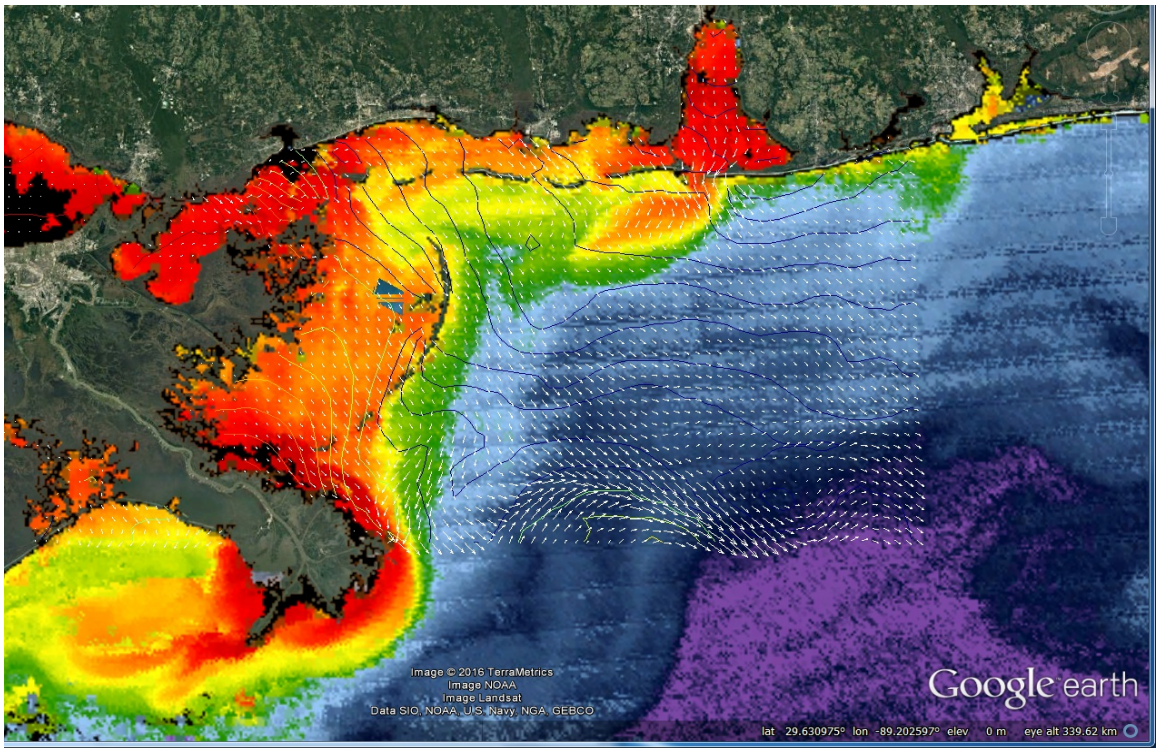
Mississippi Based RESTORE Act Center of Excellence

Science Plan



February 15, 2017

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Cover photograph, Mississippi Bight backscattering and surface currents, April 3, 2016, courtesy of Robert A. Arnone, Ocean Weather Laboratory, School of Ocean Science and Technology, Division of Marine Science, The University of Southern Mississippi, Stennis Space Center, Mississippi.

Recommended citation:

Bernard, L., Stanic, S., Wiesenburg, D. 2017. Mississippi Based RESTORE Act Center of Excellence Science Plan, School of Ocean Science and Technology, Division of Marine Science, University of Southern Mississippi, Stennis Space Center, Mississippi, 19 p.

MBRACE Science Plan

Executive Summary

The Resources and Ecosystem Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act) established within each Gulf state "Centers of Excellence to conduct research only in the Gulf Region" to "focus on science, technology and monitoring" within the five research disciplines listed in the Act. The State of Mississippi designated the Mississippi Based RESTORE Act Center of Excellence (MBRACE) as their Center of Excellence. MBRACE is a consortium of Mississippi's four research universities – Jackson State University (JSU), Mississippi State University (MSU), University of Mississippi (UM), and The University of Southern Mississippi (USM), which serves as the lead institution for MBRACE.

MBRACE will use comprehensive science and develop a technology-based understanding of the effects of chronic and acute stressors, both anthropogenic and natural, on the dynamic and productive waters and ecosystems of the northern Gulf of Mexico. MBRACE's integrated broad-based research strategy will focus on Mississippi's directive towards sustainable coastal management and work within each of the RESTORE Act Centers of Excellence discipline areas. The general research needs within these five discipline areas will include:

- Developing a detailed understanding and forecasting of the processes fundamental to the Mississippi ecosystems.
- Assessment and monitoring of the physical and biological parameters in the Northern Gulf of Mexico as it relates to Mississippi waters.
- Technology-based mapping and sea floor exploration to understand potential oil and gas exploration and production.
- Developing an understanding of the effects of event-driven impacts such as storms and geologic events on the Mississippi economy.
- Develop new, vertically structured, integrated ocean monitoring and observing technologies and data processing strategies to enable improved ecosystem knowledge and predictions.

To execute this research strategy and address the identified scientific needs, MBRACE will focus on the following three major thrust areas: monitoring and ocean observations, modeling, and process studies. The initial core research process study has been identified and will concentrate on understanding oyster reefs and their sustainability.

With a sound and broad-based research strategy, MBRACE scientists will advance our fundamental understanding of the important scientific processes and provide measurements and models to guide aspects of the restoration process. In addition, the development of long-term, scientifically based datasets will allow an assessment of ecosystem changes and variabilities that may have a significant impact on the marine resources available to the citizens of Mississippi.

This science plan provides guidance on the use of Center of Excellence research funds and outlines a broad-based research strategy that focuses on the areas identified in the RESTORE Act Center of Excellence discipline areas.

MBRACE Science Plan

I. Background

Mississippi's coastline is a geological and oceanic environment that has a unique composition controlled by numerous coupled physical and environmental processes. The Mississippi coast is characterized by a shallow-water shelf that extends offshore for approximately 150 km, with depths less than 30 m. A set of barrier islands approximately 16 km offshore separates the offshore waters from the coast. Behind these islands, the very shallow (<5 m) Mississippi Sound waters are influenced by offshore shelf, open water and numerous terrestrial inputs. The geology of the sound is characterized primarily by loose sediments, such as sand and mud. The coastal areas are also constantly being reshaped by the actions of rivers, waves, currents, tides, winds, tropical cyclones, and manmade events such as channel dredging, oil exploration, and oil spills. Gulf offshore waters are characterized by the dynamic Loop Current and warm core rings. These clear, salty, oligotrophic waters impact local weather bringing periodic fluxes of salty water across the shelf and into the Sound.

Waves in these coastal waters gather their energy and momentum from winds blowing over large expanses of the Gulf. This energy is dissipated on the barrier islands and in the region between the barrier islands and the coastal mainland. These breaking waves create nearshore currents that flow along the coastline and around the barrier islands and are responsible for the chaotic turbulence which moves and suspends sediments, controls water quality, and disperses nutrients. The shelf and Sound waters are influenced by multiple freshwater river outflow fluxes from the Biloxi, Pearl, Mobile, Pascagoula, and Mississippi Rivers. These freshwater fluxes have a strong impact on buoyancy-driven circulation and currents as they interact with the denser salt water. The interaction of these different water masses with land runoff and river discharges impacts the entire marine ecosystem (Dean and Dalrymple 2004; Nielson 1992).

The tidal inlets between the barrier islands provide an avenue for the exchange of water during tidal cycles. Wind events and tidal currents flush the sound of sediments and pollutants and help maintain water quality and salinity levels needed for a healthy aquatic environment. The freshwater discharge, along with wind and tidally driven currents, have a complex interaction with the alongshore currents and create complex hydrodynamic fields between the barrier islands, the coastline, Mobile Bay, and the areas on the western side of the Mississippi Sound. The associated advective and mixing processes affect the distribution of hypoxia zones, freshwater plumes, ocean acidification, and chlorophyll levels. It is the large- and small-scale fluctuations of these oceanographic and biological parameters that are the ecological drivers in this coastal area.

The mathematical and statistical equations governing the movement of sand and currents in these areas are complex. The lack of comprehensive oceanographic, geological, and biological measurements in Mississippi's coastal regions make it difficult to develop and verify models for both long- and short-term coastal predictions. Both the microscale and macroscale processes must be measured and modeled. Currently the macroscale process is the most useful since detailed physics of coastal processes are being unraveled. The ultimate goal is the integration of both the micro- and macroscales and the development of verified environmental, biological, and hydrodynamic models that describe these coastal processes.

II. Introduction

On April 20, 2010, an explosion, subsequent fire, and sinking of the Deepwater Horizon (DWH) mobile drilling unit killed 11 workers and triggered a massive release of oil from British Petroleum's (BP) Macondo well located about one mile below the ocean surface and about 80 km offshore. Initial efforts to cap the well following the explosion were unsuccessful, and for 87 days after the explosion, the well spewed oil and natural gas uncontrollably into the northern Gulf of Mexico (Gulf). Currents, winds, and tides carried these surface oil slicks north to the Gulf states, fouling more than 2,000 km of shoreline. These areas included beaches, bays, estuaries, and marshes from eastern Texas to the Florida Panhandle. Extensive discussions of these environmental effects are outlined in Blancher et al. 2016, DHNRDAT 2016, NOAA 2016, Venn-Watson et al. 2015, Schwack 2014, Ackleh 2012, USCG 2011, Gubbay and Earll 2000, OSB 2000.

As a result of this oil spill, the President, on July 6, 2012, signed into effect the Resources and Ecosystem Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2011 (RESTORE Act). The Act established the Gulf Coast Restoration Trust Fund in the U.S. Department of Treasury and directed 80% of the civil penalties paid after July 6, 2012, under the Federal Water Pollution Control Act in connection with the DWH oil spill, to be deposited into the Trust Fund and invested. As part of this Act, 2.5 % of funds will be dedicated to the establishment of Centers of Excellence in each of the five Gulf Coast states, with Mississippi receiving approximately $26 million over 15 years (MDEQ 2016).

The Mississippi Based RESTORE Act Center of Excellence (MBRACE) is a consortium of Mississippi's four research universities, Jackson State University (JSU), Mississippi State University (MSU), University of Mississippi (UM), and The University of Southern Mississippi (USM), which serves as the lead institution for MBRACE. MBRACE has been designated by the U.S. Department of Treasury and the Mississippi Department of Environmental Quality as the RESTORE Act Center of Excellence for the State of Mississippi under Grant No. RCEGR470004-01-00 from the U.S. Department of Treasury. MBRACE represents a broad cross-section of participants with demonstrated

ability, interest, and expertise in science, technology and monitoring that will focus on the five RESTORE Act Center of Excellence (CoE) disciplines:

A. Coastal and deltaic sustainability, restoration and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast Region.

B. Coastal fisheries and wildlife ecosystem research and monitoring in the Gulf Coast Region.

C. Offshore energy development, including research and technology to improve the sustainable and safe development of energy resources in the Gulf of Mexico.

D. Sustainable and resilient growth, economic and commercial development in the Gulf of Mexico.

E. Comprehensive observation, monitoring, and mapping of the Gulf of Mexico.

MBRACE is establishing a science program utilizing funding from the Trust Fund to develop the most effective science-based programs utilizing the expertise of the four research universities. MBRACE is establishing two peer-reviewed programs: 1) a Core Research Program to fund activities that cross the discipline areas and include all four universities, and 2) a Competitive Grants Program that will allow investigators from at least two of the four universities to propose collaborative original research projects that addresses at least one of the five CoE discipline areas.

III. MBRACE Mission and Goals

Mission

MBRACE, a consortium of Mississippi's research universities, seeks 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 and seeks to facilitate sustainable use of the Gulf's important resources.

Goals

MBRACE will: (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.

IV. RESTORE Act Center of Excellence Discipline Areas and Mississippi's Integrated Research Strategy and Needs

Working within the CoE discipline areas, MBRACE will support a broad-based research strategy that is directly related to Mississippi's marine environment. This strategy will address ocean and coastal system dynamics and their interactions with the complex natural and human environments. This research strategy outlines a comprehensive and integrated observing, monitoring, mapping, and modeling program needed to develop an understanding of the watershed discharge, ecosystem dynamics, boundary conditions, and controlling forces in the northern Gulf. In addition, the development of long-term, scientifically based data sets will allow an assessment of ecosystem changes that may have a significant impact on the marine resources available to the citizens of Mississippi. MBRACE's strategy will focus on Mississippi's directive towards understanding Mississippi's variable coastal and offshore ecosystems and marine resources. MBRACE will focus on the following integrated research strategies and needs:

A. Discipline

Coastal and deltaic sustainability, restoration and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast Region.

Research Needs

- Develop a comprehensive understanding of the productive northern Gulf ecosystem, including human impacts, and the variabilities related to environmental forcing functions.
- A detailed understanding and forecasting of the processes impacted by restoration projects, e.g., water quality changes, changes in biological community structure (birds, fish and shellfish, mammals, turtles), shoreline erosion, substrate stabilization associated with oyster restoration, marsh creation, coastal stream improvements, and living shorelines.
- Assess freshwater inflows (timing, duration, quality) and associated sedimentation.
- Improvements in all aspects of human health issues via increased ecosystem services.
- Identify seasonal trends and atypical conditions in water quality using observations which will be used to establish baseline conditions along Mississippi's coastline.

B. Discipline

Coastal fisheries and wildlife ecosystem research and monitoring in the Gulf Coast Region.

Research Needs

- Identify priority research issues for fishery and wildlife resources.
- Assess and monitor the physical and biological parameters in the Mississippi Sound and adjoining coastal regions to develop an understanding of the environmental driving forces on human health, fishery production and sustainability, and wildlife and ecosystem health.
- Integrate observation and monitoring efforts to address priority coastal fisheries and wildlife research issues.

C. Discipline

Offshore energy development, including research and technology to improve the sustainable and safe development of energy resources in the Gulf of Mexico.

Research Needs

- Conduct technology-based mapping and sea floor exploration to understand potential oil and gas exploration and production activities that could impact Mississippi's economy and resources.
- Systematic habitat mapping before and after exploration and production to provide a baseline and understanding of the spatial and temporal changes that affect the ecosystem of coastal Mississippi.
- Monitor fisheries and other biological resources associated with oil and gas structures to more accurately define ecological interactions and assess the effects of anthropogenic perturbations.
- Integrate permanent observational systems on platforms and structures to assess hydrological processes and potential implications of oil and gas activities on recruitment dynamics of economically important species.

D. Discipline

Sustainable and resilient growth, economic and commercial development in the Gulf of Mexico.

Research Needs

- Community outreach and green infrastructure planning in urban areas.
- Integration with the Governor's Oyster Restoration and Resiliency Council activities.

- Develop an understanding of the effects of event-driven impacts, such as storms and geologic events, e.g., new oil and gas seeps, oil spills, and other incidents, on the Mississippi economy.
- Develop new and unique visualization tools and spatial data products for scientists, the public, and decision-makers that can also be used to provide a platform for predictive analysis.
- Integrate social and economic drivers with new data and technological resources.
- Support development of integrative computational tools for use in coastal resource Management Strategy Evaluation approaches.

E. Discipline

Comprehensive observation, monitoring, and mapping of the Gulf of Mexico.

Research Needs

- Identify and fill the gaps in ongoing regional observation, monitoring and mapping programs to more precisely understand ecological interactions between coastal Mississippi waters and the adjacent Gulf, particularly as those relate to recruitment dynamics and hydrological processes.
- Broad-scale benthic mapping within Mississippi coastal waters to delineate oyster reefs and areas for potential reef restoration.
- Identify essential fish habitat for fishery resources and critical habitats for protected species.
- Integrate advanced acoustic technology into traditional and expanded monitoring efforts to more accurately assess fishery production and ecosystem components.
- Develop new, vertically structured integrated ocean monitoring and observing technologies and data processing strategies to enable improved ecosystem knowledge and predictions.
- Use these observing systems and model developments to provide a better understanding of restoration project impacts to the coastal Mississippi ecosystem.
- Identify seasonal trends and variabilities in water quality using observations which will be used to establish the baseline conditions along the Mississippi coastline.
- Identify harmful algal blooms (HAB) that will affect human health and fisheries.

V. Comprehensive Scientific Approach

As Mississippi prepares to invest heavily in coastal restoration, the fundamental knowledge required to understand how hydrodynamic, environmental, and biological forcing functions impact coastal ecosystems through circulation patterns, sediment transport, and water quality in the Mississippi coastal waters is lacking. This broad-based integrated research strategy will be a *foundational* step in identifying critical observational data gaps needed to support and implement an interdisciplinary modeling framework designed to address Mississippi's directive towards sustainable coastal and nearshore ecosystems and resources. To address the research objectives in the CoE discipline areas, MBRACE will focus on three major thrust areas:

(a) Monitoring and Ocean Observations

A complete and comprehensive understanding of the parameters that control these coastal processes and their forcing functions is not readily available. By monitoring the amplitudes and the spatial and temporal scales of these processes, state and federal agencies will be able to design resource management plans that will be implemented in the event of hurricanes, oil spills, climatic changes, and environmental variabilities. Climatic changes include seal-level rise, changing weather patterns resulting from increasing global temperatures, and ocean acidification due to the increasing concentrations of greenhouse gases in the atmosphere. Environmental variabilities include seasonal variations in water quality (biological, suspended sediments, nutrients), terrigenous river flux, waves, precipitation, etc. The sea level rise issue is further complicated by the fact that coastal Mississippi is undergoing subsidence. Rapid detection of atypical biological parameters is required to successfully address any resulting public health needs. Unless environmental and oceanographic parameters are measured on appropriate temporal and spatial scales, the efficiency and success of management practices cannot be evaluated.

Currently, Mississippi's coastal and offshore environmental data collection is limited to sets of instrumented monitoring sites deployed by the U.S. Geological Survey (USGS), the Mississippi Department of Marine Resources (MDMR), and the Mississippi Department of Environmental Quality (MDEQ). Sporadic observations by a number of other entities are limited to specific research projects and surface satellite observations. Currently there is no complete set of coupled surface and subsurface time-series circulation measurements. Thus, there is a critical need for a comprehensive environmental measurement and monitoring program to capture data from the coupled surface and subsurface coastal circulation of the Mississippi coastal waters. Circulation in coastal waters is extremely dynamic as a result of the exchange and interaction of river waters, offshore shelf, and open waters of the Gulf. These data will provide a comprehensive environmental, biological, and hydrodynamic data baseline against which future measurements of environmental conditions and variabilities will be compared. These measurements will provide data on the various temporal and spatial scales of

coastal oceanographic and biological variabilities and form the basis for the development of numerous environmental, oceanographic, hydrodynamic, and ecosystem predictive models.

A comprehensive knowledge of the long- and short-term circulation scales will also enable biological researchers to more clearly understand the potential impacts that changing environmental and oceanographic forcing functions will have on numerous species of fish and shellfish populations in the Mississippi Sound. Data from these observations will be used to make scientifically justified decisions that will enable coastal resource managers and economic planners to implement policies to mitigate any impacts on the marine coastal environment and public health issues.

The Mississippi coastal waters impacting the local ecosystem are influenced by multiple dynamic processes. These include tides and water mass exchange across the Mississippi shelf that is influenced by the Mississippi River plume and offshore waters from the Loop Current. These dynamic processes along the Mississippi coast can be monitored to determine how they affect the coastal ecosystem. Ensemble measurements provide an ability to define the uncertainty in coastal processes that are used for adaptive sampling along the Mississippi coast. Examples of other important measurements include river plume advection and water quality parameters.

Ocean color from satellites can provide a capability for monitoring the bio-optical properties of the water masses and can track the changing water quality conditions related to river discharge, sediment resuspension from tidal changes, and offshore shelf transport. Satellite bio-optical and physical properties affecting the ecosystem include: colored and discolored organic matter, salinity, sea surface temperature (SST), optical layers, suspended sediments, organic and inorganic particles, euphotic depth, and subsurface light levels. Satellite algorithms for ecosystem products can be tuned using *in situ* measurements and optimized for the Mississippi coastal waters. Optimization includes calibration and validation of the spectral satellite channels for ocean color and SST using *in situ* bio-optical and physical properties. The integration of satellite, ecosystem biophysical models and *in situ* observations can provide a daily monitoring of the ecosystem including the detection of HAB. Following the seasonal changes in dynamic coastal processes will help identify atypical regions and events along the Mississippi coast that will support enhanced living resource production.

(b) Modeling

The modeling framework will be designed to understand the complexity and impact of restoration efforts such as marsh creation and preservation, artificial reef placement, support of beach nourishment, and living resource restoration and production. Importantly, ecosystems do not stop at state borders, and a modeling approach will also help understand any effects that restoration efforts in neighboring states might have.

The modeling framework will be implemented using a Phase Approach Methodology. The baseline Phase 1 will deliver the capability for watershed hydrology and nearshore circulation modeling for sediment, nutrients (nitrogen and phosphorus), salinity, and circulation; Phase 2: addition of particle tracking for larval transport (e.g., oysters); Phase 3: addition of landscape models to accommodate terrestrial projects (e.g., nutrient management practices and stream bank restoration); Phase 4: addition of more living marine resource assessments; Phase 5: addition of sediment transport (e.g., with barrier islands, etc.); Phase 6: addition of brown water to blue water modeling; and Phase 7: addition of higher trophic level modeling. Data generated during each phase will be useable by decision-makers.

The modeling framework will provide a coupled hydrologic and hydrodynamic framework where distributions of suspended sediment, nutrients, dissolved oxygen and other key water quality parameters can be added. The framework's ability to simulate circulation will also assist in the design and construction of restoration projects. By exploring various inflow scenarios, model-generated projections will deliver guidance on how best to implement living resource restoration through site selection assessments that offer objective justification of coastal management expenditures. Accurate numerical simulation of the nearshore and inner shelf 4-D hydrodynamics is critically important and will provide the knowledge required to develop: 1) reliable resource management plans; 2) meaningful, scenario-based projections of anthropogenic and climate change impacts on the marine ecosystem; 3) adaptive observing-system deployments; and 4) effective coastal restoration efforts for the Mississippi Gulf Coast region.

(c) Process Studies

Process studies will also be undertaken to understand the mechanisms and process rates required to understand the physics of the oceanographic and environmental driving forces and how they control the variability of the various stages of Gulf region health. This understanding will identify how these mechanisms control oceanographic variabilities, marine habitats, food availability, and survival (Logerwell et al.). Process studies are also needed to determine the functional form of numerous biophysical processes and models (Megrey and Hinckley 2001).

Initial Core Research Program (Understanding Oyster Reefs and Their Sustainability)

Oyster reefs serve as an integral part of the ecology, economy and heritage of coastal communities in Mississippi. Over the past decade, natural and anthropogenic events have impacted those resources and caused significant reductions in oyster landings and productive oyster habitat in general. Commercial landings in Mississippi have declined from more than 400,000 sacks in 2004 to less than 27,000 sacks in 2015. Recent management discussions have included debates on whether a commercial season was even viable given the low population levels. The State of Mississippi has prioritized oysters as a key component for ecological restoration and economic development and

through the Governor's Oyster Restoration and Resiliency Council (MDMR 2015), has investigated specific economic, technological, and environmental needs and concerns. It is the intent of MBRACE to focus its initial scientific Core Research program on understanding oyster reefs and their sustainability.

Science-based needs as they relate to oyster sustainability in Mississippi and the north-central Gulf are diverse in scope and discipline, ranging from hydrological and sedimentation processes that influence larval recruitment and reef persistence to seasonal ecological factors (such as predators and disease) affecting oyster survival and growth. Basic knowledge such as benthic habitat characteristics and oyster production metrics can be improved through scientific investigation. This will promote sustainable oyster reefs through the identification of suitable benthic habitats for reef restoration efforts and appropriate survey and assessment strategies for oyster production. Also, critical to the sustainability and success of oyster reefs is a solid understanding of the hydrodynamic and sediment transport processes that impact oyster health, the food web structure and dynamics of the oyster populations, the impact of multiple stressors on oyster reef habitat quality and quantity, and the connection between restored oyster reef habitats and the living coastal and marine resources that use those habitats. Scientific investigation is also required to understand the interdependency of long-term success of shoreline protection and locations suitable for oyster reef sustainability. Specific research areas include, but are not necessarily limited to:

- Benthic habitat mapping repeated at sufficient intervals to determine spatial and temporal variations in substrate types and firmness.
- Hydrological monitoring and modeling to assess effects from riverine freshwater discharge, associated sedimentation/erosion patterns, and seasonal HAB and hypoxia events.
- Local-scale reef biological and ecological conditions, such as baseline oyster population dynamics, shell budget metrics, fine-scale water quality/chemistry parameters, and temporal influences of predators, parasites and diseases.
- Ecosystem modeling to assess local and uplands land use and associated anthropogenic stressors (i.e., pollution), loss of wetlands and barrier islands (water quantity/retention), annual commercial harvesting effects, seasonal ecological influences (e.g., salinity, sedimentation, and symbionts), and climate-associated factors.
- Monitoring and forecasting oyster reef water quality.
- Restoration strategy evaluations, including stock assessment approaches and cost-benefit analyses of reef creation materials (cultch type) as they relate to oyster productivity, shell budget and reef persistence.

To support this research assessment, MBRACE will fund research programs to (a) assess the research area using remote sensing technologies, (b) develop and deploy physical and biological sensors and underwater optical cameras, (c) conduct surveys using

autonomous vehicles and standard field-based sampling techniques, (d) when appropriate, utilize these data to model abiotic and biotic factors that enhance oyster reef success, and (e) develop adaptive models that will enable remote vehicles to quickly ascertain water quality. These high-resolution data sets will also be used to develop decision-making tools for restoration managers utilizing the latest geospatial technologies. New oyster reef locations will be assessed for potential stressors that are inherent to the site or are likely to occur (e.g., pathogens, eutrophication, hydrocarbons, climate change stressors, etc.). It will then be possible, using state-of-the-art molecular and biochemical assays, to develop an understanding of the impacts these stressors have on the physiological condition of adult and larval oysters. In addition, MBRACE will fund research to assess the biodiversity associated with healthy oyster reefs. This will determine their importance as Essential Fish Habitats and the economic benefits and social science of these resources.

The initial focus of MBRACE on oyster-related research needs will enable the State to leverage multiple funding sources to maximize the scientific output of its restoration and assessment activities through collaborative, but not duplicative, efforts. Projects such as the BP Early Restoration *Mississippi Oyster Cultch Restoration Monitoring* (MDEQ 2015) and National Fish and Wildlife Foundation *Oyster Restoration and Management* studies, in addition to recent state-supported advances in oyster aquaculture developments, will provide critical links which can be integrated with MBRACE's RESTORE CoE broad ranging science program. These efforts will support the development of a comprehensive, science-based oyster monitoring and assessment plan to help guide the State in efficiently addressing its ecological- and economic-based restoration priorities.

VI. Policies and Procedures

(a) Data Management and Quality Control

As stated in the U.S. Department of Treasury Notice of Award for the Mississippi Based RESTORE Center of Excellence (MDEQ 2016), there is a need for a comprehensive mechanism to preserve, discover, and access data and information resulting from research activities funded through RESTORE. This mechanism will facilitate multiple uses of the data while minimizing duplication of effort and maximizing the return on the investment made by the government and various agencies. Much funding has been expended by the federal government on data and information sharing and MBRACE intends to adopt the NOAA RESTORE Science Program's Data and Information Sharing statement, and implement the NOAA Policy for Public Access to Research Results (NRC 2015) and the NOAA Administrative Order on Management of Environmental Data and Information (NAO212-15 2010). The goal of the data management plan is to ensure that data are properly collected, documented, made accessible, and preserved for future use in a long-term archive facility.

The data policy goal of MBRACE is to provide free, open access to real-time, near real-time, and legacy data collected to the greatest extent practicable, with only a few exceptions to protect publications, student theses, provisional and physical sample data, and proprietary commercial data. The environmental data and information collected and/or created under an awarded grant will be made visible, accessible, and independently understandable to users in near real-time when appropriate and within two years after the data are collected. The data will have undergone quality assurance/quality control procedures using community-accepted standards and protocols and will be accessible to the public. Awards that include collection of ocean and coastal mapping data will share their proposed mapping areas, objectives, and acquisition strategies with state and federal agencies. These data will be factored into State and national mapping sites to reduce overlaps, eliminate redundancies, and further leverage investments in mapping.

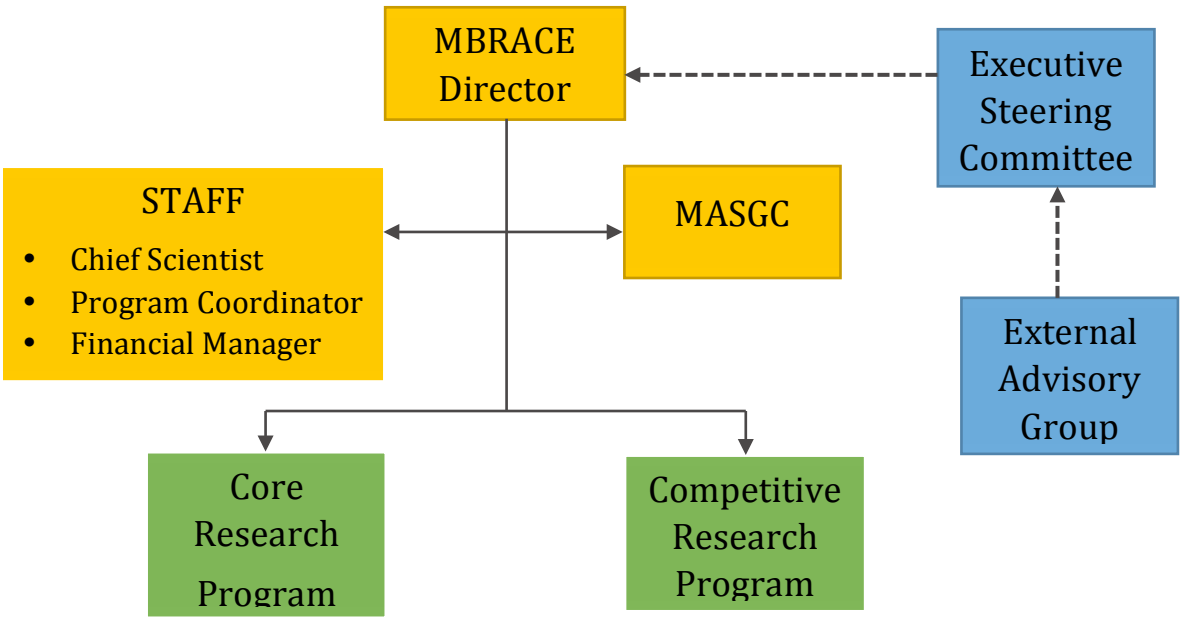
More specifically, in managing its data, MBRACE will follow NOAA's policies by implementing NOAA's Integrated Ocean Observing System (IOOS) program's established data and metadata standards for oceanographic, atmospheric, and biological parameters. For example, for conductivity-temperature-depth (CTD) and acoustic Doppler current profiler (ADCP) measurements, MBRACE will use the established data, metadata, quality control and quality assurance techniques, and archival formats at NOAA's National Centers for Environmental Information (NCEI). As unique data sets are planned for collections, where there are no established standards for these data and metadata, MBRACE will follow NOAA's IOOS program for data management to help establish the new data sets as standards. For example, MBRACE is looking into adapting an acoustics sampling technique using near-real-time acoustic data and mapping these data to oyster reef productivity. These acoustics measurements will follow the same three functional components for all MBRACE-funded data: (1) collection (2) processing, and (3) archiving. These acoustic data and processed results will reside on a USM data center server and will be available to other researchers. As with all of MBRACE's research data sets, these acoustics data and associated metadata will be provided to NOAA's NCEI.

(b) MBRACE Organizational Structure

MBRACE is a consortium of Mississippi's four research universities –JSU, MSU, UM, and USM, which serves as the lead institution for MBRACE. In addition, MBRACE will be an integrated and effective CoE with a five-person Executive Steering Committee, chaired by USM. Peer review is at the core of all MBRACE activities, and a non-conflicted External Advisory Group will provide feedback on the progress of the science conducted by the CoE.

The MBRACE Director, a USM employee, will serve as Lead Investigator. The Lead Investigator and his staff will manage JSU, MSU, and UM subcontracts and the required Mississippi Department of Environmental Quality (MDEQ) reporting. The Director will

have responsibility for establishing the Core Research Program and for managing the Competitive Grants Program and associated science communication activities. The peer review activities for both the Core Research Program and Competitive Research Program will be conducted by the Mississippi-Alabama Sea Grant Consortium (MASGC). MASGC will identify external peer reviewers and establish a Technical Review Panel to review the Core Research Program proposals and provide recommendations to the Executive Steering Committee for consideration. Recommendations may require either modification or additional explanation of the proposed work by the universities in the Core Research Program, as determined by the Executive Steering Committee, prior to release of funds to the institutions. For the Competitive Grant Program, MASGC will also assemble a Technical Review Panel to evaluate the proposals using the peer-review evaluations as a guide, and submit ranked recommendations for consideration to the Executive Steering Committee (ESC). The ESC will approve proposals for funding.



Organization Structure of MBRACE

(b.1) MBRACE Executive Steering Committee

The five-person Executive Steering Committee (ESC) comprised of voting membership from the MBRACE partners from the four Mississippi research universities (two members from USM) and *ex officio* representation of key non-university partners, MDEQ and the Mississippi Department of Marine Resources (MDMR), will develop core research questions relative to the MBRACE Program initiatives. The partnership of the Mississippi research universities have agreed that this Steering Committee will:

1. Work with the MBRACE Director and staff to develop a Science Plan that addresses the Research Science Questions developed by the ESC.

2. Review policies and procedures guiding CoE activities to ensure they are not in conflict with home institution policies and procedures.
3. Effectively communicate between institutions, agencies, corporations and MBRACE staff.
4. Work with the Director to identify potential members, and review and approve the External Advisory Group (EAG) to ensure its member composition reflects the disciplinary areas of the Science Plan.
5. Review and approve the Requests for Proposals and program funding.

The Executive Steering Committee members and alternates are appointed by the Chief Research Officers of each member university. The Chair of the ESC will be the Director of the USM School of Ocean Science and Technology (SOST), and the SOST Associate Director for the Gulf Coast Research Laboratory (GCRL) will be the second USM committee member.

(b.2) MBRACE External Advisory Group

The MBRACE-EAG is comprised of technical and scientific experts with international reputations in fields relevant to the MBRACE Science Plan. The EAG will conduct a yearly programmatic evaluation of scientific accomplishments and activities. They will provide feedback to the MBRACE Director and the ESC as required.

The membership of the EAG will operate without conflict of interest to any funded or prospectively funded person or institution receiving a financial award through MBRACE. Members of the EAG will sign statements declaring they have no conflicts of interest with the MBRACE, assuring fair practice.

VII. References

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