# Project Progress Report

Reporting Period: 10/01/06 – 06/30/07

Black skimmer (*Rhynchops niger*)

The Northern Gulf Institute (NGI) is funded by:
National Oceanic and Atmospheric Administration Award #A06OAR430264

Submitted to NOAA via:
https://www.GrantsOnline.noaa.gov

Courtesy Copy to:
John Cortinas, Ph.D., OAR CI Program Manager, National Oceanic and Atmospheric Administration

Submitted by:
David R. Shaw, Ph.D., Director, Northern Gulf Institute, Mississippi State University

Submitted on July 30, 2007

Award Investigator:
Denise Peeples, Mississippi State University

# TABLE OF CONTENTS

# 1. INTRODUCTION

## 1.1 Institute and Core Activities (including Education and Outreach)

The Northern Gulf Institute (NGI) is a NOAA Cooperative Institute, a partnership of five complementary academic institutions and NOAA. The collaboration is led by Mississippi State University (MSU), partnering with the University of Southern Mississippi (USM), Louisiana State University (LSU), Florida State University (FSU) and the Dauphin Island Sea Lab (DISL). The Institute develops, operates, and maintains an increasingly integrated research and transition *program*, the results of which fill priority gaps or reduce limitations in current Northern Gulf of Mexico awareness, understanding and decision support—especially at the intersection of upland-watershed systems and coastal waters, habitats, resources and hazards, integrating the interaction and impacts of people and communities. The NGI contributes to NOAA's priority interest in Ecosystem Management, Geospatial Data Integration and Visualization, Coastal Hazards, and Climate Effects on Regional Ecosystems research themes.

The initial funding for the NGI was received on October 1, 2007. The Council of Fellows, made up of the Senior Investigator from each of the member institutions, established an Executive Office at MSU in Starkville, MS, a Program Office at Stennis Space Center, MS and began evaluation for funding of the various proposals. Funding for the various research initiatives began in February 2007 and significant efforts are being made to address important questions related to the NOAA goals of Ecosystem Management, Weather and Water, Climate Change, and Commerce and Transport.

DISL, MSU, and USM are collaborating in the development of education and outreach programs to educate the public on NGI research and to facilitate the transition of NGI research to NOAA operational centers. NGI is working closely with the educational programs at the Gulf of Mexico Alliance and the Gulf Coast and Ocean Observing System to develop immediate communication and significant long term messaging campaign to address identified priority issues.

The overall goal of the research of the NGI is the eventual transition of this research to NOAA operations and, ultimately, to customer application. Creation and continuous development and updating of the institution's website are essential components of the collaboration, operation, and outreach of the research. See www.NorthernGulfInstitute.org. We expect

significant results of the NGI research to become more evident in the second annual report.

## 1.2 NGI Vision, Mission and Organization

**Vision**
NGI will be the preferred organization for integrative research and education that improves the resiliency and conservation of the northern Gulf of Mexico region.

**Mission**
NGI conducts high-impact research and education programs in the Northern Gulf of Mexico region focused on integration - integration of the land-coast-ocean-atmosphere continuum; integration of research to operations; and integration of individual organizational strengths into a holistic program. The program shall measurably contribute to the recovery and future health, safety, resilience and productivity of the region, through sustained research in a geospatial and ecosystem context.

**NGI Organization**
Figure 1.2 below illustrates the NGI organizational structure and collaborative connections. The top row reflects the oversight role of MSU and location of the Director of NGI who reports directly to the MSU Vice President for Research. Located in the High Performance Computing Collaboratory, the NGI MSU Office is led by a tenured faculty Director among whose responsibilities are to serve as primary liaison to NOAA's Executive Council, and as the principal point of contact for the Cooperative Institute Program Manager.

An NGI Program Office is located at the Stennis Space Center, MS and is led by the NGI Co-Director and supported by the MSU team at Stennis, including research and outreach faculty and a Chief Scientist. The NGI Program Office is responsible for maintaining regular interaction with the Council of Fellows, the lead academic body for the NGI, and the Advisory Council and the NOAA NGI Science Advisor. See list of NGI Advisory Council members, APPENDIX A. The NGI Program Office has prime responsibility for the day-to-day management of the Institute, with particular reference to Stennis-based and regional coordination, meetings of the Council of Fellows, the Annual Conference and NGI students, contractors and visiting scholars on-site at Stennis.

The NGI implementation builds upon the proposal submitted by the NGI consortium to NOAA on May 23, 2006, a number of interactions with NOAA and resulting clarifications after selection, the NOAA October 1, 2006 award,

the preparation and review of a Memorandum of Agreement between MSU and NOAA, and reference to NOAA's Cooperative Institute Interim Handbook. The NGI implementation framework presents policy, program and procedural guidance to the NGI and communications with NOAA's CI Program and participating NOAA offices, and to the various review, advisory and working-level entities affiliated with NGI.

In the second quarter of operation, staff drafted institutional strategic and implementation plans and began the review and adoption process for the instruments.

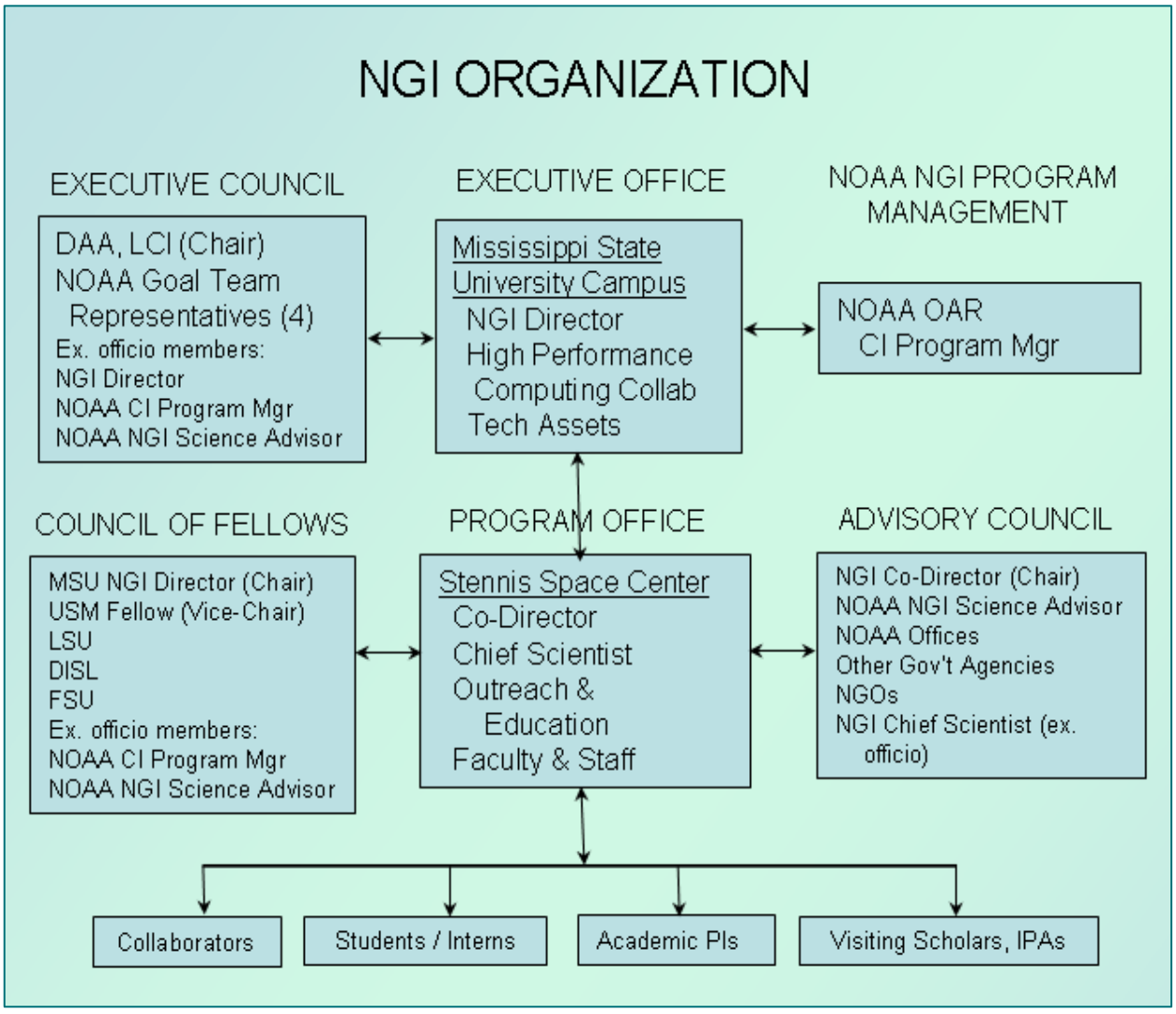


Figure 1.2 NGI Organizational Structure and Collaborative Connections

## 1.3 Executive Summary of Important Research Activities

The policies and procedures of this initial IP are consistent with and expand upon the Memorandum of Agreement between MSU and NOAA, the NOAA notice of award to MSU of October 1, 2006, NOAA's review of MSU administrative and grants processes (MSU, September 7, 2006), and the NOAA Cooperative Institute Interim Handbook (NOAA, OAR, Version 01, December 5, 2005). The NGI's Executive Office is located in Starkville, MS. A Program Office is located at Stennis Space Center, MS facilitating a link with NOAA's NGI Science Advisor and many resident federal agencies. The academic facilities of the five NGI collaborating institutions host the research, technology, education, and transition-to-use program activities.

The NGI defines the Northern Gulf of Mexico region as the upland and watershed, coastal zone, and coastal ocean areas from the Sabine River, LA in the west to the Suwannee River, FL in the east. The Northern Gulf is a rich and interdependent natural environment of great complexity and is important to the region and the nation. The riverine-dominated Northern Gulf ecosystems are under pressure from increasing population and coastal development, impacts from severe storms and climate variability, inland watershed and coastal wetlands degradation, and many other factors. NGI has chosen an approach to Northern Gulf Region issues, problems and opportunities that is closely aligned with NOAA's strategic and research priorities and its user-community. This approach is science driven, regionally focused, and coordinated with other Gulf of Mexico Basin activities, and seeks whenever appropriate to promote the application of its results to support decision makers and policy development.

A proposed partial solution to the loss of wetlands in the Mississippi River delta system requires periodic releases of fresh water (and silt) into these wetlands from the Mississippi River. Louisiana State University has recently begun four projects, all related to the health of the Mississippi River delta and related ecosystem by developing a series of linked simulation models that will allow tracking of the effects of pulsed freshwater inputs through the complex wetland environment in the Breton Sound and Barataria Basin estuaries. Related projects concern the relationship between available carbon, nitrogen, other physical oceanographic measurements and harmful algal blooms and *Vibrio* (*vulnificus* and *parahaemolyticus*) population dynamics in the two estuaries and an investigation of material exchange between the marsh and main channel to assess impacts of rising sea level and/or fluvial inputs on carbon and nitrogen budgets at the interface of a marine salt marsh environment between the Gulf of Mexico and a major river system. Related research at MSU involves the study of the impact of

man-made protection structures on hurricane storm surge in areas away from the structures.

The NGI region not only encompasses the Mississippi River system, but also other significant watersheds. The Mobile River Basin is the fourth largest watershed in the United States. Our understanding of the of the flow of sediment and specific associated pollutants in the Mobile Basin will allow resource management decision to be made in an informed manner which should ultimately result in environmental quality improvements. MSU working with the Corps of Engineers and researchers in Alabama have begun field and modeling studies of the complete system to estimate the total reservoir and distribution of contaminated sediments, as well as to provide estimates for factors impacting changes in that distribution. Particular emphasis is being placed on modeling the distribution and movement of DDT and mercury in the system. The results of this modeling will be extended to other watersheds in the NGI region in the out years of this project.

The future health of the NGI region depends on knowledge of the biogeochemical and physical dynamics of a complex system of ecosystems and their interaction with both the large system of watersheds feeding the northern Gulf Coast littoral and the deep water processes of the Gulf of Mexico. USM and FSU have begun a series of research projects addressing many of the significant issues related to fish population dynamics, harmful algal blooms (HABs), microbial source tracking, nutrient and pollutant fluxes and the interaction between near-shore and off-shore processes during extreme weather events. Both USM and FSU are working to correlate remotely sensed data with *in situ* measurements to decrease the uncertainty in remotely sensed data and develop and improve our regional HAB and hypoxia forecast capabilities.

The NGI through MSU is building a data base to allow the study of the impact of extreme events economic health of the Gulf Coast region and to develop guidance for coastal managers to develop resilient communities and their associated ecosystems.

A series of other research projects related to the NOAA Goals have also recently begun. Dauphin Island Sea Lab (DISL), Alabama's marine science education and research laboratory, has begun an examination of the potential benefits of restoration of shallow sub-tidal oyster reefs on adjacent near-shore habitats.

## 1.4 Distribution of NOAA Funding by Task and NGI Theme

The following charts depict the NOAA Cooperative Institute funding by NGI Task and by funding by NGI Research Theme.

Figure 1.4a depicts the ratio of Task I and Task II activities.

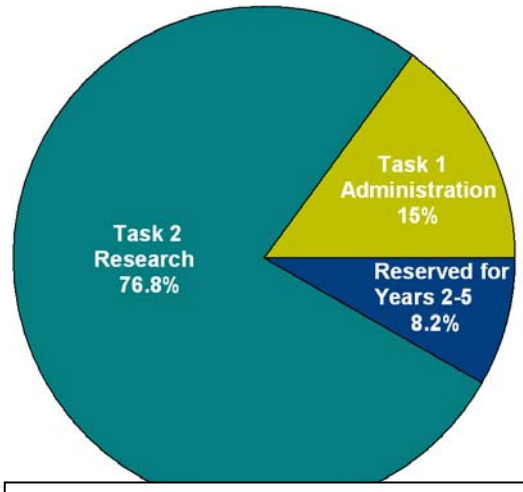


Figure 1.4a. Distribution of Task I & Task II Funding.

NGI's four (4) research themes follow and amplify the four themes presented in the NOAA Announcement of Opportunity. As NGI moves ahead on implementation it is important to reiterate and present several additional thematic guideposts.

First, an ecosystem-based approach to research and transition will pervade the NGI program. Second, geospatial technology and applications are important "glue" that connects the four NGI Themes and NGI's wider regional communities. Consistent with the ecosystem-based foundation of the program, geospatial research and products are guided by ecosystem principles, definitions and approaches. Third, climate effects are studied primarily from a regional perspective and in conjunction with ecosystem-based theory, observations and monitoring schemes. Both climate effects and hazard/resilience issues will incorporate social and economic elements and research endeavors.

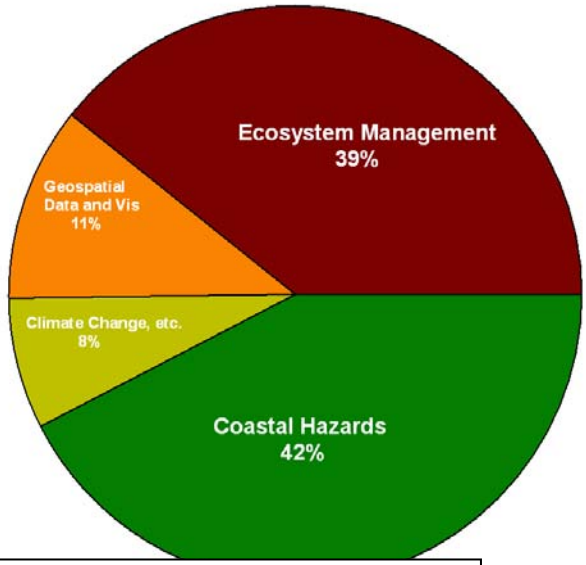


Figure 1.4b NGI Funding by Research Theme

Figure 1.4b illustrates the approximate distribution of NGI funding across the NGI research themes.

## 1.5 Council of Fellows and Executive Council

The NGI Executive Council has not been identified, but NOAA has committed to provide appropriate personnel to support this board.

The NGI Council of Fellows consists of:
Dr. David Shaw, Mississippi State University
Dr. Steven Lohrenz, University of Southern Mississippi
Dr. Eric Chassignet, Florida State University
Dr. Robert Twilley, Louisiana State University
Dr. George Crozier, Dauphin Island Sea Lab

Meetings of the NGI Council of Fellows for this reporting period are:

Oct 3-4, 2006 (Starkville)
Oct 11, 2006 (Stennis — in association with the NOAA PI meeting)
Dec 6, 2006 (teleconference)
Jan 29, 2007 (Stennis)
May 7, 2007 (teleconference)
May 17, 2007 (Biloxi, Post NGI Conference)

## 1.6 Task 1 Activities with Distribution of Funding

During this reporting period, NGI initiated the Task I administrative activities and program development in October 2006, conducted program planning, and recruited and staffed the central program office as Stennis Space Center. NGI prepared operational budgets to remain flexible with the requirements of the contract and incorporated NOAA finance and budget procedures. The NGI Director worked with the NOAA CI Program office to develop the Memorandum of Agreement, in accord with the five universities' academic collaborators. Figure 1.6 depicts the relative funding of the administrative components of Task I activities.

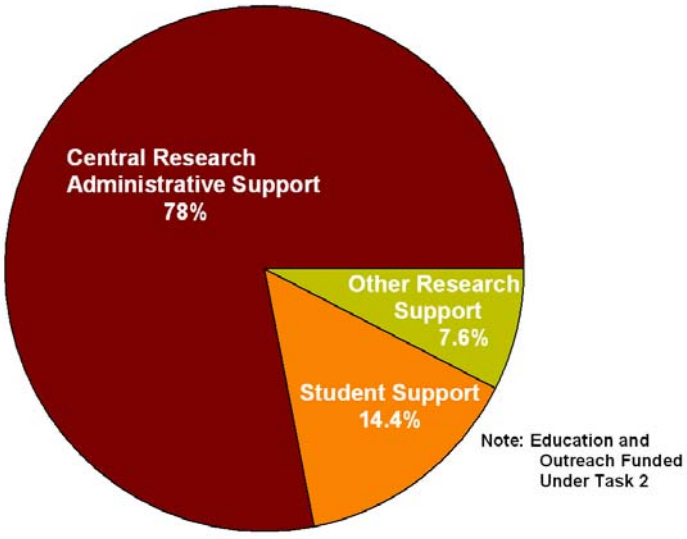


Fig. 1.6 Distribution of Task 1 Administrative Funds

The NGI Executive Office and Program Office worked with the NGI Council of Fellows to develop the first research plan and make

the selection of first year funded research. NGI senior staff expended great effort developing collaborative relationships with other Federal and State partners within the region in order to leverage the base funding. NGI held its first annual conference in May 2007 to provide a forum for presentation of current research and activities to foster collaboration.

NGI staff initiated the Education and Outreach Program by facilitating topical workshops and presenting NGI program overviews to teacher groups. NGI hosted a student technology exposition and exercise and is currently working to extend existing NOAA outreach networks (e.g., Southeastern Phytoplankton Monitoring Network) and facilitate collaboration and outreach with continuous institutional website development at www.NorthernGulfInstitute.org .

NGI staff working in concert with the Council of Fellows developed program review and evaluation processes. NGI has defined management leadership roles and established channels of communications to lay a good foundation for supporting this critical and much needed research in the Northern Gulf.

# 2. PERFORMANCE OF NOAA/NGI FUNDED PROJECTS

A full description of the 24 NGI projects funded by NOAA is provided in APPENDIX B: NGI Year 1 Project Profiles. The project profiles include project performance, with principal investigator(s) contact information. The primary NOAA contact on these projects to date is Dr. John Cortinas, Oceans and Atmospheric Research Office. Other technical contacts to NOAA personnel are developing, but are not officially listed as co-investigators at this time.

# 3. RELATIONSHIP OF NGI PROJECTS TO NOAA GOALS

The following table lists the NGI research projects in a matrix with NOAA Goals from the NOAA Strategic Plan.

| | NGI First Year Research Efforts | NOAA Goals | | | |
|---|---|---|---|---|---|
| | | Ecosystem | Climate | Weather & Water | Commerce & Transport |
| MSU | 01 Develop Foundation for Analysis of Natural & Human-Induced Disturbances to Coastal Economies | X | | X | |
| | 02 Assessing the Impact | X | | X | |
| | 03 Watershed Modeling | X | | X | |
| | 04 Spatial Technology | X | | X | |
| | 05 Modeling Mobile Bay | X | | X | X |
| | 06 Visualization | | | X | |
| | 07 An Information Semantic | X | X | X | X |
| | 08 NGI Outreach | X | X | X | X |
| | 09 Improving Hurricane | | | X | |
| USM | 01 Microbial Source Tracking | X | | X | |
| | 02 Utility of Ionosphere . . . | X | X | X | X |
| | 03 Monitoring and assessment | X | | X | |
| | 04 Interaction between off-shore circulation | X | | X | |
| | 05 Satellite & In Situ Optical Assessment of Algal Bloom | X | | X | |
| | 06 Coordination of USM NGI | X | X | X | X |
| | 07 Quantifying Ecosystem Services | X | | X | |
| | 08 Macrofaunal Indicators of Hypoxia | X | | X | |
| LSU | 1 Delta Ecosystem | X | | X | |
| | 2 Public Health and Stressors | X | | X | |
| | 3 Trophic Linkages | X | | X | |
| | 4 Investigating material exchange | X | | X | |
| FSU | 1 Integrated Research for Northeast Gulf of Mexico Big Bend Region | X | X | X | |
| DISL | 2 Habitat Restoration Research at DISL | X | | X | |
| | 1 Marine Education and Outreach at DISL | X | | X | |

NOAA Goals addressed by NGI projects are: (1) Protect, Restore, and Manage the Use of Coastal and Ocean Resources Through Ecosystem-based Management; (2) Understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond; (3) Serve Society's Needs for Weather and Water Information; and (4) Support the Nation's Commerce with Information for Safe, Efficient, and Environmentally Sound Transportation.

# 4. NGI PUBLICATIONS FOR REPORTING PERIOD

The NGI competed and awarded the first round of research projects in 2007. Several projects reported initial results, and a summary of publications by type and number are provided in Appendix C: Summary of Publications – Number and Type.

# 5. PERSONNEL SUPPORTED BY NGI FUNDING

The NGI funding availability and support for NGI institutional staff began on October 1, 2006. Research proposals were evaluated in the fall of 2006 and funding was awarded in the winter of 2007. A summary table depicting the research and administrative personnel supported by NOAA Award Number NA06OAR4320264 is found at Appendix D: Summary of Personnel Supported by NGI Funding.

# APPENDIX A: Northern Gulf Institute Advisory Council

Glade Woods, NGI/MSU, Chair
Kacky Andrews, Coastal States Organization
Russ Beard, NOAA National Coastal Data Development Center
Robert Bendick, The Nature Conservancy
Todd Davison, NOAA Gulf Coastal Services Center
Mark Glorioso, NASA Stennis Space Center
Bryon Griffith, EPA Gulf of Mexico Program
Dawn Lavoie, USGS Gulf Coast & LMV
Jeff Lillycrop, US Army Corps of Engineers
Paul Moersdorf, NOAA National Data Buoy Center
Scott Nichols, NOAA National Marine Fisheries Service
David Reed, NOAA National Weather Service
Matt Romkens, USDA National Sedimentation Lab
David Ruple, Grand Bay National Estuary Research Reserve
Martha Seguna, NPS Gulf Coast Network
LaDon Swan, Mississippi Alabama Sea Grant Consortium
Bill Walker, Mississippi Department of Marine Resources

# APPENDIX B: NGI Year 1 Project Profiles

**A. NGI Project File Number:** 06-DISL-01

**B. Project Title, PI(s), Email, and Affiliation:** Northern Gulf Institute-Education and Outreach Dauphin Island Sea Lab

Dr. John Dindo, Chair – Discovery Hall Programs, jdindo@disl.org
Dr. George F. Crozier – Executive Director, gcrozier@disl.org
Dauphin Island Sea Lab
101 Bienville Boulevard, Dauphin Island AL 36528

**C. Key Scientific Question(s)/Technical Issue(s):** Establish a direct link between marine researchers and K12 marine science education and provide a marine educator to enhance marine science education for school groups and the general public that visit the Estuarium at the sea lab

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** A PhD marine education/researcher position will work directly with DISL research scientist as well as Gulf of Mexico Alliance and NGI scientist in the capacity of integrating current research initiatives into existing K12 science program through the Discovery Hall Programs, National Marine Educators Association, National Science Teachers Association etc.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 2.5 years, beginning April 2007 and continuing through November 2009.

**F. Project Baselines:** In development

**G. Project Abstract:**

The first task in the Dauphin Island Sea Lab's collaboration in the Northern Gulf Initiative is to hire a full-time individual with both a research science background (Ph.D.) and strong K-12 educational experience. This person has been hired and will begin work in September 2007 and will be dedicated to translating and integrating recent research findings of Northern Gulf Institute scientists with the Discovery Hall Program. Another person will be placed in the Estuarium to help provide additional programs and explain the coastal research efforts of the NGI to the general public. A second educational goal will be to promulgate the efforts of the Gulf of Mexico Alliance Education Coordinator's tasks within the Governor's Action Plan that includes the following areas:

Water quality for healthy beaches and shellfish beds;

Wetland and coastal conservation and restoration;

Environmental Education;

Identification and characterization of Gulf habitats; and

Reductions in nutrient inputs to coastal ecosystems.

These research areas overlap those of the research interests demonstrated by members of the Northern Gulf Institute partnership. The Dauphin Island Sea Lab has established a partnership with the University of South Alabama's Science Education Department. The Sea Lab NGI educator/researcher will collaborate with Dr. Andre Green and Dr. Phillip Pheldman in a marine science program for minority high school students that was recently funded. This collaboration will be started in the summer of 2007 and enhanced during the fall academic year.

**H. Expected Project Contributions to:**

- *Regional Awareness:* Gulf of Mexico Environmental Protection Agency, Gulf of Mexico Alliance
- *Regional Interest:* Southern Association of Marine Educators, Gulf Coast Ocean Observation System, National Science Teachers Association
- *Regional Understanding:* enhance marine science education by infusing current Gulf of Mexico marine research into coastal K-12 classrooms, conduct assessment of the general public knowledge pertaining to key Gulf Alliance and NGI science initiatives
- *Regional Acceptance:*
- *Transition to Decision Support:*
- *Other Metrics Specific to this Project:*

**I. Contributions to Other CI Performance Measures**

- *Student support* – initiated graduate student work on hurricane impact to colonial nesting birds in Alabama, infusing this data in the near future into K-12 curriculum at DISL

**A. NGI Project File Number:** 06-DISL-02
**B. Project Title, PI(s), Email, and Affiliation:** Oyster Reef and Estuarine Landscape Restoration

Dr. John Dindo, Chair – Discovery Hall Programs, jdindo@disl.org
Dr. Ken Heck, Chair – University Programs, kheck@disl.org
Dauphin Island Sea Lab
101 Bienville Boulevard, Dauphin Island AL 36528

**C. Key Scientific Question(s)/Technical Issue(s):** Examine the potential benefit of restoration of shallow subtidal oyster reefs on adjacent nearshore habitats

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, etc., plus any involved non-sponsor project partners):** There will be close collaboration with researchers from the Alabama Oyster Restoration Program at the University of South Alabama that will integrate the proposed work into their larger efforts to restore productive shellfish grounds and other habitats important to fishery resources in the Northern Gulf of Mexico. Additional partners who are and will provide advice and collaboration include: National Marine Fisheries Service; Alabama Marine Resources Division; Mobile Bay National Estuary Program; Bon Secour Seafood, Inc.; and Auburn University Extension Service

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009)** 2.5 years, beginning April 2007 and continuing through November 2009.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* (1) to develop the scientific understanding necessary to direct oyster restoration and enhancement in the Northern Gulf of Mexico; (2) to assist in developing a long-term strategy for sustained productivity of Gulf oyster reefs and the associated ecological benefits that they provide.
- *Problems and Priorities:* Oyster reefs have been decimated by Hurricanes in the recent past and large efforts are underway to restore reefs and the oyster fishery in Louisiana, Mississippi and Alabama. Our work is being done in concert with local restoration efforts to better inform and predict the benefits of future shellfish restoration efforts with respect to fishery production, shoreline stabilization and the facilitation of additional shallow water nursery habitat.
- *Gaps:* There is a pressing need to rigorously establish whether the use of oyster reefs as living shorelines is an effective, ecologically-sound, and economical way to protect eroding shorelines and enhancing nursery habitat for valuable finfish and shellfish other than oysters.

## G. Project Abstract:

The dramatic decline in oyster populations throughout the eastern United States and many Gulf States has resulted from the combined effects of intensive harvesting, habitat destruction, reduced water quality, and disease. Whereas the economic loss of the oyster fishery is striking and has historically been responsible for government actions, recognition and public promotion of the ecological benefits of oyster reef habitat have resulted in increased efforts to restore oyster reefs. This project is designed to examine the potential benefit of restoration of shallow subtidal oyster reefs on adjacent nearshore habitats.

Specifically, the project will create subtidal oyster reefs in shallow areas near shorelines with emergent marsh. After creation, the reef will be seeded with juvenile oysters. As the seeded oyster grow and natural recruitment events add more juvenile oysters to the area, the complexity and vertical relief of the reef will increase. It is hypothesized that the presence of this complex "biogenic breakwater" will reduce hydrodynamic disturbance behind the reef and thus facilitate expansion of emergent marsh grass on the shoreline. The combination of adjacent shoreline marsh and oyster reef habitat should increase benthic prey resources and juvenile fish utilization compared to nearshore areas without oyster reefs.

Finally, it is possible that the combination of reduced hydrodynamic disturbance behind the oyster reef and reduced turbidity resulting from oyster filtration could facilitate the colonization and growth of submerged aquatic vegetation (SAV) or seagrass.

The proposed work is designed to complement and expand the on-going efforts of the Alabama Oyster Restoration Program that is administered by the University of South Alabama and which has many partners (see above). With this work we will expand the USA program to additional portions of the Alabama coast with the overarching goal of increasing the area of biologically productive habitat.

## H. Expected Project Contributions to:

*Regional Awareness and Interest*: The proposed studies will allow us to evaluate the costs and benefits of the use of oyster reefs as living shorelines. We expect to find that they protect eroding shorelines and enhance nursery habitat (e.g., marsh and submerged vegetation) for valuable finfish and shellfish other than oysters.

*Regional Acceptance*: If this project produces the expected results in producing productive habitat and reducing shoreline erosion, we anticipate that many such projects will be implemented along the Northern Gulf Coast.

## I. Contributions to Other CI Performance Measures:

- *Publications:* We will publish several short papers that address individual response variables that we will measure (e.g., nutrient concentrations and water column chlorophyll *a*) as well as a larger, comprehensive paper that

evaluates the combined impact of the reef emplacement on all our response variables.

- *NOAA Career Track*: We will work with NOAA personnel at the Habitat Restoration Division in St. Petersburg to integrate the NGI-supported results into the ongoing NOAA-supported habitat restoration work at the University of South Alabama.

- *Student support:* We anticipate supporting at least one graduate student who will develop a thesis project based on the proposed study

**A. NGI Project File Number:** 06-FSU-01

**B. Project Title, PI(s), Email, and Affiliation:** The Florida State University Contribution to the Northern Gulf of Mexico Cooperative Institute [Integrated Research for the Northeast Gulf of Mexico Big Bend Region]

Prof. Eric Chassignet, Director, Center for Atmospheric Prediction Studies
Florida State University, echassignet@coaps.fsu.edu

Prof. William Dewar, Chair, Dept. of Oceanography
Florida State University, dewar@ocean.fsu.edu

**C. Key Scientific Question(s)/Technical Issue(s):** Develop an integrated research program for the northeast Gulf of Mexico Big Bend Region, founded in interwoven modeling and observational enterprises.

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** The FSU PIs will collaborate with the other CI partners and will work closely with several NOAA offices such as the Panama City NMFS office (Dr. Doug DeVries) and NOAA AOML (Dr. Peter Ortner).

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 years.

**F. Project Baselines:**

*Contributions to Specific NOAA Goals/Objectives:* This project contributes to NOAA Mission Goals 2, 3, and 5, i.e., Understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond, Serve Society's Needs for Weather and Water Information, and Provide Critical Support for NOAA's Mission

*Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* The studies outlined here are designed to provide the baseline data needed to construct a thorough understanding of the ecosystem function of the Big Bend Region. Such information is critical to the development of a sustainable ecosystem in the Big Bend Region, the mitigation of coastal hazards, and the assessment of the regional impact of climate variability.

*Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* It is not known if the environment is estuarine in its flow characteristics or if significant vertical shear exists. Knowledge of this is, however, essential to quantifying transport characteristics. It is hypothesized that the surface wave field drives an on-shore Stokes drift that provides the primary means by which the products of offshore spawning of the grouper are transported to the seagrass beds. The development of responsive ecosystem-based, management policy cannot occur without the development of this

data base.

**G. Project Abstract:**

It is proposed to develop an integrated research program for the northeast Gulf of Mexico Big Bend Region, founded in interwoven modeling and observational enterprises. The overarching component of the effort is based in a hyper-fine resolution ocean model of the Big Bend Region (BBR), including an intra-coastal component. This model will serve several local purposes, including the synthesis of the various regional Cooperative Institute (CI) research programs within a common framework.

FSU will observe a representative, but diverse, set of environments characteristic of the BBR. These move from shallow, sea grass beds to deeper (40 m) sandy bottoms, from coastal-runoff-dominated brackish waters to coastal, clear water environments. The sampling strategies include physical oceanographic, physical meteorological, biological, and chemical components. These observations will be used to constrain the regional modeling effort, to provide it with forcing and boundary data, and to test a set of hypotheses as outlined below.

It is hypothesized that BBR fisheries in general respond to regional climatic fluctuations in precipitation and the hydrological cycle, as well as to interactions with the off-shore coastal zone. These ideas will be tested using gag grouper (*Mycteroperca microlepis*) as a representative species, because of its regional economic significance and NOAA's charge to manage it. The impact of terrestrial and shallow-water climatological conditions on grouper recruitment to and survival in BBR sea grass beds will be examined. Subsequent off-shore migration of shallow species is also hypothesized to fuel coastal gag grouper reproduction, and this will be examined.

It is further hypothesized that the exceptionally clear regional waters elevate benthic photosynthesis to leading order in comparison to water-column photosynthesis. The photosynthetic primary production forms the base of the food web and, thus, is critical for all biological and geochemical processes including fish reproduction and development of toxic anoxic environments. Benthic photosynthesis will be examined by the observational program. Implications of the results connect to the impact of water-quality fluctuations and the proper bio-geochemical modeling of the region.

**H. Expected Project Contributions to:**

*Regional Awareness*: We will emphasize the roles of sea grass beds in maintaining regional fisheries and of regional water clarity in maintaining the standing regional primary production.

*Regional Interest:* We will examine the eco-system dynamics maintaining the gag grouper fishery, one of the most commercially and recreationally important of the regional fisheries. This is also a fishery NOAA is charged with maintaining.

*Regional Understanding:* We will observe and quantify the mechanisms of onshore-offshore transport, including possible biologically mediated mechanisms. In

addition, we will clarify the contribution of benthic primary production to total primary production in the shallower waters of the BBR. We will also observe the physical characteristics in the region at locations where little to no previous data exist.
*Regional Acceptance*: I have no idea what this means, but we will distribute the results of our studies to locally identified stakeholders.
*Transition to Decision Support:* All observations will be made available to the general public by means of the web. Analyzed results will also be made available, including modeling results. We will identify regional end users and communicate them to the outreach components of the CI, who can communicate our results as needed and requested.

**I. Contributions to Other CI Performance Measures**
*Publications: peer reviewed, non-peer reviewed:* We anticipate publishing three papers per year on the gag grouper ecosystem and on the primary production of the BBR.
*Conference papers:* We will present papers in years 2 and 3 at major national conferences, such as the AGU Fall meeting and the ASLO meeting.
*Contributions to NOAA Career Track:* We do anticipate close collaborations with the Panama City NMFS office interested in gag grouper. We will also work with the CIMAS institute at the University of Miami on our modeling work.
*Student support:* We will support 5 graduate students from our base funding and hope to support a least two more through the CI fellowship program.

**A. NGI Project File Number:** 06-MSU-01

**B. Project Title, PI(s), Email, and Affiliation:** Developing a Foundation for Analysis of Natural and Human-Induced Disturbances to Coastal Economies

Garen Evans, Assistant Extension Professor, gevans@ext.msstate.edu

Terrill R. Hanson, Associate Professor, hanson@agecon.msstate.edu

Al Myles, Extension Professor, myles@agecon.msstate.edu

Dept. of Agricultural Economics
Mississippi State University
Box 5187
Mississippi State, MS 39762

**C. Key Scientific Question(s)/Technical Issue(s):** Develop regional economic valuation (REV) models that will define the interconnected relationships between the economic activities and drivers in the coastal communities

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** It is anticipated that there will be interaction with various entities within NOAA including NCDC to collect and share data and findings as well as with other agencies including those previously outlined in this proposal.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 years.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* The proposed work has linkages to all of the goals specified in the National Ocean Service Social Science Plan, which includes: enhance NOAA's ability to monitor, understand, evaluate, and communicate socioeconomic benefits of NOAA/NOS information, services, and products; provide more accurate and comprehensive decision-support tools for ecosystem management by integrating social science, natural science, and monitoring results; improve models and methods for assessing the impact of human and natural disturbances to coastal and ocean resources and infrastructure; and increase the relevancy of NOAA efforts by improving understanding of the needs, knowledge, perceptions, and values of NOAA partners and constituents." The proposed work directly relates to the third item and will contribute to all four items described above.

**G. Project Abstract:**

Coastal communities are tightly linked to the marine resources that support their vitality and are threatened by hazards unique to seaside development. To fully understand the development and economic activity of coastal communities, data must be collected to measure not only the assessed value of property but also the value of the activity associated with the economic drivers within the region. The overall goal of this project will be to develop regional economic valuation (REV) models that will define the interconnected relationships between the economic activities and drivers in the coastal communities. Specific objectives are to examine the impacts of Hurricane Katrina on coastal communities and ecosystems to identify variables required to appropriately model economic impacts of future catastrophic events; identify availability and begin initial collection of secondary data for appropriate economic analysis using geographically- and commercially-representative communities within the NGOM; and explore opportunities for synergies via collaboration with other projects administered through the Northern Gulf of Mexico Cooperative Institute and NOAA.

The REV model will estimate the economic impact of an event(s) occurring in the primarily-affected region of the Northern Gulf of Mexico (NGOM) and link these impacts to other NGOM regions. Baseline data collected on the economic valuation of the coastal areas before and during redevelopment of communities impacted by the 2005 hurricanes would include, but not be limited to, modeling development associated with local and regional economic baselines, spatial analysis, labor-intensive primary data collection and secondary data identification, and collection and development of methodologies related to the translation of catastrophic events (natural or human-induced) into NGOM economic impacts. Concurrently, economic growth and development data related to marine ecosystems will be integrated into the aforementioned REV model(s). This addition will provide a means of analysis for the changes in the economic value of marine resources under different management, regulatory and environmental conditions and enhance the economic forecasting model's ability to estimate impacts to ecosystem values from alternative resource management practices. Changes caused by these or other shocks could be evaluated by altering the frequency, magnitude, spatial, and temporal scales of the impact in the model.

Improved management, policy, and development decisions can be made through a better understanding of the value of coastal ecosystems and the potential economic impacts of coastal hazards. Local, state, and federal agencies along with economic developers, city planners, researchers, community residents, and other stakeholders will find the results of this work beneficial.

**H. Expected Project Contributions to:**

*Regional Awareness:*

Modeling development associated with local and regional economic baselines, spatial analysis, labor-intensive primary data collection and secondary data identification, and collection and development of methodologies related to the

translation of catastrophic events (natural or human-induced) into NGOM economic impacts.

*Regional Interest:*

The development of methods to translate human and natural disturbances, such as a hurricane, sewage over-run, a crash in the capture fisheries, or changes in population to impacts to other NGOM regions. For example, the model could compare hurricane landfall on an agriculture-based area versus an urban community, or some combination of economic activity areas.

*Regional Understanding:*

Further study is required to understand the economic impact of catastrophic coastal hazards and impacts of chronic pollution, harmful algae blooms, and other challenges that are correlated to the concentration of residents living on the coast and other activities within the watershed.

*Regional Acceptance:*

The understanding of the possible effects of changes in the surrounding natural environments should allow communities, business establishments and local, state and federal agencies to be better prepared before, during, and after the occurrence of such events.

*Transition to Decision Support:*

Local, state, and federal agencies along with economic developers, city planners, researchers, community residents, and other stakeholders will find the results of this work beneficial. In addition, this project is anticipated to identify areas that require more data collection and economic research.

## I. Contributions to Other CI Performance Measures

*Publications: peer reviewed, non-peer reviewed*

It is anticipated that research results will be publicized to stakeholders through journal articles, conference, and direct interaction with city and regional planners. The investigators on this project hold research and extension appointments and plan to use this to both create the models and share them with communities.

*Student support*

None to date.

**A. NGI Project File Number:** 06-MSU-02

**B. Project Title, PI(s), Email, and Affiliation:** Assessing the Impact of Ordinances, Outreach and Enforcement on the Resiliency of Gulf Coastal Watersheds

Jason Walker, Department of Landscape Architecture, jwalker@lalc.msstate.edu
Robert Brzuszek, RBrzuszek@lalc.msstate.edu
Michael Seymour, MSeymour@lalc.msstate.edu
Taze Fulford, Ctf23@msstate.edu
Timothy Schauwecker, Tis2@lalc.msstate.edu
Wayne Wilkerson, WWilkerson@lalc.msstate.edu

Mississippi State University Landscape Architecture
Box 9725, Mississippi State, MS, 39762-9725

**C. Key Scientific Question(s)/Technical Issue(s):** Test the hypothesis that the most ecologically resilient watersheds are those with well-defined ordinances and regulations that include established enforcement and are supplemented with active and effective NGO (non-governmental and Affiliation) involvement.

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):**

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 years.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* This project satisfies NOAA Mission Goal 3: Serve Society's Needs for Weather and Water Information, specifically through informing society on the role of watersheds and water quality. This project also contributes to NOAA Mission Goal 1: Protect, Restore, and Manage the Use of Coastal and Ocean Resources through an Ecosystem Approach to Management.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* Coastal community long-term resiliency can only occur by the full implementation and public acceptance of regulatory codes and ordinances that ensure wise management practices that directly affect regional watersheds and NGM water quality. There is an expressed need for a comprehensive central database that lists all regulatory codes for each strata of government for all lands and communities within coastal watersheds directly bordering the NGM.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* The project activities proposed will provide a jurisdictional baseline for coastal watersheds and water quality issues and will reveal differences in governance structures that may influence success in water quality issues.

**G. Project Abstract:**

Fulfilling the NGMCI mission "to design, develop and maintain a research and transition program that fills the NOAA Office of Oceanic and Atmospheric Research's (OAR) priority gaps and provides understanding of upland-watershed systems, coastal and ocean ecosystems and hazards in the NGM," requires the establishment of baseline data and geographical distribution of current regional watershed management approaches. This proposal outlines research to test the hypothesis that the most ecologically resilient watersheds are those with well-defined ordinances and regulations that include established enforcement and are supplemented with active and effective NGO (non-governmental and Affiliation) involvement. A GIS database will analyze and map relationships between watershed regulation and water quality by compiling regulatory codes, ordinances, enforcement actions, and NGO outreach efforts for coastal watersheds. This data will be correlated with water quality data to determine the effectiveness of regulatory action. Research activities will be coordinated with other initiatives in order to maximize results. The Year One pilot study will develop methods to assess the effectiveness of regulatory action and NGO outreach on water quality and community resiliency, while simultaneously improving the data available to other NGMCI researchers. Further research will expand our efforts to larger watersheds and define the components and characteristics of resilient coastal watersheds. It is expected that results from this effort can serve as input for policy recommendations at state, county, and municipal levels.

**H. Expected Project Contributions to:**

- *Regional Awareness:* Increase the awareness of the influence and impact regulatory codes, ordinances and NGO efforts have on coastal watersheds through collaborative research and outreach.

- *Regional Interest:* Increase the interest in water quality within the coastal region by developing a methodology for assessing the impact regulatory codes and NGO's have on coastal watersheds.

- *Regional Understanding:* Improve the understanding of the relationship between regulatory action and water quality within coastal watersheds.

- *Regional Acceptance:* By presenting project findings to coastal watershed decision-makers through outreach efforts that demonstrate successful approaches to effectively regulate water quality in coastal watersheds.

- *Transition to Decision Support:* The goal for the project is to allow stakeholders to evaluate, and ultimately address water quality deficiencies within their governance structure through informed decision-making concerning regulatory codes and NGO involvement.

- *Other Metrics Specific to this Project:* The project will contribute to the identified research areas of watershed management, BMP's, and watershed models.

## I. Contributions to Other CI Performance Measures

- *Publications: peer reviewed, non-peer reviewed*

  Non-peer reviewed: Progress reports will be generated following completion of pilot study and subsequently throughout the project, culminating in a final report. In addition, a thesis will be produced in partial fulfillment for a Master of Landscape Architecture degree.

  Peer reviewed: The project findings will be submitted to peer reviewed planning and environmental journals.

- *Conference papers*

  Conference papers will be presented at appropriate local, regional and national conferences that focus on issues related to the management, design, or understanding of natural resources.

- *Contributions to NOAA Career Track* NA

- *Student support*

  This project will support a Graduate Research Assistant and multiple Graduate and Undergraduate Student Workers throughout the project.

**A. NGI Project File Number:** 06-MSU-03

**B. Project Title, PI(s), Email, and Affiliation:** Watershed Modeling Improvements to Enhance Coastal Ecosystems;

W. H. McAnally, PhD, mcanally@cee.msstate.edu
MSU Civil and Environmental Engineering, Box 9546, Mississippi State, MS 39762

**C. Key Scientific Question(s)/Technical Issue(s):** Improved watershed-wide decision support for resource management agencies.

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** This project will be done in collaboration with the Corps of Engineers Engineer Research and Development Center, Vicksburg, MS, through an existing Cooperative R&D Agreement and an Intergovernmental Personnel Exchange Agreement. Data produced by this project will be provided to the NOAA Ecosystems Data Assembly Center (EDAC) and state agencies.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 years, Dec 2006 – Dec 2009.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* This project satisfies NOAA Mission Goal 1: Protect, Restore, and Manage Use of Coastal and Ocean Resources Through Ecosystem-Based Management. It will also contribute to Mission Goal 4: Support the Nation's Commerce for Safe, Efficient, and Environmentally Sound Transportation through increased use of environmental information in management of the Tenn-Tom and Black Warrior Waterways.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* This project will contribute generally to improved watershed management decisions by demonstrating the best use of new data and modeling technologies for ecosystem management and specifically to improved management of the Mobile Basin, with benefits to the Alabama-Mississippi coastal zone and Mississippi Sound.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* Relationships between coastal ecosystem responses and watershed-scale inputs will be quantitatively defined with improved integrated models of the entire watershed. Data compiled from multiple sources and generated by the models will be available to all stakeholders in the basin

**G. Project Abstract:**

The goal of this project is improved watershed-wide decision support for resource management agencies. Previous NASA-funded work verified and validated NASA data products for routine use in the EPA BASINS Decision Support System tool through a systems engineering approach. For this project, we will investigate additional data products from NOAA and others for improving the performance of the BASINS model HSPF by improved parameters, forcing, and initial conditions. The initial evaluation process has identified HSPF as the critical link in the BASINS Decision Support System and thus amenable for possible improvements through the infusion of additional data and data products. These include: improved parameters (i.e., topography, land use, buffer zones, etc.); improved forcing (i.e., spatially distributed precipitation, evaporation, wind, solar radiation, etc.); and improved initial conditions (i.e., snow cover, soil moisture, etc.).

This project will evaluate new or enhanced data streams for improving modeling performance of HSPF and the EPA BASINS decision support system and test the sensitivity of results to use of more sophisticated models, such as the Corps' distributed hydrologic model, Gridded Surface Subsurface Hydrologic Analysis (GSSHA) model. In preliminary studies, HSPF simulations tended to improperly estimate peak events and exhibited seasonal abnormalities between wet and dry seasons. The efforts of this project will incorporate the use of existing and new data streams to better estimate various inputs to hydrologic models as a means of improving model parameterization. Improved data sources will provide better boundary conditions and event-based inputs for rainfall-runoff components of model simulations.

**H. Expected Project Contributions to:**

- *Regional Awareness:* Through workshops, seminars, conferences, and personal contacts, the fruits of this project will be communicated to resource agency managers, and NGOs.

- *Regional Interest:* The work will highlight the importance of the Mobile basin and contribute to improved engagement of coastal and inland resource managers and users. The methods and models used will serve as a template for other basins in the Northern Gulf region.

- *Regional Understanding:* A watershed-scale model applied to a variety of scenarios will help all stakeholders to understand the interconnectedness of the basin's processes and ecosystems.

- *Regional Acceptance:* Early engagement of stakeholders to define project outcomes and regular involvement in decisions will ensure a wide acceptance of the project's tools and results.

- *Transition to Decision Support:* Improved graphical displays of results and improvements to existing decision support tools, such as Basins and SystemWide, will be transferred to the responsible agencies and affiliations through our partnerships. Since those systems are used nationwide, the benefits will propagate through the region and the nation.

- *Other Metrics Specific to this Project:* Advanced data streams and distributed modeling will produce watershed flows and constituent transport superior to any previously developed for the Mobile basin.

## I. Contributions to Other CI Performance Measures

- *Conference papers:*

    - NGI and Water Resources, American Society of Civil Engineers, Mississippi Section, August 2006.

- *Student support*
    - 2 graduate students supported beginning 1 Feb 2007

**A. NGI Project File Number:** 06-MSU-04

**B. Project Title, PI(s), Email, and Affiliation:** Spatial Technology and High Performance Computing for Improving Prediction of Surface Water Quality;

W. H. McAnally, mcanally@cee.msstate.edu
MSU Civil and Environmental Engineering; Box 9546, Mississippi State, MS 39762

**C. Key Scientific Question(s)/Technical Issue(s):** Develop and demonstrate the use of advanced spatial technology and high performance computing capabilities in the prediction of surface water quality

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** This project will be done in collaboration with the Corps of Engineers Engineer Research and Development Center, Vicksburg, MS

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late- FY 2009).** 3 years, Dec 2006 – Dec 2009.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* This project satisfies NOAA Mission Goal 1: Protect, Restore, and Manage Use of Coastal and Ocean Resources Through Ecosystem-Based Management. It will also contribute to Mission Goal 4: Support the Nation's Commerce for Safe, Efficient, and Environmentally Sound Transportation through increased use of environmental information in management of the Federal and state channels and Port of Mobile.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* This project will contribute generally to improved coastal management decisions by demonstrating the best use of new data and modeling technologies for ecosystem management and specifically to improved management of Mobile Bay, with benefits to the Alabama-Mississippi coastal zone and Mississippi Sound.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* Relationships between coastal ecosystem responses and watershed-scale inputs will be quantitatively defined and displayed using state-of-the-art geospatial tools and advanced numerical models running on high performance parallel-computing platforms. Data compiled from multiple sources and generated by the models will be available to all stakeholders in the basin

**G. Project Abstract:**

The goal of this project is to develop and demonstrate the use of advanced spatial technology and high performance computing capabilities in the prediction of surface water quality. The use of advanced spatial data analysis and high performing computing capabilities for development of input for surface water quality models, enhancing model performance, and demonstrating and displaying model results will be investigated. Surface water quality models are routinely used by various agencies for water quality management and control. Modern models of surface water quality typically consider not only in-stream hydraulic and kinetic processes and the influence of point sources, but the influence of landscape features (e.g. land uses, soils, hydrology) in order to assess water quality and evaluate alternative management strategies to improve or maintain water quality (e.g. BMPs, etc.) or biologic integrity.

Implementation strategies to achieve acceptable water quality or biologic integrity often focus primarily on the opportunities and constraints inherent in a basin. As such, much of the data required to drive these integrated models is geospatial in nature and model accuracy is often directly impacted by the availability and accuracy of those geospatial data. In addition, the application of an integrated model approach is typically computationally intensity and results in potentially enormous quantities of output that are often difficult to interpret. However, recent advances in spatial technology and high performance computing can be used to aid in the development and application of integrated modeling systems and the interpretation of model predictions. Through more accurate modeling, effective policy decisions can be made or developed by the responsible agencies.

## H. Expected Project Contributions to:

- *Regional Awareness:* Through workshops, seminars, conferences, and personal contacts, the fruits of this project will be communicated to resource agency managers, and NGOs.

- *Regional Interest:* The work will highlight the importance of the Mobile basin and contribute to improved engagement of coastal and inland resource managers and users. The methods and models used will serve as a template for other basins in the Northern Gulf region.

- *Regional Understanding:* A rigorous, high performance model applied to a variety of scenarios will help all stakeholders to understand the interconnectedness of the basin's processes and ecosystems.

- *Regional Acceptance:* Early engagement of stakeholders to define project outcomes and regular involvement in decisions will ensure a wide acceptance of the project's tools and results.

- *Transition to Decision Support:* Improved graphical displays of results and improvements to existing decision support tools, such as Basins and SystemWide, will be transferred to the responsible agencies and Affiliations through our partnerships. Since those systems are used nationwide, the benefits will propagate through the region and the nation.

- *Other Metrics Specific to this Project:* Advanced data streams, improved modeling physics, and compute-intensive scenarios will produce flows and constituent transport superior to any previously developed for Mobile Bay and its tributaries.

## I. Contributions to Other CI Performance Measures

- *Student support:*
    - 2 graduate students supported beginning 1 Feb 2007

**A. NGI Project File Number:** 06-MSU-05

**B. Project Title, PI(s), Email, and Affiliation:** Modeling Mobile Bay Sediments and Pollutants with New Technology;

W. H. McAnally, mcanally@cee.msstate.edu
MSU Civil and Environmental Engineering; Box 9546, Mississippi State, MS 39762

**C. Key Scientific Question(s)/Technical Issue(s):** Provide insight into the flow of sediment and specific associated pollutants in the Mobile Basin and similar coastal basins so that resource management decisions can be made in an informed manner and the Basin's environmental quality improved

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** This project will be done in collaboration with the Corps of Engineers Engineer Research and Development Center, Vicksburg, MS, through an existing Cooperative R&D Agreement. Data produced by this project will be provided to the NOAA Ecosystems Data Assembly Center (EDAC), the Corps of Engineers, and state agencies.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 years, Dec 2006 – Dec 2009.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* This project satisfies NOAA Mission Goal 1: Protect, Restore, and Manage Use of Coastal and Ocean Resources Through Ecosystem-Based Management.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* This project will contribute generally to improved coastal management decisions by demonstrating the best use of new sediment and contaminant data and modeling technologies for ecosystem management and specifically to improved management of sediments in Mobile Bay and adjacent waters, with benefits to the Alabama-Mississippi coastal zone and Mississippi Sound.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* Source(s) and fates of sediment and associated contaminants will be identified. Data compiled from multiple sources and model results will be available to all stakeholders in the basin

**G. Project Abstract:**

The overall goal of this proposed investigation is to provide insight into the flow of sediment and specific associated pollutants in the Mobile Basin and similar coastal basins so that resource management decisions can be made in an informed manner and the Basin's environmental quality improved. The proposed work will develop a management-oriented model of sediment, mercury, and dichlorodiphenyltrichloroethane (DDT) for Mobile Bay and the major tributaries to the Bay.

The study will first synthesize available data in order to obtain mass budget estimates for water and sediments. This budget is a necessary first step to any water quality model for strongly sorbed contaminants, since the transport and fate of the contaminant is strongly associated with the transport and fate of the solids to which the contaminant is sorbed. The available data will then be synthesized to estimate the total reservoir (storage) and distribution of contaminated sediments, as well as provide initial estimates for factors impacting changes in that distribution. Mathematic models previously applied to the system will be refocused, and/or converted, to simulation of DDT and mercury. The models, along with available data and data analysis tools, will be used in the assessment of factors impacting the fate and transport of mercury and DDT in the Basin.

Estimates will be made, wherever possible, as to the uncertainty of assessments based upon data and/or model results. Estimating uncertainties is of particular importance since, for example, some of the processes impacting the transformations of mercury, such as methylation, are poorly understood and quantified. The available data and model predictions will be used to evaluate potential management strategies (e.g. no action and action alternatives) using a weight of evidence approach. The modeling and data analysis tools will also provide a basis for a "living model" of the Basin that can be continually updated to address other management questions as they arise.

**H. Expected Project Contributions to:**

- *Regional Awareness:* Through workshops, seminars, conferences, and personal contacts, the fruits of this project will be communicated to resource agency managers, and NGOs.

- *Regional Interest:* The work will highlight the importance of the Mobile basin and contribute to improved engagement of coastal and inland resource managers and users. The methods and models used will serve as a template for other basins in the Northern Gulf region.

- *Regional Understanding:* A rigorous sediment and contaminant model applied to a variety of scenarios will help all stakeholders to understand the interconnectedness of the basin's processes and knowledge of sediment and contaminant pathways.

- *Regional Acceptance:* Early engagement of stakeholders to define project outcomes and regular involvement in decisions will ensure a wide acceptance of the project's tools and results.

- *Transition to Decision Support:* Improved graphical displays of results and improvements to existing decision support tools, such as Basins and SystemWide, will be transferred to the responsible agencies and Affiliations through our partnerships. Since those systems are used nationwide, the benefits will propagate through the region and the nation. EPA has expressed an interest in using our enhanced models for water quality management,

- *Other Metrics Specific to this Project:* Advanced physical descriptions of sedimentation processes modeling will produce transport results superior to any previously developed for the Mobile Bay

## I. Contributions to Other CI Performance Measures

- *Conference papers:*
  - Modeling Mobile Bay Sediments and Pollutants, Mississippi Water Resources Association, April 2007.

- *Student support:*
  - 2 graduate students have been supported since 1 Feb 2007.

**A. NGI Project File Number:** 06-MSU-06

**B. Project Title, PI(s), Email, and Affiliation:** Visualization Techniques for Improving Public Understanding of Catastrophic Events

Robert Moorhead, rjm@gri.msstate.edu
Song Zhang, szhang@gri.msstate.edu
Mississippi State University
PO Box 9627
Mississippi State, MS 39762

**C. Key Scientific Question(s)/Technical Issue(s):** Develop new 2D and 3D visualization tools which produce visualization products that can be made publicly available, are easily interpreted by the non-technical public, and can be viewed on personal computers or used in television coverage.

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** Initial data have been obtained from Dr. Pat Fitzpatrick and from NOAA data sites, in particular NCAR. As capacity develops, more data will likely be obtained. It is anticipated that Erik Davenport will be sought for collaboration, as well as renewed collaboration with COAMPS at FSU.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 years

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* This research will advance NOAA's leadership in applied scientific research.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* This work will allow emergency management personnel and people along the NG to better understand how to prepare for and response to catastrophic events.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* The visualization will impress the pertinent information upon people better. People will better understand the way in which flooding will occur, how objects will fail, how exit/escape routes will be impaired, etc.

**G. Project Abstract:**

One of the greatest challenges to an appropriate public response to emergencies is accurate and easily understood information. The general populace can readily

become so overloaded with information that individuals will either not realize the magnitude of the crisis and thus not prepare or respond adequately, or overreact and evacuate when such is not warranted. As modeling and forecasting improve, one important facet of public awareness that has not been sufficiently addressed is visualization of the data in such a way that the information is easily understood, and provides an accurate spatial depiction of the threat. This project will focus on developing new 2D and 3D visualization tools which produce visualization products that can be made publicly available, are easily interpreted by the non-technical public, and can be viewed on personal computers or used in television coverage.

The initial efforts will focus in two areas: storm surge and hurricane intensity/direction. This project will capitalize on the high performance computing and visualization capabilities at MSU, but will be closely linked to the severe weather modeling activities at MSU and FSU, and with partner activities at several NOAA units (including AOML, CSC, and NCDDC). It will focus on using HPC for both modeling and development of the visualization of model output, and will then create visualization products that can be produced as simple animations or static images.

The objectives of this project are to develop a hardware/software system which allows analyst with access to many and large data sources to see those many datasets in the viewing "environment" which allows them to extract the maximum amount of information and then knowledge from the datasets; extend existing visual analysis systems to ingest more data formats and types, perform data fusion in more automated ways, and display the data in more ways (e.g., 2D fields as contours, points, filled surfaces, glyphs); and study the optimal method to display various sets of multiple co-located datasets (topography, bathymetry, coastline, oceanography, and atmosphere) in the same view volume.

**H. Expected Project Contributions to:**

- *Regional Awareness:* Better understanding of and appreciation for severe storms.

- *Regional Interest:* Everyone is concerned about severe weather, especially in light of the recent increasing in hurricane activity and the widely predicted continuation of such.

- *Regional Understanding:* The visual system has the large bandwidth to the brain. People have an innate ability to recognize patterns in imagery. We can see problems and issues much better in a picture than in a list of numbers.

- *Regional Acceptance:* What they see, they will believe.

- *Transition to Decision Support:* We intend to provide improved visualization capability for both the user of decision support systems and the average citizen.

**I. Contributions to Other CI Performance Measures**

- *Publications: peer reviewed, non-peer reviewed:* We intend to publish about 2 papers a year.

- *Conference papers:* One of the 2 papers likely to be in a refereed conference.

- *Contributions to NOAA Career Track:* We hope that our work will allow NOAA scientists and those in field offices to be able to better understand the measured and modeled data to which they have access.

- *Student support:* Our hope had been to hire 2 students, but the delayed initiation of the project caused us to lose at least 2 students. We plan to support one starting in fall 2007 and hope to attract at least 1more quickly.

**A. NGI Project File Number:** 06-MSU-07

**B. Project Title, PI(s), Email, and Affiliation:** An Information Semantic Approach for Resource and Knowledge Discovery in Integrated Ocean Observing System

Roger L. King, rking@engr.msstate.edu
Mississippi State University
Box 9544
Mississippi State, MS 39762

**C. Key Scientific Question(s)/Technical Issue(s):** Develop an IOOS compliant pilot that uses semantic web technologies and web services to enable resource and knowledge discovery among private and public data sets within the northern Gulf of Mexico

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** Five partners from the public (federal and state) hold data sets from the northern Gulf of Mexico – NDBC, EPA Gulf of Mexico Program Office, Mississippi Department of Natural Resources, NOAA National Coastal Data Development Center, and USGS National Wetlands Center.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 years.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:*

The proposed project envisages addressing some important NOAA goals that the IOOS data management & communications subsystem (DMAC) system has identified such as [http://www.ocean.us/dmac_subsystem]:

  - IOOS-wide descriptions of data sets ( metadata)
  - Ability to search for and find data sets of interest ( Data Discovery)
  - The ability to access the data in an interoperable manner from client applications ( data Transport)
  - The ability to evaluate the character of the data through common web browsers and
  - The ability to securely archive data and metadata and retrieve them on demand

While addressing some of the above goals in their entirety, the scope of this project is however limited to the Northern Gulf of Mexico region.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:*

The building blocks of the Gulf Coast Ocean Observing System (GCOOS) consists of three sub regions; Texas, Louisiana/Mississippi/Alabama, and Florida. This project is focused on the Louisiana/Mississippi/Alabama region, and seeks to foster regional representation to the overall GCOOS initiative and also fill in the gaps in the existing data management system. The emphasis would be on the reconciliation of disparate data streams in this region and provide consistent data discovery mechanism which is particularly relevant after the recent hurricanes/storms that affected this region. The close collaboration with NCDDC and NDBC and development and refinement of the prototype would be based on the understanding of their requirements in the data discovery and dissemination areas.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):*

Currently, the data provided by the heterogeneous buoy sensors/ networks is not amenable to the development of integrated systems dues to conflicts arising in the data representation at syntactic, structural and semantic levels; this project seeks to fill in these gaps through the emerging Information technologies. The integration of remote sensing imagery through the content-based retrieval of knowledge is an important contribution of this research effort. Current systems are limited to searching archived coastal imagery based only on the syntactic metadata (lat/lon, sensor type, etc) which limits the discovery of actual knowledge, particularly after a coastal disaster event where it is required to rapidly retrieve affected regions. The project's Rapid image information mining (RIIM) component provides such a capability. This considerably reduces the gaps in the integration of in situ data and remote sensing imagery.

**G. Project Abstract:**

The goal of this project is to develop an IOOS compliant pilot that uses semantic web technologies and web services to enable resource and knowledge discovery among private and public data sets within the northern Gulf of Mexico. This project uses a scientific approach that utilizes an open source and standards based software approach for developing the middleware necessary for facilitating data sharing from the disparate and heterogeneous data providers of the region. It is conducted by a multi-disciplinary team and research methods that encompass computer science and engineering expertise at Mississippi State University and domain expertise resident at our federal, state, and private collaborators. The project also features an education and outreach element that reflects the multi-disciplinary modes of inquiry and increases the diversity of the workforce and a strong, but flexible management plan that supports collaborative research and delivers an ontology driven, web based system with semantic query functionality for northern Gulf of Mexico data sets.
The project is expected to provide IOOS with the functionality to begin to address three of its seven societal goals within the three year scope of the project. These goals are to provide more timely predictions of natural hazards and their impacts; to sustain, protect, and restore healthy marine and estuarine ecosystems; and to sustain, protect, and restore marine resources.

## H. Expected Project Contributions to:

- *Regional Awareness:*

Project would provide the impetus to the ongoing effort on harmonizing disparate coastal data in the Gulf of Mexico region.
Highlight the level of benefits that would accrue ranging from time critical response to coastal disasters and the consistent, continued, and standardized dissemination of information that enables to develop domain specific clients which would have the power to harvest data from multitude of coastal sensors in a seamless, transparent mode.

- *Regional Interest:*

Provide NGI the necessary tools to develop a strong presence in the data management component of the IOOS and bolster the northern gulf assets with improved data dissemination capabilities. It also would help to emphasize the region specific data management efforts and contributions in the overall IOOS.

- *Regional Understanding:*

Provide Gulf Coast stakeholders with more timely information on the state of the Gulf of Mexico and impacts on the northern gulf region.

- *Regional Acceptance:*

Provide an easier methodology to present ocean data/information to stakeholders, thus increasing their acceptance of the monitoring schemes.

- *Transition to Decision Support:*

This project directly impacts a variety of decision support tools for the northern gulf in that it provides seamless access to multiple data streams and will provide decision support tools with actionable intelligence.

- *Other Metrics Specific to this Project:*

    - Measurement of the performance of web services oriented architecture.
    - Image information mining performance metrics
    - Assessment of the level of interoperability the system is able to achieve

## I. Contributions to Other CI Performance Measures

- *Publications: peer reviewed, non-peer reviewed*

Peer reviewed and non-peer reviewed publications will be submitted.

- *Conference papers*

Conference papers will be presented in a variety of venues (e.g., IGARSS, AGU).

- *Contributions to NOAA Career Track*

Research results from this project can enhance the understanding of data streams from NOAA owned and operated resources. Thus, this can demonstrate the efficacy of these monitoring systems and perhaps lead to additional resources being brought on line. This will require NOAA personnel to gain a better understanding of these technologies and contribute to NOAA employee professional development.

- *Student support*

Two graduate students are being supported on this project.

**A. NGI Project File Number:** 06-MSU-08

**B. Project Title, PI(s), Email, and Affiliation:** Northern Gulf Institute Outreach Efforts

Sharon Hodge, shodge@ngi.msstate.edu
Mississippi State University, Northern Gulf Institute
Bldg 1103, Stennis Space Center, MS 39529

Joby Prince, jprince@ngi.msstate.edu
Mississippi State University, GeoResources Institute
Box 9652, Mississippi State, MS 39762

**C. Key Scientific Question(s)/Technical Issue(s):** Transition the NGI research results to the end user communities according to needs assessments performed.

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** Project is done in collaboration with the Gulf of Mexico Alliance Environmental Education Network, NOAA National Coastal Data Development Center (through the Southeast Phytoplankton Monitoring Network), NOAA Gulf Coast Services Center, NOAA Coastal Storms Program, COSEE, NERRs (Northern Gulf region) Education Programs, DISL k-12, US COE MsCIP, Sea Grant Extension programs (Northern Gulf region), Mississippi Department of Marine Resources, and USM's marine education and outreach effort.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 years.

**F. Project Baselines:**

*Contributions to Specific NOAA Goals/Objectives:*

NGI 's education program: aligns with NOAA's mission and strategic goals; facilitates careers in environmental and geospatial sciences; contributes to teaching the teachers; *coordinates with partners; supports informal education to increase environmental literacy of adults.*

*Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:*

The NGI Outreach effort is closely aligned with and working with the Gulf of Mexico Alliance. NGI staff participates in GOMA educational listserve activity. NGI is coordinating a university partner based contribution to the GOMA science fact-a-day distribution program.

*Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):*

NOAA name and mission recognition is needed in many sectors. NGI Outreach is working with GOMA to lead the coordination and collaboration of environmental educators in the Northern Gulf region.

**G. Project Abstract:**

A number of outreach-oriented educational activities are planned for the first year of the Northern Gulf Institute (NGI). These include community workshops that will identify high-impact federal and state program integration opportunities, and set the stage for future actions to address States' priority issues; ecosystem assessments and process research characterizing coastal and marine habitats and developing regional landscape restoration planning strategies related to transitioning the research; community risk and vulnerability assessments to identify mitigation strategies and tools; development of next-generation storm surge, coastal and inland flood, and erosion products and services; plan for a NOAA Coastal Storms Program pilot for the northern Gulf region as a continuation of the current program efforts; and train coastal and watershed managers in the application of data and technology such as remote sensing and Geographic Information Systems, employment of best management practices, and collaborative processes in watershed management. The NGI Outreach efforts will also include assisting in the mining and quality control of data for historical Gulf coast data sets in order to build 'reference data sets' depicting the long-term record of changes in the Gulf ecosystem.

The NGI proposes to work with the NOAA Gulf Coastal Services Center to identify and support activities that serve the coastal and watershed management needs of Gulf communities. Priorities include: 1) hazards, coastal storms, navigation and ports; 2) integrated ocean observing systems; 3) mapping and change analysis; 4) spatial positioning and vertical control; and 5) hydrodynamic and other physical and watershed modeling. The NGI will also become a contributing partner in the development of a Gulf of Mexico Central Regional Ocean Information System (GCOOS) to foster regional collaboration, as well as address the Gulf Alliance needs for spatial data for the six priority issue areas of water quality, wetland restoration, habitat characterization, nutrient loading, environmental education, and coastal hazards.

**H. Expected Project Contributions to:**

- *Regional Awareness:* NGI Outreach is working with numerous other environmental educators in the Northern Gulf to address regional level issues. NGI is leading the coordination of efforts and the collaboration tool development (networking through teleconferences and online group servers).

- *Regional Interest:* NGI is bringing multi-state level efforts to outreach. Participants from MS and Al are working closely together on a regular basis and reaching out to adjoining states to bring them in also.

- *Regional Understanding:* NGI is actively collaborating with the other environmental educators in the region to conduct a gap analysis and identify underserved communities. By developing demonstration projects within a GIS scheme, NGI Outreach is providing visual evidence of the regional scope of the needs in this region and the NGI activities and benefits. This visual demonstration is powerful in advancing understanding.

- *Regional Acceptance:* NGI Outreach will seek feedback on its programs to determine the most effective means for disseminating the NGI research.

- *Transition to Decision Support:* NGI hopes to affect decision support by providing important scientific facts in bite size pieces that will generate true stewardship and conscientious citizens and visitors. The consumers, constituents and developers of the region will drive the conservation of the Northern Gulf region.

- *Other Metrics Specific to this Project:* Nurturing NOAA's next scientists is another important measure of NGI Outreach. NGI hopes to introduce students and others to science and technology that will spark an interest in the NOAA related disciplines.

**I. Contributions to Other CI Performance Measures**

- *Publications: peer reviewed, non-peer reviewed:* NGI Outreach is working with several media sources to have coverage of the research.

- *Conference papers*: Poster for GeoTools 2007 Conference: Assessment of Geographic Extent of Projects Encompassed by the NOAA Northern Gulf Institute using Geographic Information Systems, J. M. Prince, D. R. Shaw, S. H. Hodge, and C. Hill, Mississippi State University, Mississippi State, Mississippi

- *Contributions to NOAA Career Track:* Developing NGI branding to enhance NOAA visibility and interest.

- *Student support:* Joby Prince, graduate student in geospatial studies (and research assistant for this and other related projects).

**A. NGI Project File Number:** 06-MSU-09

**B. Project Title, PI(s), Email, and Affiliation:** Improving Hurricane Intensity and Landfall Estimation with Refined Modeling

Pat Fitzpatrick, fitz@gri.msstate.edu
Mississippi State University
Northern Gulf Institute
Bldg 1103, Stennis Space Center, MS 39529
228-688-1157

**C. Key Scientific Question(s)/Technical Issue(s):** Address the fundamental physics of storm surge, as well as the impact of levee configurations and the loss of wetlands resulting from hurricane events

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** Project is done in collaboration with the NOAA Hurricane Research Division and the National Weather Service Evaluation Branch, Silver Spring, MD

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 1 year.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* Storm surge prediction and research has been identified as a deficient area requiring improvements. Specifically, the NOAA document *Interagency Strategic Research Plan for Tropical Cyclones: the Way Ahead* states it is a Top 5 priority (Table 4-1) and an important component of NOAA's future hurricane prediction system (Section 4.4.2) in which ADCIRC will be coupled to HWRF. Storm surge research has also been identified as a high priority action item in the National Science Foundation document *Hurricane Warning: The Critical Need for a National Hurricane Research Initiative.*

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* This research provides two primary benefits. First, it will provide an improved understanding of hurricane wind structure on the storm surge so that emergency preparedness officials can anticipate widespread storm surge events better. Second, it will quantify the impact of the Louisiana wetlands and levee system on storm surges.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.)*: This study will address the fundamental physics of storm surge, as well as the impact of levee configurations and the loss of wetlands in Louisiana, all of which contributed

to the most expensive and the fourth-most fatal hurricane in the nation's history.

**G. Project Abstract:**

The storm surge of Hurricane Katrina (2005) is unprecedented in the U.S. for its elevation, area coverage, and levee breaches in New Orleans. This extreme event poses a number of questions, including: How sensitive is storm surge to the radial distribution of tropical storm- and hurricane-force winds? Did the large eye of Katrina cause a larger area to be affected by the surge? Did the Mississippi River levee system initially block the incoming surge and contribute to a higher surge to the east? To answer these questions, this research seeks to address recent Mississippi and Louisiana storm surge issues using the finite element model ADCIRC. This research will facilitate answers to the sensitivity of the storm surge in Mississippi to wind profiles of major hurricanes, as well as to eye size.

An additional issue involves the impact of the Louisiana wetlands and the Mississippi River. It is widely believed that wetland erosion has increased storm surge vulnerability in southeast Louisiana. Grids will be created based on historical wetland data, and new ADCIRC run will be performed to examine the impact of wetland loss in the last 65 years. Specifically, we will investigate: 1) a hurricane moving over the less-eroded marsh of Louisiana in 1970 and 1940; 2) a weaker hurricane due to more marshland; and 3) a simulation without the Mississippi River levee system.

This study will address the fundamental physics of storm surge, as well as the impact of levee configurations and the loss of wetlands in Louisiana, all of which contributed to the most expensive and the fourth-most fatal hurricane in the nation's history. This research provides two primary benefits. First, it will provide an improved understanding of hurricane wind structure on the storm surge so that emergency preparedness officials can anticipate widespread storm surge events better. Second, it will quantify the impact of the Louisiana wetlands and levee system on storm surges.

**H. Expected Project Contributions to:**

- *Regional Awareness: It will make locals more aware that intensity or place of landfall is not the only factor which contributes to storm surge*
- *Regional Interest: After Katrina, storm surge research should interest many local scientists, residents, and emergency planners.*
- *Regional Understanding: This work will clarify the hurricane conditions in which Mississippi and Louisiana threatened by storm surge, and the roles of the wetlands and levees.*
- *Regional Acceptance: The accuracy of the control ADCIRC case will provide credibility to the other sensitivity runs*
- *Transition to Decision Support: ADCIRC is planned to be part of the HWRF coupled system*
- *Other Metrics Specific to this Project: Wetland impact; revised Saffir-Simpson scale*

**I. Contributions to Other CI Performance Measures**

- *Publications: peer reviewed, non-peer reviewed. Two peer-reviewed paper will be submitted in the one year time period*
- *Conference papers: 2008 AMS conference paper and a 2008 IHC presentation*
- *Contributions to NOAA Career Track: See below*
- *Student support: Civil Engineering students will participate*

**A. NGI Project File Number:** 06-USM-01

**B. Project Title, PI(s), and Affiliation:** Microbial Source Tracking and its Application to the Northern Gulf of Mexico

R.D. Ellender, Shiao Wang, Joe Lepo, Jody Harwood
University of Southern Mississippi,
University of West Florida,
University of South Florida

**C. Key Scientific Question(s)/Technical Issue(s):** Provision of a practical strategy and methodology to determine the source(s) of a human marker to coastal beach and shellfishing areas

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):**

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 2 years.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* This project is responsive to NOAA's strategic goal to "protect, restore, and manage the use of coastal and ocean resources through an ecosystem approach to management". The capability to rapidly and precisely identify pollutant sources will be a valuable tool for effective management.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* Benefits and broad applications of this project include an improved understanding of the types of fecal pollution that enter the waters of the Northern Gulf of Mexico, enhanced identification of the sources of fecal contamination, and ultimately, better calculation of the risk of increased exposure of the public to human pathogenic microorganisms from contact with Gulf waters. Knowledge of contamination sources is also crucial for mitigation and remediation of fecal contamination in coastal waters; thus, the technologies applied and developed by this work have broad application in polluted coastal waters throughout the U.S.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* Presently, we lack the practical capability to identify sources of fecal pollution in coastal waters, and the associated risk of such contamination.

**G. Project Abstract:**

Coastal water quality is an essential component of a healthy Gulf of Mexico, supporting a thriving shellfishing industry and providing the basis for the extensive tourism industry. The safety of beaches and quality of life in the Gulf region are highly dependent upon successful stewardship of coastal waters, whose safety with respect to human health is threatened by extensive development and other anthropogenic activities. Water quality is routinely monitored by enumeration of indicator bacteria, which are generally nonpathogenic. These bacteria are associated with a wide variety of fecal inputs from humans and animals, and thus offer no information about the source(s) of pollution that can degrade water quality in coastal areas. This failure impedes the ability of regulatory agencies and managers to protect public health and remediate pollution sources. Microbial (bacterial) source tracking (MST) methods have been developed and tested over the past decade, showing promise for discriminating between animal and human fecal pollution sources. Furthermore, new tools are under development that will refine MST capabilities.

This proposed research entails a collaborative laboratory and field validation of one of three MST method chosen from a suite of prospects by a group of investigators with extensive experience with MST methodologies, and includes a previously-scheduled workshop to aid in planning of the study. It is anticipated that future funding will allow the exploration of other MST methods within a similar study design, and workshops that will update researchers and regulatory officials on the progress of the studies and capabilities of the methods. The proposed research will involve scientists and institutions from Florida and Mississippi, and the MST method chosen will be field-tested in each of these states. A series of laboratory and field evaluation (validation) studies will be carried out, including tests of widespread geographic applicability, accuracy in all waters and other matrices tested, and round-robin testing among laboratories.

The purpose of this study is provision of a practical strategy and methodology to determine the source(s) of a human marker to coastal beach and shellfishing areas. This accomplishment will protect public health by (a) improving risk assessment via knowledge of the contamination source and (b) pinpointing locations where remediation of human or stormwater contamination is advisable. The use of accurate MST methodologies will allow watershed managers to determine the best strategies for controlling microbial inputs to Gulf of Mexico waters. The anticipated outcome of this work is that total maximum daily load, pollution mitigation, and risk assessment activities will be rendered more accurate, which will in turn result in cleaner environmental waters and better protection of the health of fisheries workers, consumers of seafood, and recreational water users.

**H. Expected Project Contributions to:**

- *Regional Awareness*: Dissemination of project results will be accomplished via regional meetings, presentations at regional/international meetings, and by peer publications. These mechanisms are in effect as a residual of other projects: we have conducted three regional MST meetings, presented 40 regional seminars in the last 5 years, and have contributed 8 peer reviewed publications to the MST literature.

- *Regional Interest:* The primary user community includes state and local government personnel responsible for monitoring, protection and maintenance of coastal water quality. Results interest for the products of this investigation is expected to be elevated following dissemination of the primary findings and the transfer of the technology to the user community.

- *Regional Understanding:* Knowledge of the benefits of this research is expected to create a positive understanding of the role of library independent tools in the determination and maintenance of coastal water quality and the health of the populations who use this resource.

- *Regional Acceptance:* The response of the public, personnel responsible for regional water quality, and representatives of state agencies has always been positive. Clearer understandings of the sources of pollution and the benefits of remediation have also viewed by the news media and the tourism industry as a encouraging product of this work.

- *Transition to Decision Support:* The transition period for the results of this research to the user community is expected to be realistic, and can be complete within the first year of work.

- *Other Metrics Specific to this Project:* This project will influence and allow the use of other library independent methods as confirmatory measures including other human and non human markers.

## I. Contributions to Other CI Performance Measures

- *Publications: peer reviewed, non-peer reviewed:* Results of this investigation will be published in peer reviewed journals.

- *Conference papers:* Results of this investigation will be presented at regional/national meetings such as the annual meeting of the American Society for Microbiology.

- *Student support*: All institutions involved in this project strongly support graduate as well as undergraduate research.

**A. NGI Project File Number:** 06-USM-02

**B. Project Title, PI(s), Email, And Affiliation:** Utility of Ionosphere and Troposphere Models for Extending the Range of High-Accuracy GPS

Dave Dodd, (USM), David.Dodd@usm.edu
Dave Wells (USM)
Sunil Bisnath (Harvard-Smithsonian Center for Astrophysics)

**C. Key Scientific Question(s)/Technical Issue(s):** Effects of using both the NOAA troposphere maps and the NOAA ionosphere maps to help resolve integer ambiguities over long baselines

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):**

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 2 years.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* This research addresses the activities of the NOAA Geodesy and Marine transportation Systems programs. Improved positioning accuracy will have wide-ranging societal benefit and supports NOAA's strategic goals related to navigation and transportation, as well as monitoring of coastal conditions.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* The products of this research will have wide ranging applications for a variety of stakeholders involved in navigation and transportation, and other activities that depend on precise positioning.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* Presently, the precision and accuracy of GPS positioning is limited by uncertainties associated with atmospheric variations. This research will assess the utility of NOAA ionospheric and tropospheric products to improve GPS positioning capabilities.

**G. Project Abstract:**

The proposed research will study the effects of using both the NOAA troposphere maps and the NOAA ionosphere maps to help resolve integer ambiguities over long baselines. In order to accomplish this, in-house software will be enhanced to compute fixed ambiguity GPS positions using sequential least squares algorithms with the NOAA ionosphere and troposphere maps. Studies will included both static and dynamic data with baseline ranges of 20 km to 500 km.

Long-range RTDGPS uses processing techniques that greatly reduce errors associated with satellite and receiver clocks as well as with satellite positions. However, atmospheric errors remain, specifically errors associated with the ionosphere and the troposphere. This proposed research will examine the utility of NOAA ionosphere and troposphere products for improving DGPS positioning accuracy.

Objectives of the study are to: enhance existing software to compute fixed ambiguity GPS positions using sequential least squares algorithms with the NOAA ionosphere and troposphere maps; use modified software to examine utility of NOAA troposphere maps and ionosphere maps to improve GPS positioning accuracy over long baselines for both static and dynamic data with baseline ranges of 20 km to 500 km; and prepare report summarizing the results of the analysis, which will include a description of the algorithms used to resolve integer ambiguities and compute final positions.

**H. Expected Project Contributions to:**

- *Regional Awareness:* Dissemination of project results will be accomplished via regional meetings, presentations at regional/international meetings, and by peer-reviewed publications. Results will also be communicated through institutional and NGI websites and in conjunction with public displays.

- *Regional Interest:* The primary user community includes all stakeholders requiring high precision navigation and position capability. This includes commercial shipping activities, Coast Guard, and other users.

- *Regional Understanding:* Improved GPS readings will be appreciated by a broad audience. Current GPS users (navigators, surveyors, drivers, mariners) understand basically how GPS works and that it could use some improvement.

- *Regional Acceptance:* Regional acceptance is evidenced by users relying on GPS units on a frequent basis.

- *Transition to Decision Support:* Research will be appropriate for adoption into GPS operations.

- *Other Metrics Specific to this Project:*

## I. Contributions to Other CI Performance Measures

- *Publications: peer reviewed, non-peer reviewed:* Results of this investigation will be published in peer reviewed journals.

- *Conference papers:* Results of this investigation will be presented at regional/national meetings.

- *Student support*: All institutions involved in this project strongly support graduate as well as undergraduate research.

**A. NGI Project File Number:** 06-USM-03

**B. Project Title, PI(s), Email, and Affiliation:** Monitoring and Assessment of Coastal and Marine Ecosystems in the Northern Gulf

Stephan Howden, Stephan.Howden@usm.edu
Steven Lohrenz, Steven.lohrenz@usm.edu
Donald Redalje Donald.redalje@usm.edu
Alan Shiller Alan.shiller@usm.edu
Department of Marine Science
University of Southern Mississippi
1020 Balch Blvd.
Stennis Space Center, MS 39529

**C. Key Scientific Question(s)/Technical Issue(s):** Better understand the transport and processing of nutrients and pollutants through the coastal transition zone, including issues of coastal eutrophication, fluxes of carbon through the coastal environment, and hypoxia in the Mississippi Bight.

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** Synergistic interactions are expected with the NOAA Ecosystems Data Assembly Center that will be located at the Stennis Space Center. It is also clear that there will be opportunities to interact with the NOAA project (Davenport, NOS) where retrospective satellite imagery will be merged with hydrographic and biological data for the northern Gulf of Mexico. As the project proceeds, additional interactions both within the NGI partnership and with various researchers at the NOAA National Centers for Coastal Ocean Science will develop.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 2 years.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* The research objectives of this NGI project are consistent with the overall New Priorities in NOAA's Strategic Vision. The monitoring and assessment activities associated with this project will address the NOAA Mission Goal 1 to "Protect, restore and manage the use of coastal and ocean resources through ecosystem-based management." The monitoring and observation strategies developed for this project will be supportive of those taken by NOAA through its various National Centers and Cooperative Institutes. In particular,

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* The water quality monitoring done for this project will allow the local coastal wetland and fisheries habitats to be better characterized. This

information will allow environmental managers to make better decisions regarding upland nutrient management, coastal habitat restoration, and post-hurricane coastal redevelopment. The project is pertinent to important local/regional issues such as coastal oxygen depletion, sources and fluxes of oxygen-depleting substances and other pollutants through the coastal transition zone, and setting baseline conditions against which the effects of Mississippi River diversions (through Lake Pontchartrain) might be evaluated.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* Currently, there is limited understanding of the role of different sources of freshwater inputs in delivering nutrients and other terrigenous materials into coastal waters particularly in critical habitat regions. The consequences of such inputs for carbon fluxes and variability in oxygen levels in the Mississippi Sound and Mississippi Bight remain poorly understood and require systematic assessment.

**G. Project Abstract:**

This project is aimed at understanding coastal nutrient, carbon, and trace element fluxes in these several key environments. The overarching goal is to better understand the transport and processing of nutrients and pollutants through the coastal transition zone. More specifically, the project will focus on issues of coastal eutrophication, fluxes of carbon through the coastal environment, and hypoxia in the Mississippi Bight.

The objectives of this project are to: monitor over differing seasonal and discharge conditions and compare nutrient concentrations and nitrogen to phosphorus ratios in different ecosystems including: a) a wetlands-dominated river system (Pearl River), b) a small estuarine bay (St. Louis Bay) experiencing increasing impacts of development, c) the Mississippi Sound into which with both of these systems open, and d) shelf waters outside the barrier islands; in collaboration with NOAA scientists, assess pCO2 and air-sea flux of carbon dioxide variability in coastal waters and relate it to environmental conditions of water physical properties, freshwater discharge, nutrient levels, and algal biomass; and characterize bottom water oxygen in shelf waters over seasonal time scales, identify localized hypoxia, and relate to nutrient and carbon dynamics in overlying surface waters and to water column stratification.

Hypotheses include: episodic events are important in flushing higher concentrations of nutrients and pollutants (e.g., trace metals) through the local estuarine environments; the Mississippi Sound is a significant source of phosphate for local estuaries; the greater proportion of fringing marshes in the lower Pearl River compared with St. Louis Bay results in lower throughflow of nutrients and metals in the Pearl River system; estuarine eutrophication is a contributor to regional hypoxia; seasonal development of a lower water column pycnocline is a necessary condition for hypoxia; there is a minimum level of fresh water input necessary for sufficient pycnocline development; enhanced nutrient inputs associated with

freshwater sources result in suppression of surface pCO2 and associated air-sea flux of CO2 due to stimulation of carbon fixation.

Ultimately, the analyzed data from this project will aid environmental managers in making better decisions regarding upland nutrient management, coastal habitat restoration, and post-hurricane coastal redevelopment. The project is pertinent to important local/regional issues such as coastal oxygen depletion, sources and fluxes of oxygen-depleting substances and other pollutants through the coastal transition zone, and setting baseline conditions against which the effects of Mississippi River diversions (through Lake Pontchartrain) might be evaluated.

**H. Expected Project Contributions to:**

- *Regional Awareness:* Dissemination of project results will be accomplished via regional meetings, presentations at regional/international meetings, and by peer-reviewed publications. Results will also be communicated through institutional and NGI websites and in conjunction with public displays.

- *Regional Interest:* Regional interest in this project is evidenced by the Gulf of Mexico Alliance priorities of water quality for healthy beaches and shellfish beds, and reductions in nutrient inputs to coastal ecosystems.

- *Regional Understanding:* Regional understanding will be promoted through efforts to publicize project activities in public displays, websites, and teacher workshops.

- *Regional Acceptance:* Regional acceptance will be achieved through publicizing the societal benefit and importance of this effort using activities described above.

- *Transition to Decision Support:* Transition to decision support will be accomplished through collaboration with other NGI partners.

- *Other Metrics Specific to this Project:*

**I. Contributions to Other CI Performance Measures**

- *Publications: peer reviewed, non-peer reviewed:* Results of this investigation will be published in peer reviewed journals.

- *Conference papers:* Results of this investigation will be presented at regional/national meetings.

- *Student support*: All institutions involved in this project strongly support graduate as well as undergraduate research.

**A. NGI Project File Number:** 06-USM-04

**B. Project Title, PI(s), Email, And Affiliation:** Interaction Between Off-shore Circulation and Nearshore Processes During Extreme Weather Events

Vladimar Kamenkovich Vladimar.Kamenkovich@usm.edu
Dmitri Nechaev Dmitri.Nechaev@usm.edu

Department of Marine Science
University of Southern Mississippi

**C. Key Scientific Question(s)/Technical Issue(s):** Study the interaction between the near-shore and off-shore processes during extreme weather events by using numerical modeling

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** NOAA researchers and Naval Research Laboratories specialists at Stennis Space Center

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 year.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* The project will support NOAA's mission to improve capabilities for monitoring, assessment and prediction of severe weather events in the near-shore region.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.*: The project is aimed at the establishment of regional modeling systems off the Mississippi, Alabama and western Florida coasts and will be transportable to other elements within the integrated National Backbone of observing systems. An improved capability for storm surge prediction is a high priority for the northern Gulf region as well as other regions.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* The analysis of the effects of the moving sea-land boundary and current-wave interaction on storm surges in the near-shore region will provide critical information needed to improve surge modeling.

**G. Project Abstract:**

The major goal of the proposed research is to study the interaction between the near-shore and off-shore processes during extreme weather events by using numerical modeling. The model will be based on the Princeton Ocean Model and will

take into account the recently suggested approaches to describing wavecurrents interaction and the land-sea boundary motion. The advanced numerical model capable of simultaneous reproduction of coastal dynamics and near-shore processes in the Northern Gulf of Mexico will be developed

The short-term objective of the proposed research is to analyze the effects of moving sea-land boundary and current-wave interaction on storm surges in the near-shore region. The long-term objective is to advance the understanding of the dynamical links between coastal circulation and near-shore processes during extreme weather conditions to improve modeling and monitoring of the coastal circulation. More precisely, to develop special algorithms that will allow us to predict water level variations and water quality, debris and pollutant transports, to estimate effects of coastal restoration activities on sediment transport and to assess other environmental and economical impact of severe weather events. By these efforts we plan to contribute to the establishment of regional modeling systems off the Mississippi, Alabama and western Florida coasts and the integrated National Backbone for the northern Gulf.

**H. Expected Project Contributions to:**

- *Regional Awareness:* The analysis of the effects of moving sea-land boundary and current-wave interaction on storm surges in the near-shore region is a key element in assessing environmental and economical impact of severe weather events. Dissemination of project results will be accomplished via regional meetings, presentations at regional/international meetings, and by peer-reviewed publications. Results will also be communicated through institutional and NGI websites and in conjunction with public displays.

- *Regional Interest:* The project is aimed at the establishment of regional modeling systems off the Mississippi, Alabama and western Florida coasts and the integrated National Backbone for the northern Gulf.

- *Regional Understanding:* The long-term objective is to advance the understanding of the dynamical links between coastal circulation and near-shore processes during extreme weather conditions to improve modeling and monitoring of the coastal circulation.

- *Regional Acceptance:* Regional acceptance will be achieved through publicizing the societal benefit and importance of this effort using activities described above.

- *Transition to Decision Support:* Transition to decision support will be accomplished through collaboration with other NGI partners.

- *Other Metrics Specific to this Project:*

## I. Contributions to Other CI Performance Measures

- *Publications: peer reviewed, non-peer reviewed:* Results of this investigation will be published in peer reviewed journals.

- *Conference papers:* Results of this investigation will be presented at regional/national meetings.

- *Student support*: All institutions involved in this project strongly support graduate as well as undergraduate research.

**A. NGI Project File Number:** 06-USM-05

**B. Project Title, PI(s), Email, And Affiliation:** Satellite and In Situ Optical Assessment of Algal Bloom Events in the Northern Gulf of Mexico

Steven E. Lohrenz, Steven.Lohrenz@usm.edu
Vernon Asper, Vernon.Asper@usm.edu
Xiaogang Chen, Xiaogang.Chen@usm.edu
Gregory A. Carter, Greg.Carter@usm.edu

Department of Marine Science
University of Southern Mississippi
Stennis Space Center, MS 39529

**C. Key Scientific Question(s)/Technical Issue(s):** Refine and evaluate optical approaches to detect and monitor bloom events of harmful algal species.

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** This project will involve collaboration with Dr. Hugh MacIntyre of the Dauphin Island Sea Lab. Future collaboration with Dr. Richard Stumpf of NOAA is also anticipated as results from this effort become available.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 1 year.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* This project complements the goals and objectives of the Northern Gulf Institute by addressing ecosystem management issues, public health and water quality. All of these topics are prominent elements in NOAA's strategic vision.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* This research will contribute to the Gulf of Mexico Alliance priority of promoting water quality for healthy beaches and shellfish beds.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* The traditional means of detecting and monitoring algal blooms are slow, labor intensive, and spatially limited, relying primarily on shipboard sample collection and direct microscopic observations. There is a need to develop and implement robust protocols for harmful algal bloom recognition, monitoring, and impact assessment on a national level. An effective method of bloom classification

and assessment will contribute to a better account of the incidence, trends, and causative factors of red tide events.

**G. Project Abstract:**

There is a need to develop and implement robust protocols for harmful algal bloom (HAB) recognition, monitoring, and impact assessment on a national level. An effective method of bloom classification will contribute to a better account of the incidence, trends, and causative factors of red tide events. This project seeks to examine the feasibility of detection of diagnostic optical patterns that allow identification and characterization of harmful algal bloom events.

The primary goal of this project is to refine and evaluate optical approaches to detect and monitor bloom events of harmful algal species. Specific objectives of the project are to: develop capability for glider-based optical assessments of algal bloom events in the northern Gulf of Mexico, by augmenting a glider vehicle with an in situ submersible hyperspectral spectrophotometer (BreveBuster); conduct glider deployments in coastal waters to assess algal bloom optical signatures and distributions; and compare satellite observations with in situ mapping using glider-based observations and discrete analyses of phytoplankton taxa and environmental variables at selected sites.

This proposed research will involve the glider-based deployment of automated *in situ* instrumentation that has been shown to be effective for optical detection and quantification of *Karenia brevis*, a HAB species. In addition to examining the utility of this approach for detection and assessment of *K. brevis* populations in the northern Gulf, the scope will be expanded to examine the utility of optical approaches for the detection and monitoring of *Pseudo-nitzschia* spp., another HAB species.

This effort will be complemented by analysis of satellite observations and in situ water sampling of phytoplankton taxa and environmental variables. The analysis of satellite imagery will involve an examination of alternative algorithms applied to both MODIS and hyperspectral data that could improve capabilities for discriminating HAB events. It is anticipated that this project will yield a predictive capability for environmental conditions conducive to HAB development in turbid waters.

## H. Expected Project Contributions to:

- *Regional Awareness:* Dissemination of project results will be accomplished via regional meetings, presentations at regional/international meetings, and by peer-reviewed publications. Results will also be communicated through institutional and NGI websites and in conjunction with public displays.

- *Regional Interest:* Regional interest in this project is evidenced by the Gulf of Mexico Alliance priorities of water quality for healthy beaches and shellfish beds, and reductions in nutrient inputs to coastal ecosystems.

- *Regional Understanding:* Regional understanding will be promoted through efforts to publicize project activities in public displays, websites, and teacher workshops.

- *Regional Acceptance:* Regional acceptance will be achieved through publicizing the societal benefit and importance of this effort using activities described above.

- *Transition to Decision Support:* Transition to decision support will be accomplished through collaboration with other NGI partners.

- *Other Metrics Specific to this Project:*

## I. Contributions to Other CI Performance Measures

- *Publications: peer reviewed, non-peer reviewed:* Results of this investigation will be published in peer reviewed journals.

- *Conference papers:* Results of this investigation will be presented at regional/national meetings.

- *Contributions to NOAA Career Track:* Status unknown at this time.

- *Student support*: All institutions involved in this project strongly support graduate as well as undergraduate research.

**A. NGI Project File Number:** 06-USM-06

**B. Project Title, PI(s), Email, And Affiliation:** Coordination and Educational Support for USM Northern Gulf Institute Activities

Steven E. Lohrenz, Steven.Lohrenz@usm.edu
University of Southern Mississippi

**C. Key Scientific Question(s)/Technical Issue(s):** The purpose of this project is to coordinate USM activities involved with the Northern Gulf Institute and provide outreach and education support for individual projects including graduate student participation in NGI projects.

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** Collaborations will be encouraged where possible both within USM and among other NGI partners.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 years.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* The NGI goals include the development of a research and transition program that fills priority gaps or reduces limitations in current awareness, understanding and decision support between upland-watershed systems, and coastal waters, habitats, resources and hazards. The fundamental philosophy of operations for the NGI is integration—integration of the land-coastal ocean- atmosphere continuum; integration of research to operations; integration of the collaborating institution's research and technical strengths; and cooperative integration with other entities. The proposed effort will help to integrate the research activities of USM with other elements of the NGI, and thus help to realize the goals of the NGI and solidify USM's role as a partner within the NGI. The project will also support graduate student education and outreach activities for the NGI.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* This project will contribute to several goals of the Gulf of Mexico Alliance including water quality for healthy beaches and shellfish beds, environmental education, identification and characterization of Gulf habitats, and reductions in nutrient inputs to coastal ecosystems.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* Coordination of multiple research activities is a key element to the success of the NGI. This project

seeks to provide needed support for critical elements of coordination, outreach and graduate education.

**G. Project Abstract:**

The objective is to provide coordination and integration among USM-led activities associated with the Northern Gulf Institute (NGI), and among activities of other academic and federal participants. An additional objective is to provide graduate student support for student participation in NGI projects. Finally, the proposed effort will work to publicize USM activities related to the NGI in various venues.

The objective is to provide coordination and integration among USM-led activities associated with the Northern Gulf Institute (NGI), and among activities of other academic and federal participants. An additional objective is to provide graduate student support for student participation in NGI projects. Finally, the proposed effort will work to publicize USM activities related to the NGI in various venues.

The PI will serve as a member of the NGI Council of Fellows and represent USM in meetings of the Council. In addition, the PI will arrange for regular meetings and teleconferences among USM principal investigators to encourage collaborative interactions and communication about project activities and findings. The PI will also monitor progress of USM-led projects and promote transition of research findings into operational products where feasible and appropriate.

Success of the NGI depends on meaningful communication among partners and within each participating and Affiliation. In addition, a principle objective of the NGI is to advance educational activities in fields associated with NOAA's strategic goals.

This project will support the overall goals of the NGI and specifically provide support for graduate student participation in NGI projects. Key findings and results will be publicized through websites, press releases, and other media outlets. Where feasible and appropriate, efforts will be made to transition research findings to operational elements within NOAA or other agencies.

The geographic scope corresponds to the area of operation of USM-led projects in the NGI, which is mainly the northern Gulf of Mexico.

**H. Expected Project Contributions to:**

- *Regional Awareness:* Dissemination of project results will be accomplished via regional meetings, presentations at regional/international meetings, and by peer-reviewed publications. Results will also be communicated through institutional and NGI websites and in conjunction with public displays. Graduate students will be encouraged to participate in workshop activities.

- *Regional Interest:* Regional interest in this project is evidenced by the Gulf of Mexico Alliance priorities of water quality for healthy beaches and shellfish

beds, environmental education, and reductions in nutrient inputs to coastal ecosystems.

- *Regional Understanding:* Regional understanding will be promoted through efforts to publicize project activities in public displays, websites, and teacher workshops.

- *Regional Acceptance:* Regional acceptance will be achieved through publicizing the societal benefit and importance of this effort using activities described above.

- *Transition to Decision Support:* Transition to decision support will be accomplished through collaboration with other NGI partners.

- *Other Metrics Specific to this Project:*

## I. Contributions to Other CI Performance Measures

- *Publications: peer reviewed, non-peer reviewed:* Results of this investigation will be published in peer reviewed journals.

- *Conference papers:* Results of this investigation will be presented at regional/national meetings.

- *Contributions to NOAA Career Track:* Status unknown at this time.

- *Student support*: This project will support at least three graduate students to work on NGI projects.

**A. NGI Project File Number:** 06-USM-07

**B. Project Title, PI(s), Email, and Affiliation:** Quantifying Ecosystem Services of Different Coastal Habitat Types

Richard S. Fulford, Richard.Fulford@usm.edu 228-872-4282
University of Southern Mississippi
Department of Coastal Sciences,
Gulf Coast Research Lab,
PO Box 7000, Ocean Springs, MS 39566

Harriet M. Perry, Harriet.perry@us.edu 228-872-4218
Center for Fisheries Research and Development
Gulf Coast Research Laboratory
PO Box 7100, Ocean Springs, MS 39566

Mark S. Peterson, mark.peterson@usm.edu 228-872-4203
University of Southern Mississippi
Department of Coastal Sciences,
Gulf Coast Research Lab,
PO Box 7000, Ocean Springs, MS 39566

**C. Key Scientific Question(s)/Technical Issue(s):** This project has two emphasis areas. These are 1) the links between habitat quality in emergent marsh estuaries and production of estuarine-dependent juvenile fishes and 2) how secondary production on sub-tidal oyster reefs is recovering from damage caused by Hurricane Katrina and quantify the trophic connectance of oyster reefs with the larger pelagic ecosystem.

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** This project has two collaborative partners. Dr. Rebecca Allee of the NOAA Gulf Coast Services Center, and Department of Marine Resources – Shellfish Division. This project also involves coordinated sampling of restored oyster reefs communities with a similar NGI funded effort at DISL.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 years, 2007-2009.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* This project will support Goal #1 of the NOAA Strategic Plan to **protect, restore, and manage the use of coastal ocean resources through an ecosystem approach to management**. Specifically, this project will support the development of approved indicators of ecological health in the northern GOM and assist in informing the public of the value of coastal ecosystems. This research will

also support two of the seven missions of the NOAA Trust Resources: 1) marshes, mangroves, seagrass beds, coral reefs, and other coastal habitats; and 2) commercial and recreational fishery resources.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* This project will benefit society by providing tools and data important to coastal habitat protection and communicating habitat value to the public. Specific user groups include Mississippi Department of Marine Resources in the valuation and conservation of coastal preserves, as well as private land owners who need to know the ecological value of particular coastal habitat. Additionally, NGOs like The Nature Conservancy can use these data in evaluating potential management scenarios to coastal ecosystems.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* This project will provide modeling tools intended to provide quantitative metrics of the value of two critical habitat types to the coastal ecosystem: emergent marsh and sub-tidal oyster reefs. These data are not available at present and will provide a justifiable basis for coastal habitat conservation and more balanced ecosystem-level management objectives.

**G. Project Abstract:**

This project has two emphasis areas. These are 1) the links between habitat quality in emergent marsh estuaries and production of estuarine-dependent juvenile fishes and 2) how secondary production on sub-tidal oyster reefs is recovering from damage caused by Hurricane Katrina and quantify the trophic connectance of oyster reefs with the larger pelagic ecosystem. The objectives of this study which support the first emphasis area are to: delineate estuarine habitat quality for juvenile estuarine-dependent fishes in the lower Pascagoula river delta based on spatial and temporal GIS dataset of both structural and dynamic habitat characteristics; collect data on the distribution and biomass of juvenile fishes and relate it to spatial variation in structural and dynamic habitat characteristics; and refine and validate an existing fish habitat-production model based on a landscape modeling approach for use as a planning tool for coastal habitat management.

The objectives of this project which support the second emphasis area are to: collect data on oyster reef recovery from impacts of Hurricane Katrina with a focus on community re-colonization and changes in net secondary production through time; quantify the production export from oyster reefs in western Mississippi Sound to the coastal food web with a focus on recreationally important fin fishes; and develop a food web model optimized for quantifying the energetic role of oyster reef secondary production within the coastal ecosystem as a tool for coastal planning and management.

Two other objectives facilitate data handling and database support. These are to: develop metrics of ecosystem services based on trophic interactions and physical

habitat structure in support of ecosystem-based management in NGOM including analytical models and GIS maps; and organize and project data in compliance with federal metadata standards in order to facilitate the creation of a database for the NGOM coastal ecosystem.

**H. Expected Project Contributions to:**

- *Regional Awareness:* This project will provide data which in cooperation with the NOAA Coastal Services Center will be used to generate publicly accessible maps of coastal habitat in the northern GOM that provide information on the value of certain habitat types to fishery production.

- *Regional Interest:* This is a critical time for coastal habitat management with the demands of multiple potential user-groups compounded by the damage from hurricane Katrina. Development of understandable metrics of the ecosystem importance of coastal habitat will increase the interest of managers and the public in ecosystem-based approaches to coastal management.

- *Regional Understanding:* The quantifiable data and modeling tools developed during this project will be presented in an accessible form so that all interested stake holders can understand the value of coastal habitat.

- *Regional Acceptance:* Understandable and quantifiable metrics of coastal habitat value has proven critical for acceptance of new approaches such as ecosystem-based management. This project will provide tools to bridge the acceptance gap.

- *Transition to Decision Support:* This project will provide quantitative modeling tools and data necessary for the transition to a decision support system for management.

- *Other Metrics Specific to this Project: Through the collaboration with the NOAA Coastal Services Center, Mississippi Department of Marine Resources and through coordination with similar research at DISL this project will support the development of regional-level tools for projecting ecosystem responses to coastal habitat restoration including creation of new habitat. Such data will be important for planning management responses to future severe storm events.*

**I. Contributions to Other CI Performance Measures**

- *Publications: peer reviewed, non-peer reviewed:* All data and modeling tools produced as a part of this project will be published in the peer-reviewed

literature and made available to interested stake-holders for use in public communication and management planning

- *Conference papers:* Data and modeling tools produced by this project will be presented annually at NGI-funded meetings as well as relevant meetings of the scientific community such as Estuarine Research Federation and public meetings such as the annual fisheries research symposium sponsored by the GCRL Center for Fisheries Research and Development.

- *Student support:* This project will support at least one graduate student

**A. NGI Project File Number:** 06-USM-08

**B. Project Title, PI(s), and Affiliation:** Macrofaunal Indicators of Hypoxia

Chet F. Rakocinski
Department of Coastal Sciences
The University of Southern Mississippi
Gulf Coast Research Laboratory
Ocean Springs, MS 39564

**C. Key Scientific Question(s)/Technical Issue(s):** Gain a better understanding of hypoxic effects on the benthic macrofauna, including extended effects on populations, and ecosystem function in connection with background hydrographic monitoring and assessment

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):**

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 1 year.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* This project supports NOAA's mission "to improve the capability of coastal zone managers to effectively prevent or reduce the ecological and economic impacts of hypoxia", and to "advance understanding, predicting, and managing the causes and ecological and economic impacts of hypoxia in representative coastal ecosystems."

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* This research will contribute to the Gulf of Mexico Alliance priority of promoting water quality for healthy beaches and shellfish beds.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* An understanding of the consequences of hypoxia for macrobenthic communities is currently lacking and this study will provide critical information to aid in characterizing macrobenthic responses.

**G. Project Abstract:**

Hypoxia changes ecosystem function partly by causing shifts in abundance, body-size composition and attendant vital rates, and taxonomic composition of the macrobenthos. However, a better understanding of hypoxic effects on macrobenthic organisms and extended effects on populations, and ecosystem function is badly needed before accurate models of hypoxic effects can be

developed. For this study, macrobenthic subsystem function will be characterized through the measurement of macrofaunal indicators that may respond to hypoxia, including production potential, biomass-size spectra, community turnover time, and trophic dynamics. In addition, the USEPA Benthic Index for the northern Gulf of Mexico will be calculated as a "benchmark". Previously, these macrofaunal indicators have been examined from various shallow estuarine habitats within several embayments during a recently funded EPA study; however, these same end points also need to be assessed in connection with classic hypoxia scenarios that ensue in deeper near-shelf habitats, where late-summer hypoxia is caused by turbid bottom waters trapped beneath the local pycnocline.

The purpose of this study is to gain a better understanding of hypoxic effects on the benthic macrofauna, including extended effects on populations, and ecosystem function in connection with background hydrographic monitoring and assessment. The short-term objective is to complete sampling of ten or eleven macrobenthic events in conjunction with coordinated hydrographic sampling at seven stations located along an onshore-offshore transect running between Saint Louis Bay and the western-most CenGOOS buoy. Subsets of likely hypoxic and reference stations will be sampled at two or three seasonal time points. Future possible expansions are slated to include additional stations in the lower Pearl River estuary, the Bay of St. Louis, and in the MS Sound between the Pearl River and the Bay of St. Louis. The long-term object is to provide the resource management community with reliable macrofaunal community-based indicators for assessing the consequences of hypoxia to ecosystem function. Macrofaunal responses will be interpreted within the context of the monitoring and assessment framework provided by accompanying NOAA-CI efforts.

**H. Expected Project Contributions to:**

- *Regional Awareness:* Dissemination of project results will be accomplished via regional meetings, presentations at regional/international meetings, and by peer-reviewed publications. Results will also be communicated through institutional and NGI websites and in conjunction with public displays.

- *Regional Interest:* Regional interest in this project is evidenced by the Gulf of Mexico Alliance priorities of water quality for healthy beaches and shellfish beds, and reductions in nutrient inputs to coastal ecosystems.

- *Regional Understanding:* Regional understanding will be promoted through efforts to publicize project activities in public displays, websites, and teacher workshops.

- *Regional Acceptance:* Regional acceptance will be achieved through publicizing the societal benefit and importance of this effort using activities described above.

- *Transition to Decision Support:* Transition to decision support will be accomplished through collaboration with other NGI partners.

- *Other Metrics Specific to this Project:*

**I. Contributions to Other CI Performance Measures**

- *Publications: peer reviewed, non-peer reviewed:* Results of this investigation will be published in peer reviewed journals.

- *Conference papers:* Results of this investigation will be presented at regional/national meetings.

- *Student support*: All institutions involved in this project strongly support graduate as well as undergraduate research.

**A. NGI Project File Number:** 06-LSU-01

**B. Project Title, PI(s), Email, and Affiliation:** DELTA Ecosystem Forecasting System

Dubravko Justic, Kenny Rose, Masamichi Inoue and Chunyan Li,
Department of Oceanography and Coastal Sciences,
Louisiana State University

**C. Key Scientific Question(s)/Technical Issue(s):** Understand the effects of different types of pulsing scenarios on coastal ecosystem dynamics.

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** This Project will be coordinated with the DELTA observation system proposed with funding from a Shell grant to LSU.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 1 year.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* This project specifically addresses the NOAA's ecological forecasting initiative.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* This project will impact the educational missions of Louisiana State University in several ways by enhancing the mission of its land-grant and sea-grant institution status. The proposed research involves a significant amount of modeling research, with opportunities for student training (both graduate and undergraduate) in both settings.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* Currently there is no established standard for tools to forecast ecosystem response to restoration projects or a generic approach that will entirely encompass all needs and expectations of ecosystem resilience. Ecosystem forecasting is limited by a number of factors including inadequate initialization information, unknown boundary conditions, inaccurate model physics and atmospheric forcing functions, and inadequate algorithm development of geomorphic and ecological responses to geophysical processes. Moreover, establishing skill levels in coast wide forecasting is also limited by inadequate validation data and the ambiguity of defining skill. To effectively model the Mississippi River delta, a much more comprehensive and dynamic approach is needed. This includes the ability to couple models, invoke dynamic algorithms based on streams of sensor and satellite data, locate appropriate data and computational resources, and create necessary workflows on demand, all in

real time. Such an approach could enhance planning restoration strategies, ecological forecasting, placement of future sensors, control of water diversion for salinity control, or predict/control harmful algal blooms.

**G. Project Abstract:**

This project seeks to develop and apply a series of linked simulation models that will allow tracking the effects of pulsed freshwater inputs through hydrodynamics, biogeochemical cycling, primary production, zooplankton dynamics, fish growth, and water quality dynamics. Each of these models necessarily operate on temporal and spatial scales appropriate for their dynamics; common development of these models will enable them to share information and be linked via the predictions of one model being used as input values for another model. All of the models will be applied to the Breton Sound estuary and Barataria Basin, and will be used to generate spatio-temporal maps of key state variables. The coordinated field sampling and modeling will enable development of a consistent set of data to ensure that the different models can be calibrated to the same conditions. Both field data and models will be used to evaluate the hypotheses that contrast how energy and nutrients are propagated up the food chain and exported under the many, small and the fewer, large pulsing scenarios. As one part of knowledge-building efforts to guide restoration and recovery, it is proposed to evaluate the stability of former, current (i.e., Post Katrina), and potentially altered stable states. This project will use a variety of models (e.g., IBM's, traditional fisheries population models, etc.) to guide future data acquisition.

The central objective of this DELTA research plan is to understand the different types of pulsing scenarios on coastal ecosystem dynamics. There are two fundamental types of pulses that this project will investigate: 1) pulsing of controlled river diversion structures that simulate specific frequency and duration events on ecosystem state change (Breton Sound); 2) proposed pulsing of river water in basin with much longer freshwater residence time (Barataria Basin).

The central tenet of the proposed research is that wetlands and adjacent waters associated with deltas are pulse-regulated ecosystems. Different spatial and temporal scales and the pattern of pulsed freshwater inputs are critical parameters controlling nutrient cycling, productivity, residence time and export, and trophic structure. The interrelationships of biological, biogeochemical, and physical processes at temporal, spatial, and process will be evaluated. Particular emphasis will be given to linkages between biogeochemical, physical, and biological cycles within the context of human influences on river-dominated coastal ecosystems.

## H. Expected Project Contributions to:

- *Regional Awareness:* The project will specifically target outreach at the state level through interactions with stakeholder groups, including the interagency advisory committees for the Breton Sound and Barataria Basins.

- *Regional Interest:* Rehabilitating the ecosystems of the Mississippi River Delta is a formidable challenge whose failure and ineffectiveness would have huge consequences to the Gulf coast region and the nation's ecological and economic resources. The tools developed in this modeling program for habitat utilization by higher trophic levels and water quality conditions with nutrient loading are of regional and national interest in support of ecosystem-based coastal management.

- *Regional Understanding: The project will help improve management decisions to sustain ecosystem productivity and lessen the impacts from extreme natural events and human activities.* Restoration science and engineering needs tools to forecast ecosystem state change associated with specific restoration measures. System performance is critical to assessment of effective restoration techniques. The modeling tools proposed will assist in understanding system performance to large-scale manipulations.

- *Regional Acceptance:* Based on the positive responses to wetland restoration proposals, it is likely the public acceptance will be high. Modeling and information management are critical to disseminate our understanding of system response to restoration techniques. Effective modeling tools can help stakeholder understanding of what is effective; thus important in accepting nature of restoration approaches of achieving specific goals.

- *Transition to Decision Support:* Our connections to the interagency advisory committees in Louisiana and the state review team for science and engineering will facilitate a rapid transfer to the decision makers. Modeling is critical tool in decision-support systems as advanced in development of ecological forecasting. Emphasis on higher trophic level response and eutrophication are two critical areas of decision support needed in Gulf Coast region.

- *Other Metrics Specific to this Project:* None at this time.

## I. Contributions to Other CI Performance Measures

- *Contributions to NOAA Career Track:* Increasing the awareness about NOAA mission may facilitate career opportunities for our students. Interactions with NOAA on the regional restoration planning and implementation program (CPRA and LaCPR) will help facilitate career opportunities by better understanding the tools that will be developed in this proposal.

- *Student support:* The project will provide partial support for two graduate students.

**A. NGI Project File Number:** 06-LSU-02

**B. Project Title, PI(s), Email, and Affiliation:** Public Health and Stressors


| | | |
|---|---|---|
| Sibel Bargu Ates[1] | sbargu@lsu.edu | 225-578-0029 |
| Gene Turner[1] | euturne@lsu.edu | 225-578-6454 |
| Aixin Hou[2] | ahou@lsu.edu | 225-578-4294 |
| Brian Fry[1] | bfry@lsu.edu | 225-578-9403 |

[1] Department of Oceanography and Coastal Sciences, 1001 Energy, Coast & Environment Building, Louisiana State University, Baton Rouge, Louisiana 70803

[2] Department of Environmental Studies, 001 Energy, Coast & Environment Building, Louisiana State University, Baton Rouge, Louisiana 70803


**C. Key Scientific Question(s)/Technical Issue(s):**
We have four objectives:

1. Community Biomass and Turnover. We will quantify temporal and spatial dynamics of community biomass in the two estuaries, using POM samples collected from open waters during routine monthly transects and algal growth bioassays. Because N is often a limiting element for planktonic biomass and turnover, we will also focus on quantifying N sources to the estuaries using isotope measurements of nitrate and N fixation.

2. Community Metrics. We will determine plankton community metrics, using fingerprint of microbial metabolites, nutrient bioassays (algae) and sediment records.

3. HABs. We will routinely sample estuarine waters to quantify occurrence and abundance of harmful algal species, and also begin to quantify HAB toxicity using ELISA and HPLC.

4. *Vibrio*. We will develop qPCR protocols to detect and quantify potentially pathogenic *Vibrio* species of interest in coastal waters and study the temporal and spatial dynamics of *Vibrio vulnificus* and *Vibrio parahaemolyticus* using both culturing and molecular methods. We will also determine the impacts of physiochemical parameters (temperature, salinity, and nutrients in particular) on the development of the populations.

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** This Project will be coordinated with the DELTA observation system proposed with funding from a Shell grant to LSU.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 years.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:*
  The Mississippi River delta is one of the most impacted coastal ecosystems in the world including four of the most significant national issues relative to the NOAA mission: 1) climate change and sea level impacts on coastal resources; 2) hazards including hurricane disturbance to cultural, economic and natural resources of coastal regions; 3) habitat loss and ecosystem management including the loss of nearly one-third of the deltaic wetland landscape (4,500 km2) in the last one hundred years; and 4) water quality including the periodic occurrence of one of the largest hypoxic zones among coastal ocean regions.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:*
  Coastal wetland sustainability, eutrophication, sea level rise, freshwater inputs to coastal areas, and fishery productivity can all be addressed by evaluating their status and functioning in a major river system, such as at the Mississippi River Delta. Information regarding the role of hydrologic pulsing (as imitating natural flood regimes) will be of significant value to occupants of other major river systems in the world. This project will impact the educational missions of Louisiana State University in several ways by enhancing the mission of its land-grant and sea-grant institution status.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):*
  This project will contribute significantly to a number of scientific and management issues at local, regional, and global scales. Eutrophication, sea level rise, freshwater inputs to coastal areas, and public health and stressors can all be addressed by evaluating their status and functioning in a major river system, such as at the Mississippi River Delta. The burden placed on coastal water bodies by humans (e.g. as point and non-point source inputs) has been implicated in the alarming rates of coastal eutrophication. Studies of Louisiana coastal waters document the occurrence of potentially toxic algal populations and potentially pathogenic bacteria for many years; often in bloom quantities. However, the species level response and toxin production to changing environmental conditions, and many aspects of species-specific dynamics of this microbial and algal community that contributes to bloom formation are, however, still poorly understood.

**G. Project Abstract:**

Inputs of Mississippi River water change both hydrologic regime and nutrient loading to the Breton Sound and Barataria Bay estuaries. It is hypothesized that this bottom-up forcing changes in community structure and function of phytoplankton and microbial communities, creating fast turnover dynamics under nutrient-rich, fast flow-through systems. River inputs also flush marshes during flood events and likely result in a more complex mixed system in the open waters sampled during transect work. It is also hypothesized that the algal groups that will

respond to eutrophication will differ between marine and fresh water systems.

The objectives of this project are to quantify temporal and spatial dynamics of community biomass in the two estuaries, using POM samples collected from open waters during routine monthly transects; determine plankton community metrics, using fingerprint of microbial metabolites, nutrient bioassays (algae), respiratory demand (whole plankton community) and sediment records; routinely sample estuarine waters to quantify occurrence and abundance of harmful algal species, and also begin to quantify HAB toxicity using ELISA and HPLC; and develop qPCR protocols to detect and quantify potentially pathogenic *Vibrio* species of interest in coastal waters and study the temporal and spatial dynamics of *Vibrio vulnificus* and *Vibrio parahaemolyticus* using both culturing and molecular methods. This project also determines the impacts of physiochemical parameters (temperature, salinity, and nutrients in particular) on the development of the populations.

**H. Expected Project Contributions to:**

- *Regional Awareness:*
  Educational support, data development and improved science-based management support

- *Regional Interest:*
  The long-term consequences of eutrophication may include reduced biodiversity, increased dominance of opportunistic species, and changes in material and energy flows. It has become increasingly apparent that these symptoms of eutrophication are not minor and localized, but have large-scale implications and are spreading. The estuaries and coastal waters of the northern Gulf of Mexico (GOM) are classic examples of these phenomena. Concerns for the Barataria and Breton Sound Estuaries targeted for "restoration" by increased inputs of Mississippi river water thus include possible eutrophication and hypoxia, probably in localized areas. Eutrophication can also stimulate HABs and HAB toxin production. Phytoplankton toxins have been the subject of regional interest for many decades in the Gulf of Mexico. Clearly, large rivers like the Mississippi can have a significant impact on biological processes in the coastal zone and shifts in nutrients within estuaries may promote growth of potentially toxic algal species. Besides HABs, pathogenic *Vibrio* bacteria can also pose health risks in coastal systems. Infection by *Vibrio vulnificus* is one of the leading causes of seafood-related illnesses in the United States.

.

- *Regional Understanding:*
  Educational support, data development and improved science-based management support

- *Regional Acceptance:* To be determined

- *Transition to Decision Support:*
  Our connections to advisory committees in Louisiana will facilitate a rapid transfer to the decision makers

▪ *Other Metrics Specific to this Project:* Not at this time

## I. Contributions to Other CI Performance Measures

▪ *Contributions to NOAA Career Track*
Our collaborations with Dr. Greg Doucette at Marine Biotoxins Program, NOAA/NOS Charleston, South Carolina, Dr. Rost Parson at the NCDDC and Dr. Hugh MacIntyre at the Dauphin Island Sea Lab, AL will facilitate career opportunities for our students.

▪*Student support*
3 students were budgeted in this project, but budget uncertainties made it little difficult to recruit all 3 students, so we postponed 2 student recruitments until year 2008.

**A. NGI Project File Number:** 06-LSU-03

**B. Project Title, PI(s), Email, and Affiliation:**
Trophic Linkages and Biomass Production in Estuarine Ecosystems


| | | |
|---|---|---|
| Malinda Sutor | msutor1@lsu.edu | 225-578-8055 |
| Sibel Bargu Ates | sbargu@lsu.edu | 225-578-0029 |
| James H. Cowan, Jr. | jhcowan@lsu.edu | 225-578-9400 |
| Richard F. Shaw | rshaw@lsu.edu | 225-578-6734 |

Department of Oceanography and Coastal Sciences
1001 Energy, Coast, & Environment Building
Louisiana State University
Baton Rouge, Louisiana 70803


**C. Key Scientific Question(s)/Technical Issue(s):**

1). To determine how pulsed water regime will affect pelagic primary productivity

2). To determine if estuarine-dependent and/or estuarine-resident fishes assimilate a significant portion of the available carbon and nitrogen delivered to Breton Sound and Barataria Bay via high consumption rates of zooplankton and benthos, which then are exported as fish biomass at the end of the growing season (late fall-early winter).

3). To determine if during large deliveries of water to the estuary (Breton Sound only), whether estuarine-resident killifishes (*Fundulus sp.)* will benefit more from nutrients delivered to the estuary via trophic pathways that favor high marsh productivity relative to aquatic primary productivity. In contrast we will determine (in Breton Sound only) if smaller pulses of water to the estuary benefit estuarine transient species such as bay anchovy, gulf menhaden and Atlantic croaker via trophic pathways that favor aquatic primary productivity relative to marsh productivity.

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** This Project will be coordinated with the DELTA observation system proposed with funding from a Shell grant to LSU. In addition, this project will be coordinated with ongoing research efforts of PI's funded by Louisiana Department of Wildlife and Fisheries and the US Fish and Wildlife Department to conduct fisheries related surveys in the study areas.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 years.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:* Our project addresses the ecological function of coastal wetlands under different freshwater pulsing regimes. A greater understanding of seasonal trophic processes will help to address several issues specific to NOAA mission, namely 1) enhance our understanding and management of hazards including hurricane disturbance to cultural, economic and natural resources of coastal regions; and 2) provide information that will increase our understanding of the implications of habitat loss and better guide ecosystem management and coastal restoration in this important river delta system.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:* Coastal wetland sustainability, eutrophication, sea level rise, freshwater inputs to coastal areas, and fishery productivity can all be addressed by evaluating their status and functioning in a major river system, such as at the Mississippi River Delta. Information regarding the role of hydrologic pulsing (as imitating natural flood regimes) will be of significant value to occupants of other major river systems in the world. This project will impact the educational missions of Louisiana State University in several ways by enhancing the mission of its land-grant and sea-grant institution status.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):* There is a great need for enhanced knowledge of biogeochemical and energy cycling in coastal ecosystems to improve model prediction of biomass changes over various temporal and spatial scales. The data collected on plankton biomass and taxonomic distributions in these areas will be of great value as there is a relative paucity of these data collected in coastal Louisiana.

**G. Project Abstract:**

Higher trophic level production in estuaries is governed by the laws of trophic supply and demand and changes in nutrient supply for primary producers can filter up through the food web to fishes, thereby increasing organismal production, if overall production is increased at lower trophic levels. Moreover, estuaries serve as nursery areas for fishes that spawn offshore, enter the estuary as larvae and, after a period of juvenile residency, move back offshore to complete their life cycles. Evidence suggests that the migration of juvenile fishes offshore represents a significant export of energy from estuaries Although this link has rarely been quantified, biogeochemical cycling may be affected in northern Gulf of Mexico estuaries through energy translocation via biomass (and its constituent composition of C and N) export by estuarine dependent fishes, and this pathway may be important in the top-down control of energy subsidies to coastal ecosystems. **The central tenet of our proposal is that wetlands and adjacent waters associated with deltas are pulse-regulated ecosystems. Different spatial and temporal scales and the pattern of pulsed freshwater inputs are**

**critical parameters controlling nutrient cycling, productivity, residence time and export, and trophic structure.**

**H. Expected Project Contributions to:**

- *Regional Awareness:* This project is closely tied to work at LDWF and will enhance regional awareness of the seasonal functions of estuarine and coastal habitats for important fish stocks.

- *Regional Interest:* The ecological functioning of estuarine and coastal environments in southern Louisiana is critical to assess to determine the relative impacts of coastal loss and degradation and to guide restoration efforts. As many commercial fish species important to the economy of southern Louisiana utilize these areas as critical habitat, we feel there will be great interest in our findings.

- *Regional Understanding:* We will develop, in cooperation with Dr. S. Hodge (NGI Outreach Coordinator, a formal Outreach Plan, facilitated through Louisiana Sea Grant.

- *Regional Acceptance:* The results of this research have the potential to greatly enhance our understanding of the ecological function of coastal wetlands, particularly as they translate to fisheries issues, and given the importance of these issues to Louisiana, we anticipate our work will be well accepted.

- *Transition to Decision Support:* Due to the close ties our project has with LDWF and USFW, we anticipate that the additional ecological perspective our results will bring to the ongoing research efforts through those agencies will translate well to regional and federal managers.

- *Other Metrics Specific to this Project:* none at this time

**I. Contributions to Other CI Performance Measures**

- *Student support:* There is partial support for one graduate student and a student worker in our proposal

**A. NGI Project File Number:** 06-LSU-04

**B. Project Title, PI(s), Email, and Affiliation:**
Investigating Material Exchange Between the Marsh and Channel Along an Estuarine Gradient


| | | |
|---|---|---|
| Jaye Cable | jcable@lsu.edu | 225-578-9402 |
| Irving Mendelsohn | imendel@lsu.edu | 225-578-6425 |
| John White | jrwhite@lsu.edu | 225-578-8792 |
| Robert Twilley | rtwilley@lsu.edu | 225-578-8806 |

Department of Oceanography and Coastal Sciences, 1001 Energy, Coast, & Environment Building, Louisiana State University, Baton Rouge, Louisiana 70803


**C. Key Scientific Question(s)/Technical Issue(s):**
How do rising sea levels and/or riverine pulses
(a) enhance carbon and nitrogen export from coastal wetlands; and
(b) modify processes responsible for coastal marsh sustainability (e.g. productivity, accretion)?

**D. Project Sponsor(s) (NMFS, NRL, FSU, DISL, and etc., plus any involved non-sponsor project partners):** This Project will be coordinated with the DELTA observation system proposed with funding from a Shell Foundation grant to LSU. In addition, the NOAA Coastal Ocean Program funded project underway at LSU addresses cumulative stressors in coastal areas of Louisiana, including the marsh response to these stressors. This project will be coordinated with the ongoing research of this and several other NOAA-funded projects conducted by PIs listed on this NGI project.

**E. Project Duration: (not to exceed 3 years, i.e., so as to be substantially complete by the start of Renewal Review that begins in mid- to late-FY 2009).** 3 years.

**F. Project Baselines:**

- *Contributions to Specific NOAA Goals/Objectives:*
  The project addresses carbon export to the coastal ocean as climate change and rising sea levels increasingly impact coastal salt marsh systems. Carbon fluxes from rivers and other point sources to ocean margins are fairly well established, but the diffuse contribution of carbon to the ocean from marshes and how this source will change as climate varies are not well understood. This project specifically fits the NOAA mission goals to understand climate variability and ecosystem management due to the implications for both local-scale coastal eutrophication and the global carbon budget.

- *Problems and Priorities, i.e., how is the project tied to regional issues and priorities, identify priority stakeholders, e.g., Gulf Alliance, specific user groups, etc.:*

Coastal wetland sustainability, potential sources for eutrophication, and sea level rise will be addressed by evaluating their status and functioning in wetlands of a major river system, e.g., the Mississippi River. How hydrologic pulsing (as imitating natural flood regimes) impacts these wetlands will be of significant value to occupants of other major river systems in the world. This project will impact the educational missions of Louisiana State University by training undergraduate and graduate students and enhancing the mission of its land-grant and sea-grant institution status. PIs have previously established relationships with stakeholders (CIAC diversion stakeholder committee and the State of Louisiana Science and Engineering Review Team) in which we will disseminate our results through formal scientific presentations to stakeholders and policy makers.

- *Gaps (describe how the project will narrow gaps in regional knowledge, data, model performance, geographic coverage, etc.):*

  Very little is understood about ocean margin carbon sources and the role in the global carbon budget. This project will improve our understanding of carbon export from fresh and salt marshes in northern Gulf of Mexico through a study in coastal Louisiana. Data collected will support regional models for ecosystem management through the Delta Observing System Project (06-LSU-01).

**G. Project Abstract:**

The wetland boundary between terrestrial and coastal ocean environments is a dynamic and highly productive zone, but its role in biogeochemical cycling and ocean productivity is not well understood. Dittmar et al. (2006) estimate that >10% of the terrestrial DOC fluxes to the world oceans are derived from mangrove wetlands alone. Material exchange with marshes and groundwater are two key sources for carbon to the coastal ocean. Along the northern Gulf of Mexico coast, prolific point and non-point sources of carbon and nitrogen exist in the form of major rivers and expansive wetland ecosystems that extend from Florida to Texas. Most notably, the Mississippi River and its associated deltaic estuaries have been linked to carbon and nitrogen storage and offshore transfer of energy. Relative sea level rise due to subsidence and eustatic changes in sea level has enhanced coastal wetland destruction. Inundation frequency and duration of marsh water levels as sea level rises will have a strong impact on the net retention or release of C, N and P in accreted organic matter. Extended low water or dry periods in a marsh can lead to a net export of nutrients and a loss of carbon. Rapid wetland loss due to rising sea levels combined with landscape-scale hydrologic alterations indicate these buried carbon repositories (marshes) may be vulnerable to remineralization processes and ultimately contribute to ocean-atmosphere carbon pools. The proposed study contributes to two NGI major research themes and several ongoing NOAA funded research efforts aimed at ecosystem management and climate change variability.

The scientific goal of this project is to assess impacts of rising sea level and/or fluvial inputs on C and N budgets in a marine salt marsh environment at the interface between the Gulf of Mexico and a major river system. We intend to

establish (1) a quantitative baseline for water, C, and N cycling between the marsh and channel and (2) how this cycling contributes to marsh productivity and accretion.

**H. Expected Project Contributions to:**

- *Regional Awareness:* The project will specifically target outreach at the state level through interactions with stakeholder groups. These include our ongoing relationship with interagency advisory committees for the Breton Sound and Barataria Basins. One PI is also a member of the State of Louisiana Science and Engineering Review Team and will provide a crucial outlet for dissemination of our results. We will work with Florida State University to the extent possible, specifically Thorsten Dittmar, to compare our results with his research findings.

- *Regional Interest:* Climate change and rising sea levels are of interest to all coastal populations, not just along the Gulf coast. Salt marshes are a common feature along the US Gulf coast, and citizens of this region will be interested in the impact climate change will have on this critical ecosystem. We predict our findings related to carbon export to the ocean will be of great regional and national interest.

- *Regional Understanding:* Our efforts in outreach will extend to our collaborations with the Mississippi State University Outreach Program. In addition, Cable is active in ocean exploration outreach through NOAA and the science teacher training program. We will contribute to regional public understanding of our project through policy makers and outreach.
- *Regional Acceptance*: To be determined, but based on the positive responses to environmental messages about climate change in the media lately, it is likely the public acceptance will be high.

- *Transition to Decision Support:* Our connections to the interagency advisory committees in Louisiana and the state review team for science and engineering will facilitate a rapid transfer to the decision makers.

- *Other Metrics Specific to this Project:* Not at this time.

**I. Contributions to Other CI Performance Measures**

- *Conference papers:* None to report yet.

- *Contributions to NOAA Career Track:* Our collaborations with Mr. John Rapp in the NOAA Baton Rouge office and Ms. Kate Clark in the NOAA Narragansett office may facilitate career opportunities for our students.

- *Student support:* We are training and supporting two students with this project.

# APPENDIX C: Summary of Publications – Number and Type

The following is a summary of publications for the period of October 1, 2006 through June 30, 2007.

| | Institute Lead Author | | | NOAA Lead Author | | | Other Lead Author | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 2007-08 | | | 2007-08 | | | 2007-08 |
| **Peer Reviewed** | | | 4 | | | | | | 4 |
| **Non Peer Reviewed** | | | 2 | | | | | | 1 |

This table provides a total count of publications for the reporting period and previous periods categorized by NOAA lead author, Institute (or subgrantee) lead author, and other lead author and whether it was peer-reviewed and non peer-reviewed (not including presentations).

# APPENDIX D: Summary of Personnel Supported by NGI Funding

Pursuant to the instructions provided in the July 12, 2007 reporting guidance letter, the following table summarizes the total number of researches and administrative professionals supported by NGI funding.

| Personnel | | | | |
|---|---|---|---|---|
| Category | Total | B.S. | M.S. | Ph.D. |
| Research Scientist | 13 | | 5 | 8 |
| Visiting Scientist | 0 | | | |
| Postdoctoral Fellow | 1 | | | 1 |
| Research Support Staff | 2 | 1 | 1 | |
| Administrative | 5 | 1 | 1 | 3 |
| **Total (**≥ 50% support) | 21 | 2 | 7 | 12 |
| Undergraduate Students | 1 | 1 | | |
| Graduate Students | 21 | 2 | 15 | 4 |
| Employees that receive < 50% NOAA Funding (not including students) | 36 | 2 | 9 | 24 |
| Located at Lab (include name of lab) | 0 | | | |
| Obtained NOAA employment within the last year | 3 | | | |

ii. total number of employees by job title and terminal degree that receive at least 50% support from NOAA, postdocs and visiting scientists;
iii. total number of undergraduate and graduate students receiving any level of support;
iv. number of employees (including postdocs and visiting scientists) that received less than 50% annual salary support;
v. for Institutes that award subcontracts, please obtain only information on the number of supported postdocs and students from your subgrantees.
vi. number of employees/students that receive 100% of their funding from an OAR laboratory and/or are located within that laboratory;
vii. number of employees/students that were hired by NOAA within the last year.

NGI

NORTHERN GULF INSTITUTE

Mississippi State

UNIVERSITY

The Northern Gulf Institute is a member center of the High Performance Computing Center HPC² at Mississippi State University.