Mississippi Department of Environmental Quality
FY 2019 Annual Report for the Centers of Excellence Research Grants Program (COE)
Grant Number 4 RCEGR470004-01-0002

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. 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. 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 established a five-person Executive Steering Committee (ESC) comprised of leadership from the four MBRACE universities. The ESC developed core research questions and a science plan relative to the COE eligible disciplines. The science plan guides the Core Research Program conducted by MBRACE. A Call for Proposals to fund research under the Core Research Program was developed to solicit proposals from MBRACE universities. Proposals submitted by the University of Southern Mississippi, the University of Mississippi, Mississippi State University, and Jackson State University have been approved, and the sub-award agreements have been executed. Research activity under each sub-award agreement is underway; a summary of activity for each sub-award is provided below.

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 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.

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.

MBRACE was selected as the Mississippi's Center of Excellence under Bucket 5 of the RESTORE Act. 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. 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. 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. A Key Personnel Change occurred; effective May 1, 2019, Dr. Kelly Darnell assumed the role of Principal/Lead Investigator for The University of Southern Mississippi/MBRACE. MDEQ submitted an amendment request to the U. S. Department of the Treasury to extend the period of performance, extend the Core Research Program, and implement the Competitive Research Program; this request was under Treasury review as of September 30, 2019.

The MBRACE ESC finalized the Science Plan and submitted it to the U.S. Department of the Treasury during the prior reporting period. MBRACE'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 to the External Advisory Group (EAG) during the reporting period. MBRACE finalized an agreement with Texas A&M University to perform data management services; data management activities were underway as of September 30, 2019. 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.

MBRACE's monitoring strategy for Core Research Program sub-recipients was finalized in a prior reporting period.

Proposals approved under the Core Research Program focus on understanding oyster reefs and their sustainability. MBRACE 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
   Principal Investigators: R. Moorhead, P. Dash, A. Skarke
2. **Abiotic and Biotic Influences on Current and Historic Distributions of Oyster Reefs**
   University of Mississippi
   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
   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
   Principal Investigators: K. Ali, F. Tuluri, H. Shih, R. Kafouri

Core Research Program

University of Southern Mississippi

Project Summary: USM's proposal for funding under the Core Research Program was approved for $625,000; activities are being performed under the existing subaward between MDEQ and USM. These

funds are being used for research on the sustainability and restoration of oyster reef habitat in the Mississippi Sound. The University of Southern Mississippi continued work on their project titled "Sustainability and Restoration of Oyster Reef Habitat in Mississippi Sound: A Larval Transport and Recruitment Approach."

Work performed in prior reporting periods: University of Southern Mississippi researchers began collecting ocean current data using stations in Waveland and Pass Christian, Mississippi, and researchers began implementing plankton sampling. University of Southern Mississippi researchers collected CODAR ocean current data using stations in Waveland and Pass Christian, Mississippi. Additional activities included completing planned baseline mapping, development of sediment transport models and circulations models, plankton and larvae sampling, as well as model simulations.

Work performed in the current reporting period: The University made several field trips over the reporting period as well as initiated and continued sample processing including zooplankton samples. Data analytical work was undertaken tied to the model assessment and validation, including CODAR data collection, continuing to process bathymetric and backscatter data sets, and coordinating data between PIs and institutions.

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 the 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 are being 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.

Work performed in prior reporting periods: The University of Mississippi began work on their project titled "Abiotic and Biotic Influences on Current and Historic Distributions of Oyster Reefs" Researchers coordinated with University of Southern Mississippi to submit a joint "MDMR Scientific Research Permit" application form. Permit # SRP-035-17 was approved and issued on September 8, 2017. Additional activities included transferring oyster broodstock from University of Southern Mississippi Gulf Coast Research Lab to University of Mississippi and collecting water and sediment samples. The University of Mississippi deployed the landers at each of the designated sites, water quality samples were collected, and the biomarker oysters that had been deployed earlier were retrieved and processed. A summer exposure experiment

also took place. All landers have been retrieved that could be found and the University is currently in the data analysis phase, analyzing raw data, and continued data collection of clearance rates and hemocyte samples from summer exposure experiment. Additionally, data was collected from the Bonnet Carre spillway opening in May, 2018.

Work performed in the current reporting period: The University of Mississippi made several trips into the field over the reporting period retrieving landers, deploying landers, as well as coordinating with Jackson State University. Continued biological sample processing occurred including completed RNA extraction / collected cDNA of tissue samples to be used for gene expression analysis. Additionally, new assays for detecting multiple proteins and biological pathways were tested, as well as sample processing and analyses occurred from deployments.

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 are being used for research on the influence of water quality and benthic habitat conditions on the health of oyster reefs in the Mississippi Sound.

Work performed in prior reporting periods: Mississippi State University began work on their project titled "Water Quality and Benthic Habitat Observations for Enhanced Understanding and Sustainable Management of Oyster Reefs in the Mississippi Sound." Laboratory supplies were purchased and the procurement process for necessary field equipment was initiated. MSU worked on the development of UAS and satellite algorithms and tested various data acquisition protocols. Several in-field measurements and data collection efforts were undertaken, including the collection of water quality data using both in-situ and remote sensing sensors (data being analyzed for relationships between sensors and in-situ water quality parameters). Several other data parameters were collected including chirp sub-bottom profilers data, as well as the initiation of several data analysis streams including processing of MSI/HIS imagery, examination of side-sonar data, and continued collection of water samples and testing for algal components, organic and inorganic sediments, and absorption. Additionally, data was collected from the Bonnet Carre spillway opening in May, 2018.

Work performed in the current reporting period: MSU undertook several field surveys in which they collected their suite of water quality variables, biological samples, and imagery. MSU continued to work on improving the remote sensing algorithms, as well as stood up several collaborations between this research work and USM investigators on submarine groundwater discharge data and providing access to data in support of MBRACE goals. MSU also continued to process MSI/HIS imagery and associated data to obtain reflectance of the water and thus produce algorithms for water quality determination.

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 are being 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.

Work performed in prior reporting periods: Jackson State University began work on their project titled "Monitoring, Mapping, and Visualization of Oyster Reefs Habitat in the Mississippi Gulf Coast." The University performed research on the experimental setup by developing a waterproof setup, testing underwater connectors and battery enclosure, testing battery longevity under different software settings, starting Wi-Fi ready code development, starting GSM/GPRS code development, and starting sensor calibration and linearization. JSU tested the sensor systems and developed the code and hardware needed for project implementation. Late summer oysters were selected and transferred into experimental tanks and sensors were installed. Data acquisition started on collected oysters analyzing for a spawning event, working on various power consumption scenarios with the individual sensors, and completing the build out of a cellular sensor system for remote data transfer.

Work performed in the current reporting period: The University continues to refine and complete construction and refinement on the underwater sensor, as well as 6 Underwater time release mechanisms, in preparation for deployment with University of Mississippi. The Underwater Sensor as well as the underwater release mechanism had to be redesigned to be more efficient in the field, to fit the lander appropriately, as well as redesigned to have minimal moving parts.

Competitive Research Program and Continuation of Core Research Program

In June 2019, MBRACE issued a Request for Proposals (RFP) soliciting proposals from the four consortium universities (Jackson State University, Mississippi State University, University of Mississippi and University of Southern Mississippi) for implementation of the Competitive Research Program and continuation of the Core Research Program. Approximately $1.4M will be available to fund three (3) awards under the Competitive Research Program and approximately $1.4M will be available to fund one (1) award under the Core Research Program, which will build on prior research. Proposals were accepted in July 2019 and were under review as of September 30, 2019.

Annual All-Hands Meeting

The annual All-Hands meeting was held at Jackson State University on August 22-23, 2019.. This meeting was an opportunity for the lead PIs of the respective institutions to present their research to the larger Center of Excellence group, hear from the state agencies (MDEQ and MDMR) to restoration priorities and research needs, as well as hear from the External Advisory Group. 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 Research Program, as well as understand how the various PI components fit together for the Core Research Proposal II. It was clear that Core Research Proposal II was a more synergistic effort between the four MBRACE institutions and that collectively better understanding of coastal ecosystems, specifically around oysters will begin to materialize. Additional topics of discussion included: Core Research Program project updates; data management and entry into GRIIDC; data synthesis and integration; State needs to support restoration; and feedback provided by the EAG.

Financial Elements

Award Recipient

Recipient:	Mississippi Department of Environmental Quality
Award Amount:	$4,036,236.00
Expenditures to Date:	$1,584,894.64
Funds Leveraged:	$0.00

Consortium Lead

Sub-recipient:	The University of Southern Mississippi
Sub-award Amount:	$3,442,337.00
Expenditures to Date:	$426,077.53
Funds Leveraged:	$0.00

Core Research Program

Sub-recipient:	The University of Southern Mississippi
Sub-award Amount:	$658,033.50
Expenditures to Date:	$285646.87
Funds Leveraged:	$0.00

Sub-recipient:	University of Mississippi
Sub-award Amount:	$658,033.50
Expenditures to Date:	$234,651.24
Funds Leveraged:	$0.00

Sub-recipient:	Mississippi State University
Sub-award Amount:	$658,033.50
Expenditures to Date:	$299,848.02
Funds Leveraged:	$0.00

Sub-recipient:	Jackson State University
Sub-award Amount:	$658,033.50

Expenditures to Date: $50,071.66
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. 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 MBRACE-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 MBRACE 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. 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. Not only will the results from the multi-faceted NFWF GEBF-project inform future oyster research funded out of MBRACE 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 MBRACE 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.