Mississippi Department of Environmental Quality
FY 2024 Annual Report for the Centers of Excellence Research Grants Program (COE)
Grant Number RCEGR470433-01-00
10.1.2024 – 9.30.2025

EXECUTIVE SUMMARY

Brief Description of the Center of Excellence

The Mississippi Based Restore Act Center of Excellence (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. MBRACE's long-term Science Plan focuses on the State's directive toward sustainable coastal management through three major thrust areas: (1) monitoring and ocean observations, (2) modeling, and (3) process studies.

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. MBRACE continued working on three key All Hands Meeting Action Items: (1) Model Coordination; (2) Conceptual Model and Paper Development; and (3) Policy Brief. Follow-up work included coordinating and contributing to meetings with PIs and ESC, communicating via e-mail and calls, and text/figure review and revision. Regular e-mails and communications with EAG, ESC, and PIs and Leads continue on these topics.

PROGRAMMATIC ELEMENTS

Award Recipient

Treasury – MDEQ: Treasury issued the federal award to MDEQ on May 1, 2023. MDEQ will use MBRACE to implement the Centers of Excellence Research Grants Program. 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. 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. MDEQ prepared and submitted amendment #01 to Treasury to increase the Federal Award with the amount of de-obligated sub-recipient funds from Grant No. RCEGR470004. MDEQ also prepared and submitted amendment #02 in June 2025 to Treasury to increase the Federal Award for allowable purchase of a vehicle.

Award Sub-recipient/Consortium Lead

MDEQ – University of Southern Mississippi: The sub-award agreement was executed on July 7, 2023, between MDEQ and the University of Southern Mississippi (Principal – Marcia Landen) for $9,216,337.79 (modified). The sub-award was modified in June 2025 to add de-obligated sub-recipient funds from Grant No. RCEGR470004.

MBRACE was selected as the Mississippi's Center of Excellence under Bucket 5 of the RESTORE Act. The funds are being used to implement the MBRACE program. This program is conducting research and development on the Gulf Coast Region that focuses on science, technology, and monitoring. The mission of MBRACE 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 MBRACE conducted routine monitoring and reporting activities, including monthly reporting submittal and monthly status calls, and participated in routine meetings. MBRACE held the 2025 All Hands meeting in February 2025. This event featured presentations from funded researchers, highlighting key findings and their applications to coastal management and restoration. Panel discussions and breakout sessions fostered collaboration, ensuring that research outcomes align with the needs of decision-makers and coastal communities. The ESC meeting was held in March 2025 to discuss the EAG programmatic review of MBRACE and path forward for Principal Investigator and Directorate responses to the EAG. MBRACE staff attended key industry conferences and meetings to collaborate and ensure research outcomes.

In a prior reporting period, MBRACE accepted research proposals focused on understanding oyster reefs and their sustainability under the initial Core Research Program (Core-3) and proposals to address water quality and oyster resource needs under the Competitive Grants Program. These include:

Core Research Program (Core-3)

1. **Observations of Hydrodynamics and Water Quality**
   Mississippi State University (MSU)
   Principal Investigators: A. Skarke
2. **The Roles of Bacteria in Oyster Reef Sustainability**

University of Mississippi (UM)
Principal Investigators: M. Slattery

3. **Early Oyster Recruitment Limitation**
   The University of Southern Mississippi (USM)
   Principal Investigators: J.D. Wiggert, M. Kemal Cambazoglu, S. Milroy, C. Rakocinski
4. **Application of Gape Sensors to Characterize Oyster Behavior and Growth**
   Jackson State University (JSU)
   Principal Investigators: K. Ali, B. Thoma, A. Abu-El-Humos, H. Shih

Competitive Grants Program

1. **The Bacterial Environment of Mississippi Coastal Systems**
   University of Mississippi (UM)
   Principal Investigators: C. Jackson (UM)
2. **Transport and Fate of Bacterial Communities in Mississippi Coastal Ecosystems**
   Mississippi State University (MSU)
   Principal Investigators: N. Wisnoski (MSU)
3. **Satellite-based Virtual Buoy Observation Network as Water Quality Support Tool for Oyster Sustainability in Mississippi Sound**
   Mississippi State University (MSU)
   Principal Investigators: V. Martins (MSU), E. Sparks (MSU), J. Paz (MSU), U. Aires (MSU)
4. **Is Food Supply Adequate for Oyster Larvae in Mississippi Sound? Evaluation of Food Quality and Quantity Through Optical, Biochemical, and Biological Observations and Modeling**
   The University of Southern Mississippi (USM)
   Principal Investigators: X. Zhang (USM), E. Powell (USM), K. Mojica (USM)

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

Core Research Program (Core-3)

University of Southern Mississippi

Project Summary: USM's proposal for funding under the Core Research Program was approved for $749,679.00 for the project titled "Early Oyster Recruitment Limitation"; activities are being performed under the existing subaward between MDEQ and USM. These funds will be used to develop an interannual perspective on health of the oyster reefs of the Mississippi Sound and gain insight on long-term viability of Mississippi Sound and state of water quality conditions. A daily model application will be refined and extended to provide real-time environmental fields critical to interpret on-going sampling efforts of the MBRACE project teams and enable informed resource management decisions.

Work performed in the current reporting period: Model implementation continued through the reporting period, with the daily circulation model running continuously since June 2022. The university completed research on habitat suitability index (HSI) modeling of various age-classes of blue crab and

brown shrimp in response to multiple environmental stressors and prepared the final draft of the MS Thesis; presentation of the MS Thesis is scheduled during the next reporting period. Plankton and Larvae sampling continued throughout the reporting period. Deployment of spat settlement samplers and Milroy data sondes at eight sites located throughout the Mississippi Sound.

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 one sub-award agreement during the previous reporting period; the remaining subawards were executed in the current reporting period.

University of Southern Mississippi – University of Mississippi:

Project Summary: Project Summary: The sub-award agreement was executed on October 18, 2023, between the University of Southern Mississippi and the University of Mississippi (Principal – Mark Slattery, UEI - G1THVR8BNL4) for $592,211.00. With these funds, UM will perform research activities under its project titled "The Roles of Bacteria in Oyster Reef Sustainability." This project aims to understand temporal and spatial dynamics of bacterial water quality along the Mississippi Gulf Coast and the effect of bacteria on early life history stages of the oyster.

During the reporting period, the awardee completed three microbial sampling events and analyzed data. Conducted feeding and pathogenesis preliminary assays and began planning/coordination activities for the next round of sampling.

University of Southern Mississippi – Mississippi State University:

Project Summary: The sub-award agreement was executed on October 9, 2023, between the University of Southern Mississippi and Mississippi State University (Principal – Adam Skarke, UEI - NTXJM52SHKS7) for $582,110.00. With these funds, MSU will perform research activities under its project titled "Observations of Hydrodynamics and Water Quality." This project will integrate field sampling, remote sensing observations, and numerical modeling of water quality and hydrodynamic conditions in the western Mississippi Sound to constrain the spatiotemporal variability of water quality parameters with emphasis on freshwater inflow and oyster habitat suitability.

During the reporting period, the awardee continued work on hydrodynamic modeling development and calibration, laboratory analysis, and coordination and planning for field work. Fieldwork was conducted in August 2025. Staff continue conducting literature reviews, writing reviews, and validating models for Remote Sensing Reflectance using OLCI data.

University of Southern Mississippi – Jackson State University:

Project Summary: The sub-award agreement was executed on October 10, 2023, between the University of Southern Mississippi and Jackson State University (Principal – Joseph Whittaker, UEI - WFVHMSF6BU45) for a total of $616,000. The goal of this research is to utilize artificial intelligence to infer the health of oysters and assess the environment based on oyster gape behaviors. This will be achieved by collecting a substantial amount of data on oyster gape, obtained under controlled environmental conditions in both lab and field settings.

During the reporting period, the awardee continued development of the wet lab at Jackson State University and continued working on the programming of the cellular sensor system; completed the design and testing of a sensor system with local data storage; and continued planning activities for the upcoming sensor deployment.

Competitive Research Program

Activity under the Competitive Research Program began during the reporting period. MBRACE funded four projects through the Competitive Grants Program under the topic areas of (1) Water Quality, and (2) Oyster Reefs and their Sustainability. Projects are funded for two years (2023 - 2025). 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 $614,909.00; activities are being performed under the existing subaward between MDEQ and USM. With these funds, USM will perform research activities under its project titled "Is Food Supply Adequate for Oyster Larvae in Mississippi Sound? Evaluation of Food Quality and Quantity Through Optical, Biochemical, and Biological Observations and Modeling". This project will Integrate optical, biochemical and biological observation with a cutting-edge oyster larval model to identify, understand, and predict the nutritional constraints on oyster larvae performance as measured by survival, growth, and success at metamorphosis in the Mississippi Sound.

Work Performed in the Current Reporting Period: USM continued field experiments and fractionation of water samples including analysis of each size class.

University of Southern Mississippi – Mississippi State University

Sub-Award Agreement Summary: The sub-award agreement was executed on October 3, 2023, between University of Southern Mississippi and Mississippi State University (Principal – Kacey Strickland, Director, Office of Sponsored Projects, UEI - NTXJM52SHKS7) for $614,757.00. With these funds, MSU will perform research activities under its project titled "Transport and Fate of Bacterial Communities in Mississippi Coastal Ecosystems." This project will investigate the ecological mechanisms that influence the spatial

and temporal dynamics of bacterial communities in the Mississippi Sound, with a particular focus on the movement of materials and organisms across the land-ocean interface.

Work Performed in the Current Reporting Period: MSU hired a postdoctoral researcher to oversee sampling and data generation. Conducted extensive training with the PhD students for field ecology techniques including aquatic and soil microbial sampling, and sample transportation. Submitted a manuscript about the interaction of dispersal and biotic/environmental controls on patterns of diversity for peer review and continued detailed planning of the project.

University of Southern Mississippi – Mississippi State University

Sub-Award Agreement Summary: The sub-award agreement was executed on October 3, 2023, between University of Southern Mississippi and Mississippi State University (Principal – Kacey Strickland, Director, Office of Sponsored Projects, UEI - NTXJM52SHKS7) for $614,994.00. With these funds, MSU will perform research activities under its project titled "Satellite-based Virtual Buoy Observation Network as Water Quality Support Tool for Oyster Sustainability in Mississippi Sound." This project will develop a new support tool, called Satellite-based Virtual Buoy Observation Network, to characterize water quality using satellite observations at oyster reef sites across Mississippi Sound

Work Performed in the Current Reporting Period: During the reporting period, fieldwork was performed, and samples were analyzed. MSU continued to develop the SatBouy data portal. PhD student Cassia Caballero published a paper about the project task on Sentinel-3 Coastal Analysis Ready Data (S3CARD) on the Water Research Journal. PhD students Rejane and Cassia are working on the paper about satellite virtual station for MS coast.

University of Southern Mississippi – The University of Mississippi:

Sub-Award Agreement Summary: The sub-award agreement was executed on October 3, 2023, between University of Southern Mississippi and The University of Mississippi (Principal – Renita L. Gray, Interim Director of Sponsored Programs Administration, UEI - G1THVR8BNL4) for $614,986.00. With these funds, UM will perform research activities under its projects titled "The Bacterial Environment of Mississippi Coastal Systems." This project will provide a comprehensive assessment of the composition and function of bacterial communities in water and sediment along Mississippi Gulf Coast beaches, and what influences these bacterial communities.

Work Performed in the Current Reporting Period: The University continued sampling trips to collect samples for microbial community analysis. Samples were assayed for microbial activity and preserved for DNA extraction. Completed and submitted three manuscripts based on completed aspects of the project. Completed RNA transcriptome sequencing and began initial data processing. Continued

collaboration with core research staff continued, including microbial community analysis on water and sediment samples from CORE research sample sites.

Financial Elements

Award Recipient
Recipient: Mississippi Department of Environmental Quality
Award Amount: $9,669,541.79
Expenditures to Date: $2,758,231.61
Funds Leveraged: $0.00

Consortium Lead
Sub-recipient: The University of Southern Mississippi
Sub-award Amount: $8,998,034.00
Expenditures to Date: $2,575,800.35
Funds Leveraged: $0.00

Core Research Program (CORE 3)
Sub-recipient: Jackson State University
Sub-award Amount: $616,000.00
Expenditures to Date: $151,131.06
Funds Leveraged: $0.00

Sub-recipient: Mississippi State University
Sub-award Amount: $582,110.00
Expenditures to Date: $191,858.66
Funds Leveraged: $0.00

Sub-recipient: University of Southern Mississippi
Sub-award Amount: $749,679.00
Expenditures to Date: $147,525.69
Funds Leveraged: $0.00

Sub-recipient: University of Mississippi
Sub-award Amount: $592,211.00
Expenditures to Date: $59,913.76
Funds Leveraged: $0.00

Competitive Research Program
Sub-recipient: The University of Southern Mississippi
Sub-award Amount: $614,909.00
Expenditures to Date: $268,210.22
Funds Leveraged: $0.00

Sub-recipient: University of Mississippi

Sub-award Amount: $614,986.00
Expenditures to Date: $271,285.69
Funds Leveraged: $0.00

Sub-recipient: Mississippi State University
Sub-award Amount: $614,994.00
Expenditures to Date: $283,045.27
Funds Leveraged: $0.00

Sub-recipient: Mississippi State University
Sub-award Amount: $614,757.00
Expenditures to Date: $115,612.93
Funds Leveraged: $0.00

Gulf Coast Ecosystem Restoration Council Elements

Relevant Synergies/Collaboration with other RESTORE funding streams

Currently, MDEQ has 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 restoring oysters at the Pascagoula Oyster Reef Complex (ORC). This project includes benthic habitat mapping, reef monitoring, and deployment of oyster cultch materials to increase productivity on reefs. The data collected from the MBRACE-funded projects may help inform the outcomes of this project. In addition to oyster restoration efforts, MDEQ has obligated a significant amount of RESTORE funds through Buckets 1, 2, and 3 for water quality restoration, specifically the reduction of bacteria in coastal waters that are sourced from wastewater infrastructure. MBRACE included water quality as a focus area in the 2023 RFP for competitive research grants. As a result, research projects were selected that relate to bacteria composition, transport, and fate in Mississippi coastal waters. MDEQ will use these data results to help inform restoration efforts related to wastewater infrastructure repair and water quality enhancement.

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 MBRACE-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. MDEQ will coordinate the storing and analysis of data outputs from various DWH-funded projects. This coordination will be key in leveraging results from multiple projects and multiple funding mechanisms.

Opportunities

MDEQ routinely seeks opportunities for research and data acquisition to further the sustainable implementation of oyster and water quality restoration projects. Currently, MDEQ does not see any need for modifications to existing laws or program rules to improve the COE grant program. MBRACE, in coordination with the AL/MS Sea Grant, continued to build upon efforts to enhance *research to management* engagement.