement” on its initial Mississippi State Expenditure Plan (RESTORE Act Oil Spill Impact Component). This project supports the restoration and protection of natural resources by relaying oysters from the Pascagoula Oyster Reef Complex (ORC) to harvestable reefs and enhancing the ORC.

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This project may include benthic habitat mapping, reef monitoring, and relay of oyster resources to increase productivity on harvestable reefs. The data collected from the MBACE-funded projects will help inform the outcomes of this project. MDEQ will coordinate the storing and analysis of the data to come out of various DWH-funded projects. This coordination will be key in leveraging results coming out of multiple projects and multiple funding mechanisms. MDEQ is still determining the next steps with this project and will coordinate with MBACE accordingly.

*Relevant Synergies/Collaboration with other DWH funding mechanisms*

In 2015, the National Fish and Wildlife Foundation Gulf Environmental Benefit Fund (NFWF GEBF) funded an \$11.7 million project to replenish and protect oyster populations in Mississippi through increasing oyster reef habitat acreage and productivity. Project components include experimental cultch deployment, contaminated cultch assessment, water quality analysis, oyster gardening, and data synthesis. Additionally, in 2019, NFWF-GEBF funded Phase II of this initial project that considers placement of cultch in areas determined by best available science suitable for oyster growth and tests hypotheses of oyster survival, mortality, and recruitment in these areas. The results from the various MBACE-funded projects will leverage the NFWF GEBF-funded findings to bolster new and relevant data regarding oyster populations in the Mississippi Sound. MDEQ is working very closely with the Mississippi Department of Marine Resources (MDMR), University of Southern Mississippi, and Mississippi State University on this project. Not only will the results from the multi-faceted NFWF GEBF-project inform future oyster research funded out of MBACE and vice versa, but the close partnerships with MDMR allow for this research to directly impact the management of Mississippi's marine shellfish resources. MDEQ is collaborating and coordinating with MSU to provide the benthic habitat mapping data from this NFWF project to help with swath bathymetry work that MBACE is undertaking.

*Opportunities*

MDEQ is constantly seeking opportunities for research and data acquisition to further the sustainable implementation of oyster restoration projects. Currently, MDEQ does not see any need for modifications to existing laws or program rules to improve the COE grant program. MDEQ engaged the COE Core-2 PIs and the Competitive Research Program PIs to initiate discussions on coordination of research activities and possible management implications for restoration.